Summary of 2011-2021 trap data for the endangered Morrison Creek Lamprey (Lampetra richardsoni)

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This document describes sampling activities and summarizes results from 2011 to 2021 trapping surveys of Morison Creek Lamprey, a unique population of Western Brook Lamprey (*Lampetra richardsoni*). Morrison Creek Lamprey is an endangered species at risk, present only in the Morrison Creek watershed in Courtenay, British Columbia. The trapping activities reported here not only help to monitor the population, but have also provided an opportunity to identify conservation concerns and protect the species and its habitat. The data provided in this document shows persistence of the population within its range, and should not be used as an indicator of population abundance or relative abundance.

RÉSUMÉ

Wade, J. 2022. Summary of 2011–2021 trap data for the endangered Morrison Creek Lamprey (*Lampetra richardsoni*). Can. Tech. Rep. Fish. Aquat. Sci. 3469: vi + 17 p.

Le présent document décrit les activités d’échantillonnage et résume les résultats des relevés de piégeage de 2011 à 2021 de la lamproie du ruisseau Morison, une population unique de lamproie du ruisseau de l’Ouest (*Lampetra richardsoni*). La lamproie du ruisseau Morrison est une espèce en voie de disparition en péril, présente uniquement dans le bassin versant du ruisseau Morrison à Courtenay, en Colombie-Britannique. Les activités de piégeage signalées ici aident non seulement à surveiller la population, mais ont également fourni l’occasion d’identifier les préoccupations en matière de conservation et de protéger l’espèce et son habitat. Les données fournies dans le présent document montrent la persistance de la population dans son aire de répartition et ne devraient pas être utilisées comme indicateur de l’abondance ou de l’abondance relative de la population.

INTRODUCTION

The peculiarities of the Western Brook Lamprey population (*Lampetra richardsoni*) in Morrison Creek in Courtenay, British Columbia (BC) were first identified by Dr. Dick Beamish in 1980. Initially, he was studying Western River Lamprey (*Lampetra ayresii*) predation on Pacific Herring (*Clupea pallasii*) and salmon (*Oncorhynchus* spp.) and upon examination of specimens labelled *L. ayresii* from Morrison Creek in the University of British Columbia collection, decided to try collecting some fish from Morrison Creek for experiments (Beamish 2013). Quickly Dr. Beamish realized these fish were not typical Western River Lamprey and work began to try to understand what was happening with lamprey in this watershed.

This work contributed to the Morrison Creek population of Western Brook Lamprey (Morrison Creek Lamprey) being listed as endangered under schedule 1 of the *Species at Risk Act* (SARA). Although the Morrison Creek Lamprey is polymorphic, both distinct life history forms are considered part of the Morrison Creek Lamprey population and protected under SARA. These forms consist of a non-parasitic and parasitic form, which are indistinguishable as ammocoetes (pre-metamorphosis larval phase). However, after metamorphosis adults of the non-parasitic form are characterized by their dark colouration whereas the parasitic form is silver in colour and has sharp teeth. In addition to the protection of the species itself under the SARA, the critical habitat order which protects habitat that is necessary for the survival or recovery of the species under SARA came into force in 2019.

A summary of early field studies (1978–1987) conducted by Dr. Beamish and collaborators was published in 2013 (see Beamish 2013). Because it was recognized that this population was unique, trapping stopped in 1987 and no further field work was conducted until 2011. In 2011, Dr. Beamish and his team deployed similar traps at similar locations to those used in the late 1970s and 1980s. Since then, trapping in the mainstem of Morrison Creek has continued, along with trapping in the headwaters of Morrison Creek. This technical report summarizes the past 10 years (2011–2021) of trapping activities in the watershed. Some of these data have been presented elsewhere and further information can be found in those documents (see Wade 2011, 2012, 2015, 2019; Wade and MacConnachie 2014; MacConnachie *et al.* 2014, 2017; Wade *et al.* 2019; Wade *et al.* 2021). It is important to note that the methods used, and information and data provided in this document were designed to only show persistence of the population within its range, and are not suitable for the calculation of population abundance or relative abundance.

METHODS

PASSIVE DOWNSTREAM TRAPS

The traps used over the period 2011–2021 are consistent with those used in the initial trapping studies in the late 1970s and 1980s. The traps are passive downstream traps which catch fish live, either moving downstream for flushed downstream with the current. The traps consist of a modified collection tank with a funnel (or hood) attached to the upstream end (Figure 1). Using cable ties, the funnel is affixed to wings held in place with rebar. The wings extend upstream on an angle toward the opposite shore, placed so that they do not block off the entire creek.

The collection tank is oval with a flat bottom. The approximate dimensions are 110 cm long x 50 cm wide x 42 cm high. In order to keep the tank stationary, large rocks are placed in the bottom of the tank. “Windows” made of plastic mesh (0.35 cm^2) were cut into the sides of the tanks, centered at the approximate water line, to allow water to exit. A four inch (approximately 10 cm) diameter ABS pipe is inserted in the front of the tank (upstream side), centered at the approximate water line, and secured in place using silicone. Approximately 10 cm of pipe extends in front of the tank and 30 cm of pipe into the tank. The pipe extends into the tank in order to hold mesh to stop fish from swimming back out of the tank once caught. The fine mesh funnel is held in place to the outside pipe with a hose clamp, with sides pulled taut before being affixed to the rebar holding up the wings. Rocks are placed on the bottom of the funnel to keep it from floating up and allowing fish to swim underneath.

The length of the wings varies depending on stream width, but is generally more than two meters. All wings are made of approximately 1 cm^2 wire or plastic mesh. Vexar® plastic netting is the preferred material as it is highly pliable and less likely to cause injury during installation, cleaning, and removal. A second layer of mesh (approximately 0.5 cm^2) is cable-tied onto the bottom of the wings to ensure small fish are retained. Rocks are placed along the bottom of the wings to ensure they maintain contact with the substrate. The wings and funnel are all affixed to the rebar with black cable ties.

Good installation of the trap will ensure that water is flowing into the tank to fill at least 50% of the ABS pipe, the tank sits securely on the bottom, funnel and wings are taut and straight and held securely in place. A piece of plywood is placed on top of the tank and held in place with bull clips to deter predators.

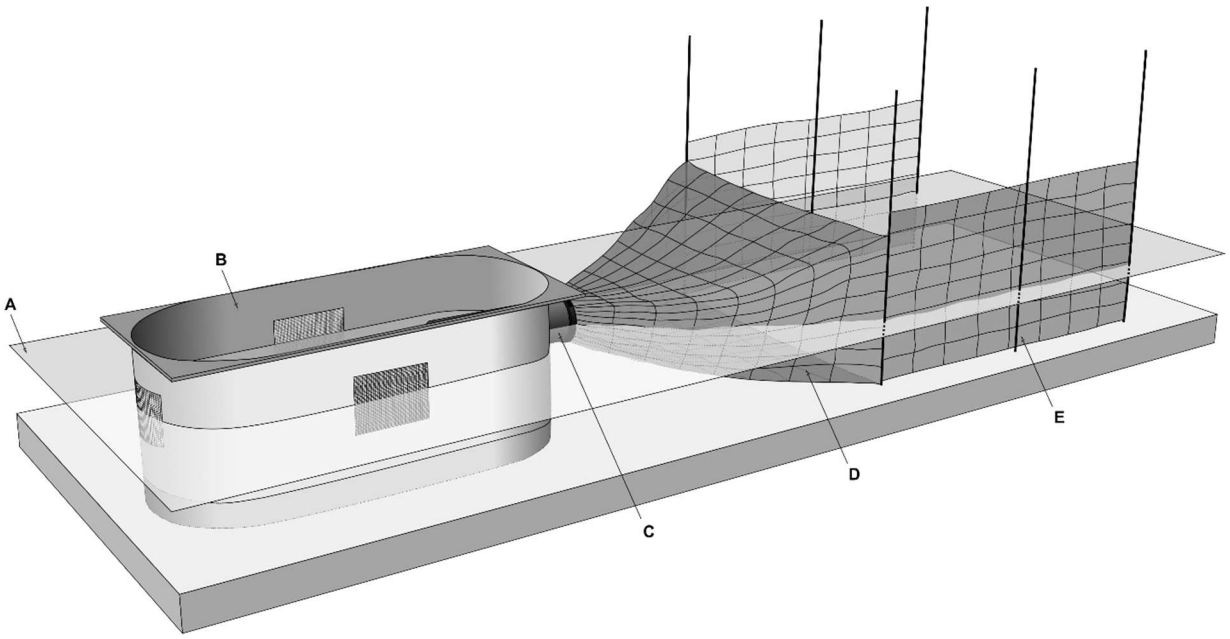

Figure 1. Schematic diagram of the passive downstream traps used for the live capture of Morrison Creek Lamprey. A= approximate water level, B= plywood cover to deter predators, C= ABS pipe, D= mesh funnel, E= hard plastic wings held in place with rebar.

TRAPPING LOCATIONS

Nine different locations were used for trapping between 2011–2021, six along the mainstem of Morrison Creek in the City of Courtenay and three in the headwaters of Morrison Creek. Locations are approximate and are generally within a few meters in a given location, year to year (Table 1, Figure 2).

Table 1. Morrison Creek Lamprey trapping locations in Courtenay, British Columbia (2011–2021).

Number	Trapping location	Years trapped	Latitude	Longitude	Description
1	Roy Stewart Morrison Nature Park	2011-13, 2017, 2019, 2021	49.680211	-125.02135	Upstream of the footbridge in the park.
2	Munster Rd.	2011	49.669875	-125.03991	At the end of Munster Rd.
3	1st St. and Willemar Ave.	2011-13	49.686567	-125.01579	Either side of the bridge at this intersection.
4	2nd St. and Willemar Ave.	2017, 2019, 2021	49.685250	-125.016067	Downstream of the remediated area at the end of 2nd St.
5	2nd St. and Willemar Ave. b	2021	49.685333	-125.016217	Far side of the island at the end of 2nd St.

6	Marsden Rd.	2012, 2013, 2017	49.674741	-125.037942	Upstream side of the bridge.
7	Powerhouse Rd.	2011	49.67745	-125.02693	Upstream side of the bridge.
8	HW 1	2015-17	49.651389	-125.037814	Headwaters 1 (HW 1), right side of horse bridge away from highway.
9	HW 2	2015-17, 2019	49.651389	-125.034333	Headwaters 2 (HW 2), highway side of horse bridge.
10	HW 3	2015, 2016	49.65395	-125.041806	Headwaters 3 (HW 3)

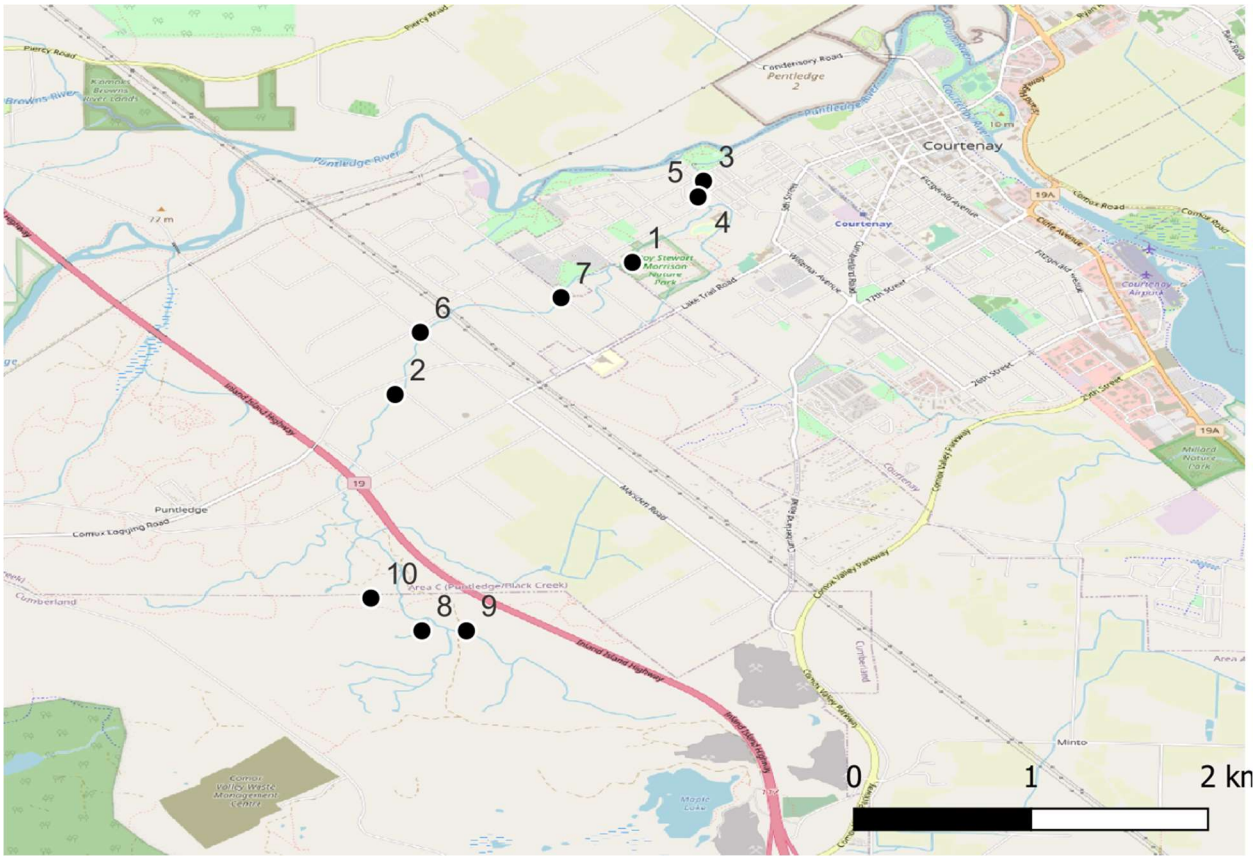

Figure 2. Location of passive downstream traps in Morrison Creek (1–7) and headwaters (8–10) from 2011–2021. See Table 1 for list of trap location names and details.

Roy Stewart Morrison Nature Park

The Roy Stewart Morrison Nature Park is a 12.5 hectare Nature Trust property managed by the City of Courtenay. Overall the habitat is riparian and largely second

growth forest with marsh areas. It is surrounded by schools and residential development and is connected to other greenways via trails.

Traps have been placed in the park six times since 2011 (Table 1), in the area upstream of the footbridge. Substrate in the area is typically mixed sand, cobble and small rocks with gradual sloping banks and vigorous riparian cover including grasses, small shrubs and trees.

Munster Road

The Munster Road location has only been used once (2011) in the past 10 years (Table 1). The trap was installed at the terminus of a dead end road. The substrate was mixed but mostly small and medium size rocks with some cobble.

1st Street and Willemar Avenue

Morrison Creek flows under Willemar Avenue just before it merges into the Puntledge River in Puntledge Park. This area is an established residential area with new residential developments adjoining. Immediately after turning off 1st St. onto Willemar Avenue there is a small bridge over Morrison Creek. Traps have been installed on both the upstream and downstream side of the bridge in three of the past 10 years (Table 1). Whether the trap was placed upstream or downstream was dependent on water conditions and site visibility. In order to prevent vandalism, it is preferable in such a populated area to place the traps so that they could not be seen from the road. The substrate on either side was relatively similar, a mix of sand, small cobble and rocks.

2nd Street and Willemar Avenue

The 2nd Street and Willmar Avenue trapping location is less than 100 m upstream from the 1st Street and Willmar Avenue site. It is situated downstream of where an old salmon counting weir once stood at the end of 2nd Street. In 2013 after surveying Morrison Creek, it was determined that this weir was impassable to lamprey (Wade and Beamish 2014). In 2015, after securing enough funding, this area was remediated to ensure it was passable to both lamprey and salmon and that substrates could support both salmon and lamprey spawning (Wade and MacConnachie 2017). In 2017, 2019, and 2021, traps were placed immediately downstream of this remediated area. In 2021 a second trap (2nd St. and Willemar Ave. b) was also placed on the far side of the island bisecting Morrison Creek in this remediated area. The substrate in this area consists of a mix of sand, cobble, small rocks, and woody debris. Deep pools are maintained on both sides of the island year-round.

Marsden Road

The trapping location at Marsden Road is immediately upstream of the bridge crossing Morrison Creek. Access to the location is via a steep bank on the upstream side of the bridge. Trapping has occurred three times since 2011 at this location (Table 1). The substrate is hard packed with overlaying sediment and cobble. The substrate is so hard

packed that it is difficult to find suitable locations in which to hammer the rebar for the traps (see next section for description of traps). Riparian vegetation consists mostly of grasses and shrubs, banks are steep, with loose sediment.

Powerhouse Road

The Powerhouse Road trapping site was chosen as it was one of the locations which was trapped in the 1980s. Traps were only installed here once, in 2011, as the substrate and water flow were not suitable for successful trapping. It appeared that the stream had been modified since the 1980s and considerable rip rap had been added to the area, likely with road and bridge repairs. In 2011, the water was very fast and there was little sand and cobble, mostly medium to large sized rocks.

Headwaters Trapping Locations

There is a small wooden horse bridge over Morrison Creek mainstem in the headwaters. There are two good trapping locations (HW 1 and 2) in reasonably accessible spots, one on either side of the horse bridge. Both locations are within 100 m of the bridge. HW 1 is in a low flow area with shallow banks and lots of vegetation. The sediment is soft with muddy spots interspersed with sand, gravel and small cobble. HW 2 is nestled in tall grasses in a meandering part of the Creek. This location is typically deeper than HW 1, but the water is similarly slow flowing. Substrate consists of mud, sand, gravel and small cobble. The Headwaters 3 (HW 3) trapping site is located off one of the main trails in the headwaters. The substrate at this location consists largely of muddy areas with some sand and silt. The riparian vegetation is less dense than at HW 1 or 2.

SAMPLING

In all years, traps were installed all in one day; each subsequent day they were all checked. In most years bycatch was counted and recorded, but not in all years. Typical bycatch categories include “salmonid”, “crayfish”, and “stickleback”.

Lamprey were removed from the holding tank with an aquarium dipnet and placed in a small bucket with creek water. In earlier years fin clips were taken for DNA analysis. For this procedure, fish were anesthetized with tricaine methanesulphonate (TMS) (100–125 ppm) to reduce stress and harm. After clipping, fish were measured and length was recorded. Fish recovered in a separate bucket with fresh creek water before being returned to the wild, downstream from the trap.

In recent years, fin clipping has not occurred because there was no scientific rational to support this activity. It was determined that the added harm to the individual was not appropriate without a specific research question. As no invasive procedures were taking place and lamprey will typically suction their oral disc onto the measuring board, an accurate measurement of length without anesthesia is possible.

Whether under anesthesia or not, each lamprey was identified as ammocoete or metamorphosing, and which of the two polymorphic forms: either silver (parasitic) or non-parasitic. In some years there was also a distinction made between animals in spawning condition; in some cases, sex was recorded.

When examining the data from these trapping events it is important to remember that both polymorphic forms in Morrison and Arden creeks are considered part of the population of Morrison Creek Lamprey and it is only after metamorphosis that the parasitic or silver form can be distinguished from the non-parasitic, typical form of Western Brook Lamprey.

Therefore, because the data were not always recorded the same way each year, for the purposes of this document, the data have been presented under the following categories a) ammocoete b) metamorphic c) adult silver (parasitic form) and, d) adult non-parasitic. Adult spawning condition was not recorded unless otherwise specified.

RESULTS

TRAPPING EFFORT

Trapping has occurred in the Morrison Creek watershed in 8 of the past 10 years (2011–2021) using the traps described above. In addition, in 2014, a series of wire traps stuffed with straw were installed in the headwaters to look for ammocoete presence in remote locations. This study was not a standardized survey so it is not included in this report, but details of the straw trap study can be found in Wade and MacConnachie (2014).

From 2011–2021, traps were installed for a total of 695 days (Table 2). The earliest traps were installed was May 30th, the latest they have been removed was July 26th. The number of traps installed varied from three to five, depending on the year. Trapping days was calculated as a measure of effort:

$$Trapping\ days = \sum \#\ traps * \left(\frac{\#\ days\ installed}{trap}\right)$$

The average number of trapping days per year between 2011–2021 was 87 days (range 39–165 days).

Table 2. Summary of trapping dates for Morrison Creek Lamprey in Morrison Creek from 2011–2021. Dates displayed as Year-Month-Day.

Year	Date first trap installed	Date last trap removed	# traps installed	Total trapping days
2011	2011-06-08	2011-07-23	4	112
2012	2012-06-01	2012-07-26	3	165
2013	2013-06-12	2013-07-16	3	102
2015	2015-06-12	2015-07-06	3	72
2016	2016-05-30	2016-06-15	3	48

2017	2017-06-05	2017-06-19	5	65
2019	2019-06-08	2019-06-21	3	39
2021	2021-06-11	2021-07-05	4	92
Total				**695**

Most trapping efforts have been focused on the mainstem of Morrison Creek running through Courtenay (Figure 2). Trapping began in the headwaters of Morrison Creek in 2015, with traps monitored in four different years: 2015, 2016, 2017 and 2019 (Table 3). Due to circumstances (water and weather conditions, vandalism) traps may not be installed for the same number of days as each other in a given year or a trap may be removed and relocated. A summary of the trapping effort for each location is provided in Table 3.

Table 3. Summary of trapping effort for Morrison Creek Lamprey in Morrison Creek mainstem and headwaters from 2011 to 2021. Dates displayed as Year-Month-Day (HW= headwaters). See Table 1. Morrison Creek Lamprey trapping locations in Courtenay, British Columbia (2011–2021).Table 1 and Figure 2 for physical locations of trapping sites.

Year	Trapping location	Date installed	Date removed	Trapping days (#)
2011	Roy Morrison Park	2011-06-08	2011-07-23	45
2011	1st St. & Willemar Ave.	2011-06-29	2011-07-23	24
2011	Munster Road	2011-06-21	2011-07-23	32
2011	Powerhouse Road	2011-07-12	2011-07-23	11
2012	1st St. & Willemar Ave.	2012-06-01	2012-07-26	55
2012	Marsden Road	2012-06-01	2012-07-26	55
2012	Roy Morrison Park	2012-06-01	2012-07-26	55
2013	1st St. & Willemar Ave.	2013-06-12	2013-07-16	34
2013	Marsden Road	2013-06-12	2013-07-16	34
2013	Roy Morrison Park	2013-06-12	2013-07-16	34
2015	HW 1	2015-06-12	2015-07-06	24
2015	HW 2	2015-06-12	2015-07-06	24
2015	HW 3	2015-06-12	2015-07-06	24
2016	HW 1	2016-05-30	2016-06-15	16
2016	HW 2	2016-05-30	2016-06-15	16
2016	HW 3	2016-05-30	2016-06-15	16
2017	2nd St. & Willemar Ave.	2017-06-05	2017-06-14	9
2017	HW 1	2017-06-05	2017-06-19	14
2017	HW 2	2017-06-05	2017-06-19	14
2017	Marsden Road	2017-06-05	2017-06-19	14
2017	Roy Morrison Park	2017-06-05	2017-06-19	14
2019	2nd St. & Willemar Ave.	2019-06-08	2019-06-21	13
2019	HW 2	2019-06-08	2019-06-21	13

2019	Roy Morrison Park	2019-06-08	2019-06-21	13
2021	2nd St. & Willemar Ave.	2021-06-11	2021-07-05	24
2021	2nd St. & Willemar Ave. b	2021-06-11	2021-07-05	24
2021	Marsden Road	2021-06-11	2021-07-05	24
2021	Roy Morrison Park	2021-06-11	2021-07-01	20
Total				**695**

CATCH

The type of trap used has been shown to be effective in trapping post-metamorphic lamprey. They are passive traps which rely on lamprey being active in the water column and not buried in the sediment in order to be caught, as they either actively move downstream or are swept downstream. Only 19% of the total number of lamprey caught were ammocoetes, which are more likely to be buried in sediment (Table 4).

In eight trapping years (2011–2021; excluding 2014, 2018, 2020), the majority (72%) of lamprey caught in passive traps were non-parasitic adults (n= 668). A total of 59 of the silver (parasitic) form were captured during this time with only one silver form caught in each of the past two years of trapping (2019 and 2021) (Table 4, Figure 3).

Table 4. Annual catch of Morrison Creek Lamprey (2011–2021) by developmental stage/form (ammocoete, metamorphic, non-parasitic adult, and silver (parasitic) adult) from all locations.

Year	Ammocoete	Metamorphic	Non-parasitic adult	Silver (parasitic) adult	Total
2011	41	2	188	17	**248**
2012	11	2	59	4	**76**
2013	6	0	46	11	**63**
2015	5	4	154	13	**176**
2016	38	4	72	8	**122**
2017	63	4	116	4	**187**
2019	8	3	26	1	**38**
2021	4	1	7	1	**13**
Total	**176**	**20**	**668**	**59**	**923**

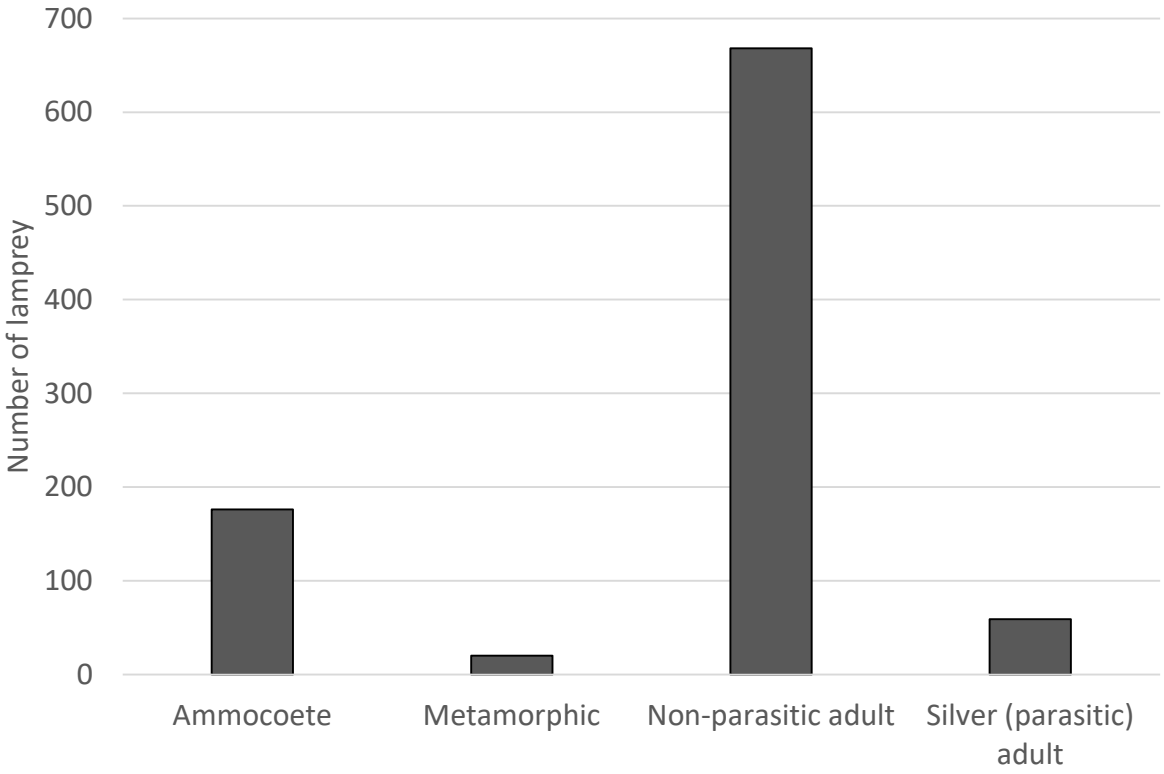

Figure 3. Total number of Morrison Creek Lamprey caught (2011–2021) by developmental stage/form (ammocoete, metamorphic, non-parasitic adult, and silver (parasitic) adult) from all locations.

Averaged over the amount of trapping effort, non-parasitic adults were caught almost every trapping day (0.96 catch/day) (Table 5). Over time, catch rates of total lamprey per year ranged between a minimum of 0.14 to a maximum of 2.88 lamprey/day. The metamorphic stage has always been the least frequently caught (0.0-0.08 catch/day) followed by the silver (parasitic) adult form of Morrison Creek Lamprey (range between 0.01 and 0.18 lamprey/day) (Table 5).

Table 5. Annual catch per trapping day of each stage of development and form (ammocoete, metamorphic, non-parasitic adult, and silver (parasitic) adult) of Morrison Creek Lamprey (2011–2021) from all locations.

Year	# trapping days	Catch per day				
		Ammocoete	Metamorphic	Non-parasitic Adults	Silver (parasitic) Adults	Total all stages
2011	112	0.37	0.02	1.68	0.15	2.21

2012	165	0.07	0.01	0.36	0.02	0.46
2013	102	0.06	0.00	0.45	0.11	0.62
2015	72	0.07	0.06	2.14	0.18	2.44
2016	48	0.79	0.08	1.50	0.17	2.54
2017	65	0.97	0.06	1.78	0.06	2.88
2019	39	0.21	0.08	0.67	0.03	0.97
2021	92	0.04	0.01	0.08	0.01	0.14
Average	**87**	**0.25**	**0.03**	**0.96**	**0.08**	**1.33**

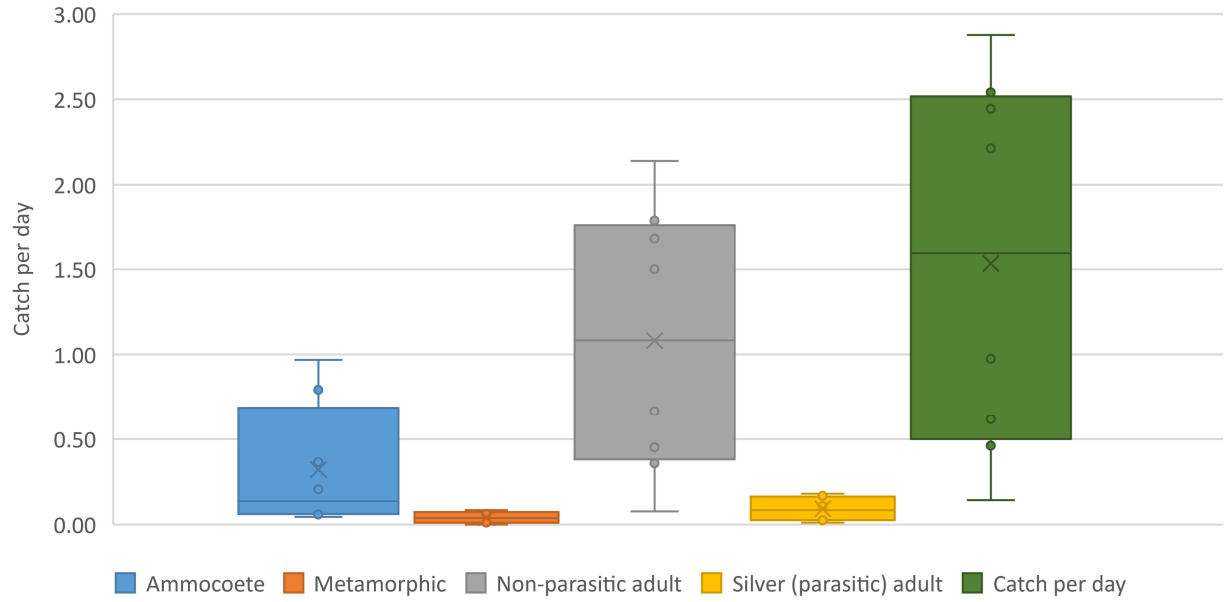

Figure 4. Box plot of total catch per day of each stage and form (ammocoete, metamorphic, Non-parasitic adult and Silver (parasitic) adult of Morrison Creek Lamprey caught (2011–2021) from all locations.

The silver (parasitic) adult form in this population is what makes it unique. There has been some concern that numbers of the silver form may be decreasing and if catch is an indicator, there has been a decrease in the number of the silver form caught since 2011 (Table 4, Figure 5). That is not to say that there has been a decrease in the population, only in catch. All lamprey included, catch per day is highly variable (Figure 6) and is likely strongly influenced by environmental conditions.

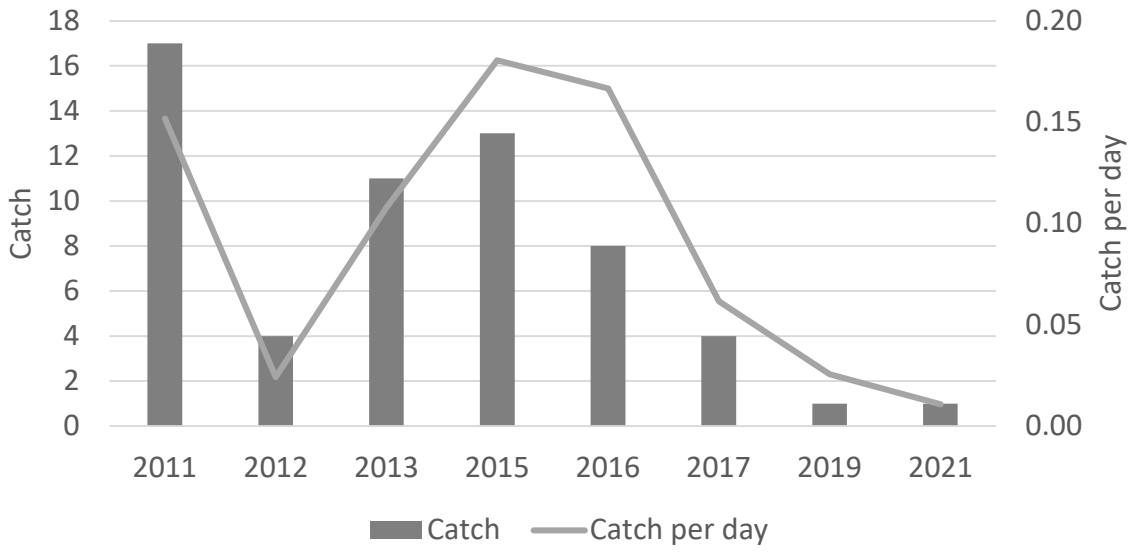

Figure 5. Total catch and catch per day of the silver (parasitic) adult form of Morrison Creek Lamprey from all locations (2011–2021).

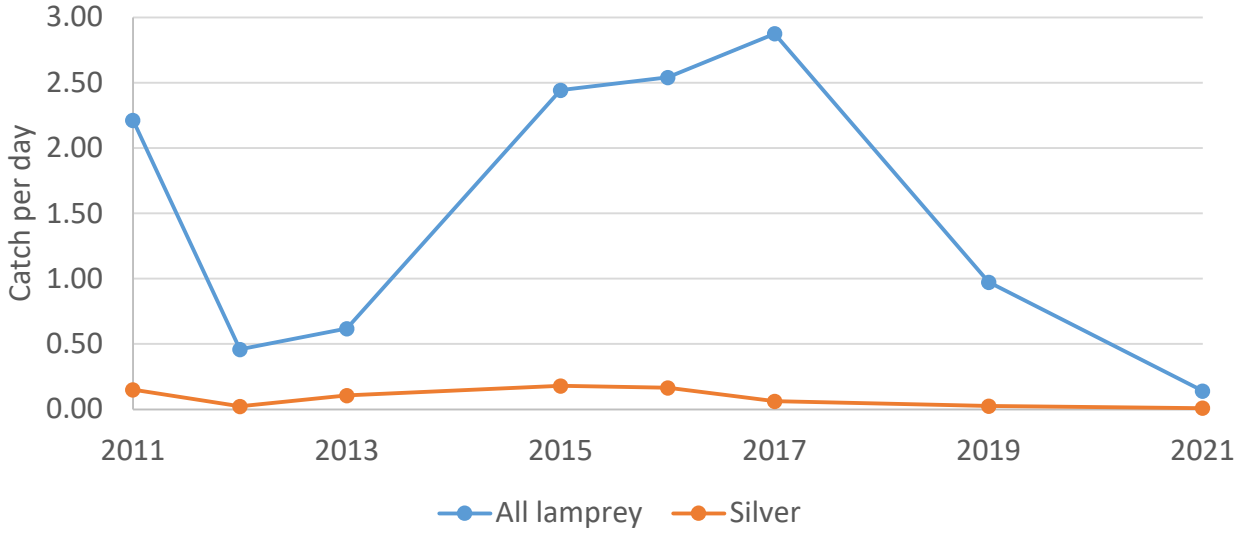

Figure 6. Catch per day of the silver form of Morrison Creek Lamprey and all lamprey (ammocoete, metamorphic, non-parasitic adult, and silver (parasitic) adult) caught between 2011 and 2021.

LOCATIONS

Trapping has been more successful in some locations than others (Table 6, Table 7, Figure 7). The greatest number of lamprey caught were in the HW 2 location (n= 326 lamprey, 4.87 catch/day), the second highest catches were in Roy Morrison Park (n=213 lamprey) but due to differences in effort, the catch per day at this location was

not the second highest, which occurred at the HW 1 location (n= 93, 1.72 catch/day) (Table 7).

Although few of the silver (parasitic) form have been caught since 2011, the highest catch per day has been at the HW 2 location with 15 animals caught in a total of 67 days (Table 7). The First St. and Willemar Ave. location on the mainstem of Morrison Creek in Courtenay had the second highest catch per day at 0.17, where 19 silver form were caught in 113 trapping days (Table 7). Overall, the highest catch per day for both total lamprey (all stages and forms) and just the silver (parasitic) adult form has been at the HW 2 location (Table 7).

Table 6. Morrison Creek Lamprey catches by stage of development and form (ammocoete, metamorphic, non-parasitic adult, and silver (parasitic) adult) from each location (2011–2021). Blank cells = 0.

Location	Ammocoete	Metamorphic	Non-parasitic adult	Silver (parasitic) adult	Total lamprey caught
1st St. & Willemar Ave.	23	2	132	19	176
2nd St. & Willemar Ave.	3	1	10	1	15
2nd St. & Willemar Ave. b			2		2
HW 1	32	3	50	8	93
HW 2	71	10	230	15	326
HW 3	7		12	2	21
Marsden Rd.	3	1	48	3	55
Munster Rd.	1		8		9
Powerhouse Rd.	11		1	1	13
Roy Morrison Park	25	3	175	10	213
Total	**176**	**20**	**668**	**59**	**923**

Table 7. Catch data for each trapping location over the period 2011–2021 in the mainstem and headwaters (HW) of Morrison Creek, Courtenay, BC. Total lamprey include all stages of development and forms (ammocoete, metamorphic, non-parasitic adult, and silver (parasitic) adult), and the total for the silver (parasitic) adults is also presented seprately.

Location	Total trapping days	Total lamprey		Total silver form	
		Catch	Catch/day	Catch	Catch/ day
1st St. & Willemar Ave.	113	176	1.56	19	0.17
2nd St. & Willemar Ave.	46	15	0.33	1	0.02
2nd St. & Willemar Ave. b	24	2	0.08	0	0.00
Marsden Rd.	127	55	0.43	3	0.02
Munster Rd.	32	9	0.28	0	0.00

Powerhouse Rd.	11	13	1.18	1	0.09
Roy Morrison Park	181	213	1.18	10	0.06
HW 1	54	93	1.72	8	0.15
HW 2	67	326	4.87	15	0.22
HW 3	40	21	0.53	2	0.05

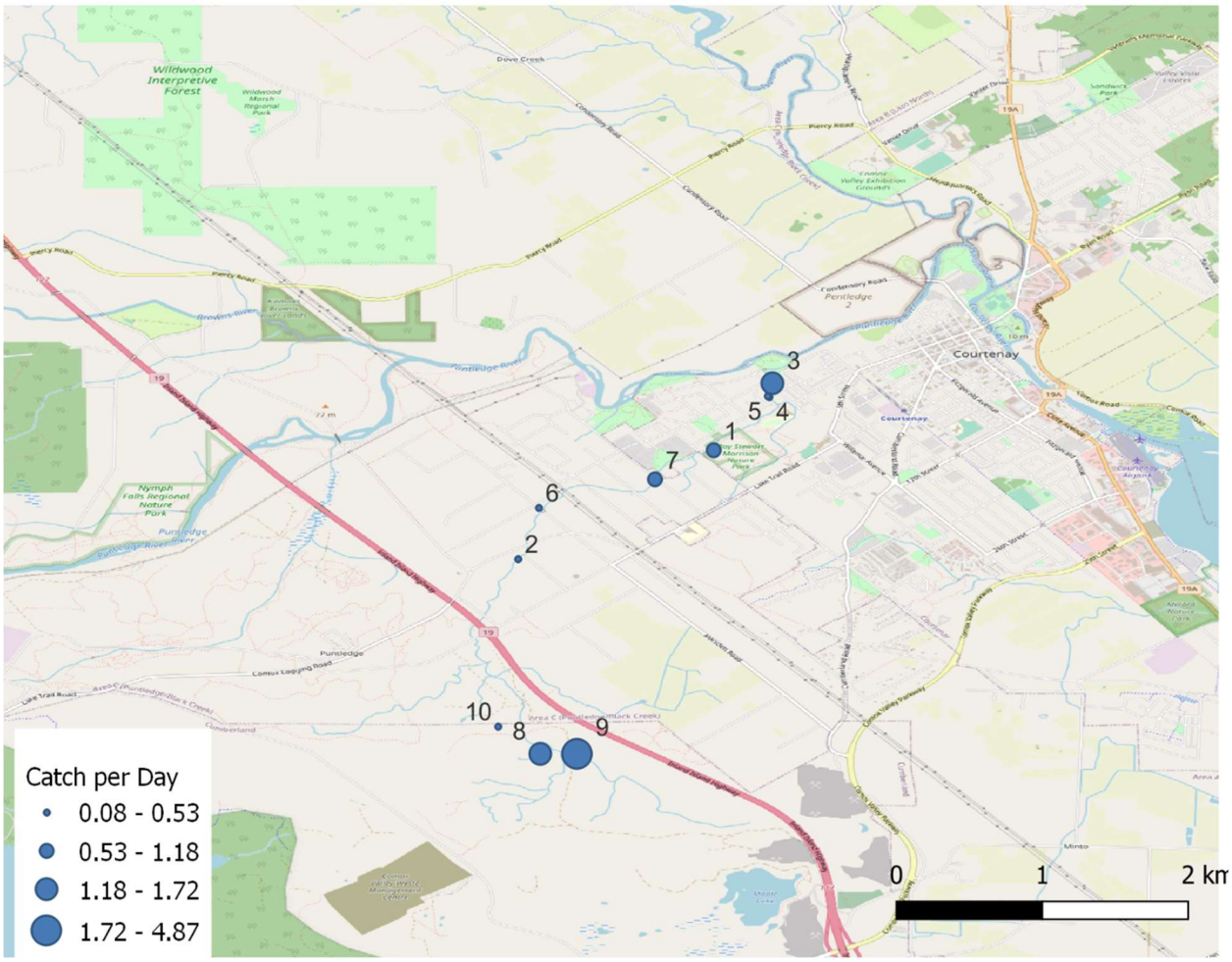

Figure 7. Total lamprey catch per day including all lamprey stages of development and forms (ammocoete, metamorphic, non-parasitic adult and silver (parasitic) adult) at each trapping location in the mainstem of Morrison Creek (1–7) and headwaters (8–10) from 2011–2021. See Table 1 for a list of trap location names and Table 7 for supporting data.

LENGTH

Length data is summarized separately for the various stages and each adult form. Non-parasitic adults were delineated between those in spawning condition and those not in spawning condition. Where spawning condition was not identified, those individuals were not included in Table 8. Of the animals for which sex was assigned, the sex ratio

across years was 38 female: 87 male; this should not be interpreted as an indication of the sex ratio of the population as sex was not regularly identified.

The average length of lamprey was similar across categories: 115.6 mm for those undergoing metamorphosis, 111.5 mm for non-parasitic adults in non-spawning condition, and 114.6 mm for non-parasitic adults in spawning condition (Table 8). This is not surprising in a non-parasitic population where growth is minimal between metamorphosis, spawning, and death. The silver (parasitic) adult form continues to grow after metamorphosis (average length 126.4 mm), which is expected from parasitic lamprey. This should only be interpreted as an observation consistent with our current knowledge of the population as the sample sizes for both lamprey undergoing metamorphosis (n= 20) and the silver form (n= 47) are small.

Table 8. Total length of Morrison Creek Lamprey caught in passive downstream traps in the mainstem and headwaters of Morrison Creek (2011–2021).

	Length (mm)				
Stage/ form	**N**	**Average**	**Minimum**	**Maximum**	**Standard deviation**
Ammocoete	160	95.9	32.0	144.0	22.6
Metamorphic	20	115.6	99.0	133.0	10.5
Non-parasitic adult (non-spawning condition)	296	111.5	87.0	149.0	11.7
Non-parasitic adult (spawning condition)	285	114.6	85.0	165.0	10.9
Silver (parasitic) adult form	47	126.4	98.0	179.0	14.0

Over the past 10 years both the total catch and catch per day of the silver (parasitic) adult form of Morrison Creek Lamprey has varied, but with a downward trend. This is particularly concerning when comparing the past 10 years of trapping success to that of the 1970s and 1980s. Beamish (2013) presents the average daily catch rate at one location, for the silver (parasitic) adult form of Morrison Creek Lamprey in 1983, 1984 and 1987 to be 1.1, 2.2 and 1.4 respectively. From June 15 to July 15 1984 there were a staggering 67 silver (parasitic) adult form caught (Beamish 2013). The highest number of lamprey caught in the past 10 years has been 19 and highest catch rate, 0.22. Because of how the data were recorded in the 1970s and 1980s, it is not possible compare the total number of lamprey caught in these early years to those of the past 10 years.

CONCLUSION

Trap location matters. This was something identified in Beamish (2013) regarding trapping efforts in the 1970s and 1980s. In terms of catch per day, trapping efforts in the

headwaters resulted in the greatest success. Catch per day was highest at the HW 2 location for both total lamprey (4.87 lamprey/day) and specifically the silver (parasitic) adult form (0.22 silver lamprey/day). It is possible that connectivity issues within the mainstem of Morrison Creek have fragmented habitat and impeded lamprey movement. Traps may have been placed in these areas which would affect the number of lamprey available for catching. For example, log jams and hung culverts have been identified in several locations along the mainstem. In many cases, it is not known how long they may have been there or the downstream effects. The trapping locations in the headwaters by comparison have changed little over the period of trapping.

Continued monitoring of the population and its habitat are necessary in order to maintain the integrity of the critical habitat and minimize potential harms and build resilience for the continued survival of this unique population.

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