Baseline Survey of Habitat Conditions for Misty Lake Lentic and Lotic Threespine Stickleback (*Gasterosteus aculeatus*)

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by

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ABSTRACT

Gilmore, S., Boothroyd, M., Castañeda, R.A., Colbourne, K., Dyke, K., Kwok, C., LoScerbo, D., Loseto, L., Noel, M., Therriault, T., and Grant, P. 2026. Baseline Survey of Habitat Conditions for Misty Lake Lentic and Lotic Threespine Stickleback (*Gasterosteus aculeatus*). Can. Manuscr. Rep. Fish. Aquat. Sci. 3348: vii + 43 p. https://doi.org/10.60825/aawj-vn90

In 2023, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reassessed the Misty Lake Lentic and Lotic Threespine Stickleback (*Gasterosteus aculeatus*) populations confirming them as endangered, citing their restricted distribution and continued decline in habitat quality. To allow for future comparisons and assess habitat changes, baseline habitat studies were undertaken in 2025. Surveys to examine riparian vegetation, aquatic invasive species presence, aquatic invertebrates and general biodiversity were undertaken. To confirm continued occupancy of critical habitat, sticklebacks were sampled at accessible locations throughout the watershed. A selection of these fish were euthanised to examine stomach contents and external parasites. Misty Lake Stickleback were detected in the lake, outlet stream, and multiple inlet stream sites, confirming continued occupancy of sampled critical habitat. Diet composition varied among locations and reflected both aquatic and terrestrial prey resources. These surveys provide baseline data for future assessment of habitat condition, prey availability, species composition, and continued occupancy.

RÉSUMÉ

Gilmore, S., Boothroyd, M., Castañeda, R.A., Colbourne, K., Dyke, K., Kwok, C., LoScerbo, D., Loseto, L., Noel, M., Therriault, T., and Grant, P. 2026. Baseline Survey of Habitat Conditions for Misty Lake Lentic and Lotic Threespine Stickleback (*Gasterosteus aculeatus*). Can. Manuscr. Rep. Fish. Aquat. Sci. 3348: vii + 43 p. https://doi.org/10.60825/aawj-vn90

En 2023, le Comité sur la situation des espèces en péril au Canada (COSEPAC) réévalué les populations d'épinoches à trois épines lentique et lotique du lac Misty (Gasterosteus aculeatus) en confirmant qu'elles étaient en voie de disparition, citant leur répartition restreinte et le déclin continu de la qualité de l'habitat. Afin de permettre des comparaisons futures et d'évaluer les changements de l'habitat, des études de base sur l'habitat ont été entreprises en 2025. Des relevés visant à examiner la végétation riveraine, la présence d'espèces aquatiques envahissantes, les invertébrés aquatiques et la biodiversité générale ont été entrepris. Pour confirmer l'occupation continue de l'habitat essentiel, des épinoches ont été échantillonnées à des endroits accessibles dans l'ensemble du bassin versant. Une sélection de ces poissons a été euthanasiée pour examiner le contenu de l'estomac et les parasites externes. Des épinoches du lac Misty ont été détectées dans le lac, le cours d'eau de décharge et plusieurs sites de cours d'eau d'affluent, confirmant l'occupation continue de l'habitat essentiel échantillonné. La composition du régime alimentaire variait d'un endroit à l'autre et reflétait les ressources en proies aquatiques et terrestres. Ces relevés fournissent des données de base pour l'évaluation future de l'état de l'habitat, de la disponibilité des proies, de la composition des espèces et de l'occupation continue.

INTRODUCTION

Misty Lake is located northwest of Port McNeil on Vancouver Island, British Columbia, Canada. The Misty Lake Lotic and Lentic Threespine Stickleback (MLS; (*Gasterosteus aculeatus*)) are an endemic species pair found only in the lake and surrounding inlet and outlet streams (COSEWIC 2023). In 2023, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reassessed both populations of MLS and confirmed their recommendation as endangered, due to their small distribution, continuing decline in habitat quality related to highway proximity and forestry activities, and risk of invasive species introduction (COSEWIC 2023). Both populations were listed as Endangered under Schedule 1 of the Federal *Species at Risk Act* in 2010 and the Critical Habitat Order was ratified in 2018 (SOR/2018-208).

Lotic and Lentic MLS occur in two distinct habitats of Misty Lake; the lotic population resides in the inlet streams, while the lentic population is found in the outlet stream and the lake (Sharpe et al. 2008, COSEWIC 2023). The inlet stream is a dendritic network with the mainstem approximately 20 km long, composed of fast-flowing riffles and slow-flowing deep pools, in mixed forest with active logging and beaver activity. At the confluence of the inlet creek and Misty Lake, there is a swampy transition area of dense brush and high beaver activity, where hybridization between the lotic and lentic populations occur (McPhail 1994, COSEWIC 2023). The lentic population is found in Misty Lake and the outlet stream, which drains from the lake into the Keogh River. Misty Lake is a small lake, with a surface area of 0.36 km^2, and a maximum depth of 6.1 m (COSEWIC 2023). The outlet stream is approximately 2 km long, passes through dense brush, bogs and mixed forest, and is dominantly slow flowing with deep pools and runs. The forest surrounding parts of the outlet stream also has active logging and beaver activity. The water in the Misty Lake system is distinctly dark coloured from tannins (Lavin & McPhail 1993). Tannins are naturally occurring organic compounds released during the decomposition of terrestrial vegetation and transported into aquatic systems with dissolved organic matter from the surrounding watershed. This coloured organic matter reduces light penetration and can influence primary productivity, thermal conditions, and aquatic food webs; consequently, changes in these inputs may also influence habitat conditions and prey availability within the Misty Lake system. The naturally tannin-rich water is therefore an important baseline characteristic of Misty Lake.

The MLS Action Plan (Fisheries and Oceans Canada 2020) outlines recovery measures that provide the best chance of achieving the population and distribution objectives in the MLS Recovery Strategy (Fisheries and Oceans Canada 2018). Oke et al. (2017) undertook a population estimate study in the inlet, lake and outlet, the results of which far surpassed earlier estimates by Hatfield (2009). Our work focused on addressing other recovery measures from the Action Plan, including increasing understanding of information gaps related to MLS life history and habitat health. Stickleback are known to breed in the littoral zone of lakes making this zone important for spawning, incubation and juvenile rearing (Hatfield 2009). Our baseline surveys focused on littoral habitat by examining shrub cover using riparian edge transect surveys and aquatic invertebrate

surveys in this zone. The tannic waters of Misty Lake results from high inputs of organic matter from surrounding and upstream forests. Part of this organic matter is a potential food source in the form of terrestrial insects (DFO 2020). While the impacts and influences of these allochthonous elements are not easily measured, an objective of this study was to record general biodiversity in order to characterize potential invertebrate food sources for MLS and other in-lake species. Fish distribution surveys at easily accessible sites along with diet and ectoparasite analysis were also conducted. Additional surveys on physical water quality monitoring are reported in LoScerbo et al. (2026).

METHODS

Site naming conventions and locations

A map and description of Misty Lake and surrounding area along with sampling sites can be seen in Table 1 and Figure 1. Misty Lake inlet sites (MLU) refers to the upstream reaches of the Misty Lake watershed, which occurs to the southeast of Misty Lake, beginning at the hybrid zone near the lake, continuing under the Island Highway (Highway 19) and expanding to three reaches which make up the critical habitat for the lotic population (Figure 1). Sampling of the upstream reaches was conducted at five locations: two easily accessible sampling locations on either side of the Island Highway (MLU1 [Figure 2A], MLU2), two more where the reaches cross the Misty Lake Main Forest Service Road (MLU3, MLU5 [Figure 2B,C]) and one where the reach crossed the M900 Forest Service Road (MLU4). Misty Lake sites (MLL) refers to sampling locations within the lake itself. Access to the lake was from the Misty Lake Rest Area off the Island Highway. Fish sampling was conducted near this access point in the southwestern corner of the lake to minimize impact on littoral habitat. Misty Lake outlet sites (MLO) refers to the 2 km stretch from the lake to where the stream joins the Keogh River. Access is on Rupert Main Forest Service Road and a much smaller, dead end, side road. With only two access locations (A and B; Figure 2D–F) surveys were conducted on both sides of the road at these locations.

Table 1: Sampling locations in the Misty Lake watershed.

Site label	Descriptor	Comment
MLOA	Misty Lake outlet A	Both outlet stream sampling locations were accessed from the Rupert Main Forest Service Road
MLOB	Misty Lake outlet B	
MLL	Misty Lake access point	Access point for Misty Lake, Misty Lake Rest Area
MLU1	Misty Lake upstream site 1	Easily accessible location on South side of Island Highway
MLU2	Misty Lake upstream site 2	Easily accessible location on North side of Island Highway

MLU3	Misty Lake upstream site 3	Access point where Misty Lake Main Forest Service Road crosses creek
MLU4	Misty Lake upstream site 4	Access point where M900 Forest Service Road crosses creek
MLU5	Misty Lake upstream site 5	Access point where Misty Lake Main Forest Service Road crosses creek

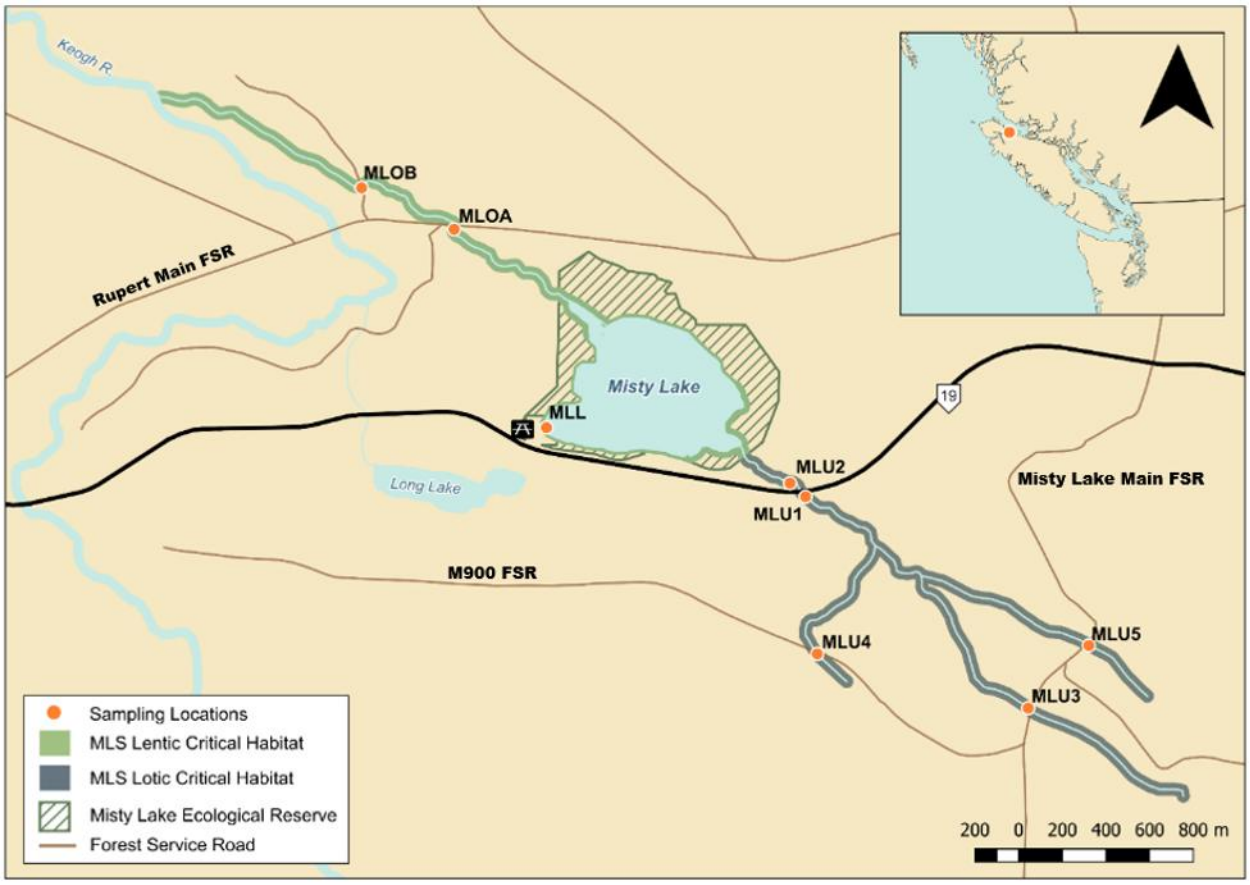


Figure 1: Map of Misty Lake watershed showing the lake, inlet and outlet streams, as well as sampling locations.

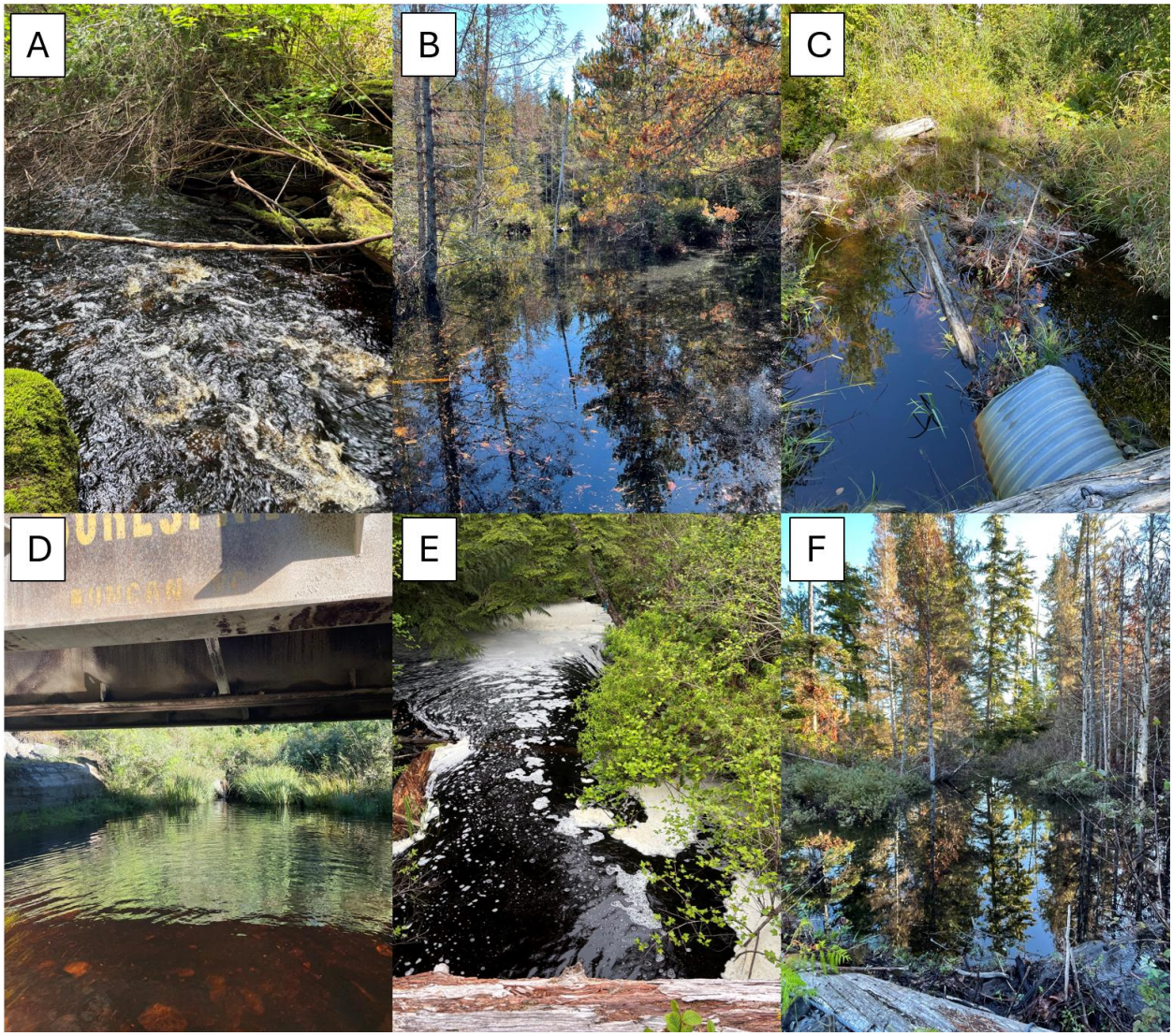


Figure 2: Views of Misty Lake inlet and outlet. A) MLU2, north side of Island Hwy B) MLU5 upstream on east side of Misty Lake main, C) MLU5 downstream, on west side of Misty Lake main, D) MLOA below road bridge on Rupert main, E) MLOB downstream of road off of Rupert main, F) MLOB upstream of road off of Rupert main. (Photos A,B,E: Scott Gilmore; Photos C,D,F: Maggie Boothroyd)

Riparian Edge Transect

An inventory of riparian vegetation was conducted on 7 August, 2025. Ten 10 m transects along the riparian edge waterline were randomly selected from a predefined survey area surrounding the Misty Lake Rest Area access point (50.60544, -127.26919). To minimize disturbance in the littoral zone, all 10 transects were taken in the southwestern portion of Misty Lake with 5 sites on each side of the lake access trail (Figure 1, MLL).

The survey rope, marked at 1 m intervals, was placed along the vegetation at the water's edge. All shrubs were identified to species, and frequency (F), number (N), and coverage (C) were recorded for each transect. Frequency refers to the number of 1 m segments in the line transect in which that species is recorded. Number refers to the count of individual plants of a given species intercepted by the line transect. Coverage refers to the cumulative length (in metres) of the transect occupied by the foliage of each shrub species. Relative frequency (F_i), relative number (N_i) and relative coverage (C_i) were calculated for each species. These measures describe how commonly a species occurred across the transects, its relative abundance, and the amount of transect it occupied, respectively. An Importance Value Index (IVI) was then calculated for each species as the sum of relative frequency, relative number, and relative coverage, providing an overall measure of the relative prominence of each shrub species within the sampled riparian vegetation.

Aquatic Invertebrate Survey

To survey the diversity and abundance of nearshore aquatic invertebrates, invertebrate collections were made at 10 sites adjacent to the riparian edge transects. Wearing waders and utilizing a long handled aquatic net (500 micron) collections were made by sweeping the net back and forth through the survey site which was a 2 m^2 section adjacent to the riparian transect. This motion increased the likelihood of capturing aquatic invertebrates taking refuge under submerged debris. For consistency, all sweeps were completed by the same individual.

This survey was completed prior to the riparian edge transect in order to sample an undisturbed area. Each survey location was between 0.5 m and 2 m from the lake edge, and had an average water depth of 50 cm. The contents of the net were transferred to white tubs (15 x 13 x 6.5 inches) containing lake water from the nearshore area. Plant material and other debris were removed by hand, and macroinvertebrates were collected and placed into vials with 70% EtOH. All vials were labelled according to transect. Identifications of invertebrates were made with the aid of a Leica S9i stereo microscope and taxonomic literature including Thorp and Rogers (2016) and Merritt, Cummins and Berg (2008) as well as order taxa specific literature. Specialist literature was used for some groups including Odonata (Needham, Westfall and May 2000), Ephemeroptera (Needham 1996), Trichoptera (Wiggins 1998), and Molluscs (Clarke 1981, Herrington 1962). Images of a selection of individuals have been uploaded to iNaturalist and will appear in the Misty Lake Ecological Reserve Project (https://www.inaturalist.org/projects/misty-lake-ecological-reserve).

Aquatic Invasive Species Survey

A risk-based approach was used to identify potential priority aquatic invasive plant species for Misty Lake. First, a master list of aquatic invasive species (AIS) was generated using a horizon scanning exercise based on a variety of sources such as AIS databases (U.S. Fish and Wildlife Service, 2025; USGS, 2025); government priority,

prohibited, or regulated lists, as well as species being considered for regulatory amendment (B.C. Inter-Ministry Invasive Species Working Group, 2026; Gazette Officielle Du Québec, 2025; Government of Alberta, 2015; 2018; Government of British Columbia, 2019; Government of Canada,1993; 2015; 2025; Great Lakes St. Lawrence Governors and Premiers, 2023); Canadian and British Columbian trade record data from literature (Chan et al., 2022; Kingsbury et al., 2025; Skelton, pers comm.), and species from various other literature (Burner, 2023; Cassemiro et al., 2018; Commission for Environmental Cooperation, 2009; Chan et al., 2019; Courtenay and Williams, 2004; Dean et al., 2024; Vilizzi et al., 2021; Warrington,1994; Washington State Legislature, 2019). Of these species pre-conditioning filters were applied including retaining only freshwater obligate (OBL) wetland aquatic plants, those that have a potential invasion vector to British Columbia (e.g., are in trade or in adjoining states/provinces), those that have a reasonable climate match both under current trending and future climate change scenarios, and those that are known to be high risk invaders. The filtered 173 species were assessed through a screening level assessment tool, The Non-Indigenous Species Screening Tool (NISST; Wilcox et al., 2025) in order to prioritize and identify the highest risk species. Using various sources [E-Fauna (Klinkenberg, 2021), GBIF (2026), and iNaturalist (2025)] species' distributions on Vancouver Island and more specifically north Vancouver Island (defined for this purpose as north of Campbell River) and south Vancouver Island (south of Campbell River) were identified.

With the goal of detecting the potential presence of these high-risk aquatic plants in Misty Lake, a survey was conducted using both the riparian edge transects and adjacent visual littoral areas chosen on the south-west side of the lake nearest to the public access (MLL in Figure 1), as well as randomized littoral searches on the northern, eastern and southern perimeters using a non-motorized boat. Surveys took place on August 7, 2025. Additionally the non-indigenous aquatic plants identified in north Vancouver Island were opportunistically searched for between 6-8 August, 2025, to confirm their presence

Potential invasive fish and crayfish were surveyed for as part of the fish survey (see below).

Fish Survey

Between 15 and 17 September, 2025, minnow traps were set across the Misty Lake watershed to assess MLS distribution. Unbaited traps were set between 2.5 and 4.5 hours (Oke et al. 2017). Traps were deployed at five sites in the inlet streams (MLU1 - MLU5), at two sites in the outlet steam (MLOA, MLOB), and at one site in the lake (MLL), which was divided into five transects (Figure 1). A total of 30 traps were set at the inlet sites, where five traps were set at sites MLU1 - MLU4 and 10 traps were set at MLU5, five on each side of the road. At the two outlet stream sites (MLOA, MLOB), 20 traps were set where five traps were placed on either side of the road for a total of 10

traps per site; MLOA/B1 are upstream of the roads while MLOA/B2 are downstream of the roads. At the lake site, each of the five transects were sampled using a 6 m rope with five traps attached every 1.5 m, for a total of 25 traps. The rope transects were set perpendicular to shore. Trap depth was estimated against body height or by the length of rope attached to them. Wetted width of streams was measured with a measuring tape. When the traps were pulled, the fish were transferred to a bucket, immediately identified and enumerated, and a selection of MLS were taken for measurements and diet analysis (see below). All remaining fish were released at the point of capture. Catch per unit effort (CPUE) was calculated as the number of MLS caught per hour the minnow trap was deployed (Oke et al. 2017). CPUE was averaged across all traps for each site. For the lake site, CPUE was average across all traps across all five transects (Oke et al. 2017).

Diet Analysis

Sixty fish captured during the fish survey were euthanised using a buffered MS-222 at a concentration of 250mg/L and kept for diet analysis. Euthanized fish were measured for fork length using a standard measuring board, and weight was determined using an Ohaus Compass Digital Balance 1200. After measurements were recorded, a parasite scrape was taken (see below) and then fish were placed in bags on dry ice for preservation. In the lab, fish were later thawed and their stomachs were extracted. Stomach contents from fish collected at the same location were combined for counts. For the combined lake sample fish stomachs, a Folsom plankton splitter was used to allow more accurate counts. Stomach contents were sent to Nadia Plamondon (Zotaxy, Nova Street, Nanaimo) to be identified to the lowest easily identifiable level. Following this basic identification a secondary look at the stomach contents was done by the authors where contents were classified as aquatic or terrestrial, and examined for species overlap with the aquatic invertebrate study. Images were taken on a Leica S9i.

Parasite Survey

After euthanasia and measurements, but prior to freezing, a slide was scraped along the base of the dorsal fin and twice along the body from head towards the tail to collect skin cells for later examination of ectoparasites. These slides were stored in 95% EtOH until visual analysis. All fish were examined while being measured and those with clear signs of abnormalities, which may be parasites, were photographed. Photographs were examined by parasitologist Timothy Goater (VIU).

Biodiversity Survey

During all surveys, opportunistic sightings of organisms were recorded to increase understanding of biodiversity within the Misty Lake watershed. Most of these sightings were photographed and uploaded to iNaturalist. Additionally, all birds seen or heard were identified and recorded using eBird. Occasionally species were observed and identified but not photographed or uploaded to iNaturalist. This data together with

existing records from iNaturalist, eBird, museum records from the UBC Ichthyology collection, and the Misty Lake Ecological Reserve profile on the BC Parks website (BC Parks n.d.) were used to create a list which was curated and reduced to a single observation per species (earliest record). The accuracy of iNaturalist and museum records were not confirmed. Records with less refined identifications were retained or excluded based on similarity to other records.

Data on iNaturalist was collected from the lake and surrounding 1.5 km area, and from the inlet and outlet streams. Museum records were searched by location. The collected data was curated to generate a species list for both the Misty Lake Ecological Reserve and the area surrounding Misty Lake inlet and outlet regions. Searches of iNaturalist and eBird were finalized and completed on January 28, 2026.

RESULTS

Riparian Edge Transect

A total of eight plant species were identified at the riparian edge. Sweet gale (*Myrica gale*) is by far the most common shrub at the water's edge, in frequency, number, and coverage (Figure 3), followed by Hardhack (*Spiraea douglassi*), and Salmonberry (*Rubus spectabilis*) (Tables 2–4). Sweet gale also had the highest Importance Value Index, followed by Hardhack and Great Burnet (*Sanguisorba officinalis*) (Table 5). Note that at times counting individual plants was very challenging and estimates were made based on mutual stem location. This may result in over-estimates when plants spread by suckers such as *Myrica gale*.



Figure 3: Photograph of riparian edge of southwestern Misty Lake showing density of Sweet Gale (*Myrica gale*) at the water's edge. (Photo: Scott Gilmore).

Table 2: Total frequency of shrub species across all ten, 10m transects from the southwestern corner (50.6054, -127.2692) of Misty Lake. Each column (1–10) represents an individual transect. A frequency of 10 means a shrub was found in each of the 10 segments of that transect.

		Frequency by Transect											
Species	Scientific Name	1	2	3	4	5	6	7	8	9	10	sum	F_i
Sweet Gale	*Myrica gale*	10	10	10	10	10	10	10	10	10	10	100	0.75188
Hardhack	*Spiraea douglasii*		5	1		2	4	2		1	4	19	0.14286
Salmonberry	*Rubus spectabilis*			1		2						3	0.02256
Mock Azelea	*Rhododendron menziesii*				1							1	0.00752
Pacific Ninebark	*Physocarpus capitatus*					2						2	0.01504
Salal	*Gaultheria shallon*					1						1	0.00752
Red Huckleberry	*Vaccinium parvifolium*					2						2	0.01504
Great Burnet	*Sanguisorba officinalis*						4		1			5	0.03759

Table 3: Total number of individuals of each shrub species in all ten, 10m transects from the southwestern corner (50.6054, -127.2692) of Misty Lake. Each column (1–10) represents an individual transect. A number of 34 means 34 individual plants were counted along the 10m transect.

		Number by Transect											
Species	Scientific Name	1	2	3	4	5	6	7	8	9	10	sum	N_i
Sweet Gale	*Myrica gale*	34	21	18	18	17	35	40	29	27	36	275	0.90759
Hardhack	*Spiraea douglasii*		3	1		2	4	2		1	4	17	0.05611
Salmonberry	*Rubus spectabilis*			1		1						2	0.00660
Mock Azelea	*Rhododendron menziesii*				1							1	0.00330
Pacific Ninebark	*Physocarpus capitatus*					1						1	0.00330
Salal	*Gaultheria shallon*					1						1	0.00330
Red Huckleberry	*Vaccinium parvifolium*					1						1	0.00330
Great Burnet	*Sanguisorba officinalis*						4		1			5	0.01650

Table 4: Total coverage (in metres) of each shrub species along all ten, 10m transects from the southwestern corner (50.6054, -127.2692) of Misty Lake. Each column (1–10) represents an individual transect.

		Coverage by Transect											
Species	Scientific Name	1	2	3	4	5	6	7	8	9	10	sum	C_i
Sweet Gale	*Myrica gale*	10	9	9.8	10	7.7	10	10	10	8	10	94.5	0.91659
Hardhack	*Spiraea douglasii*		0.6	0.1		0.2	0.8	2		0.2	1.6	5.5	0.05335
Salmonberry	*Rubus spectabilis*			0.3		1.1						1.4	0.01358
Mock Azelea	*Rhododendron menziesii*				0.6							0.6	0.00582
Pacific Ninebark	*Physocarpus capitatus*					0.2						0.2	0.00194
Salal	*Gaultheria shallon*					0.3						0.3	0.00291
Red Huckleberry	*Vaccinium parvifolium*					0.2						0.2	0.00194
Great Burnet	*Sanguisorba officinalis*						0.3		0.1			0.4	0.00388

Table 5: Misty Lake riparian edge transect results showing the rank of Importance Value Index (sum of the relative frequency, relative number and relative coverage) of shrub species at the water's edge.

Species	Scientific Name	F_i	N_i	C_i	Importance
Sweet Gale	*Myrica gale*	0.75188	0.90759	0.91659	2.57606
Hardhack	*Spiraea douglasii*	0.14286	0.05611	0.05335	0.25231
Great Burnet	*Sanguisorba officinalis*	0.03759	0.01650	0.00388	0.05798
Salmonberry	*Rubus spectabilis*	0.02256	0.00660	0.01358	0.04274
Pacific Ninebark	*Physocarpus capitatus*	0.01504	0.00330	0.00194	0.02028
Red Huckleberry	*Vaccinium parvifolium*	0.01504	0.00330	0.00194	0.02028
Mock Azelea	*Rhododendron menziesii*	0.00752	0.00330	0.00582	0.01664
Salal	*Gaultheria shallon*	0.00752	0.00330	0.00291	0.01373

Aquatic Invertebrate Survey:

A total of nine invertebrate species were identified (Table 6) within the orders of Amphipoda, Odonata, Sphaeriida, Ephemeroptera, and Hemiptera, and class Gastropoda. An amphipod from the genus *Hyalella* was the most common organism, present in 9 of the 10 surveyed sites. This was followed by the pea clam (*Musculium sp*), present at 8 sites. Two juvenile (<15 mm) MLS were caught during this survey and released unharmed (Figure 4).

Table 6: Invertebrate species composition and individual counts from each site.

Transect	*Crangonyx richmondensis*	*Hyalella*	*Aeshna eremita*	*Musculium*	*Callibaetis*	*Paraleptophlebia*	*Hesperocorixa*	*Ferrissia rivularis*	*Planorbella trivolvis*
1		1		5		2		1	
2		6				1			1
3	2	2	1	3					
4		3		2			1		1
5		1		1		1			
6		2		5	1				
7	1	3		2		2			1
8	1			2					
9		1				1			1
10		1		1					1

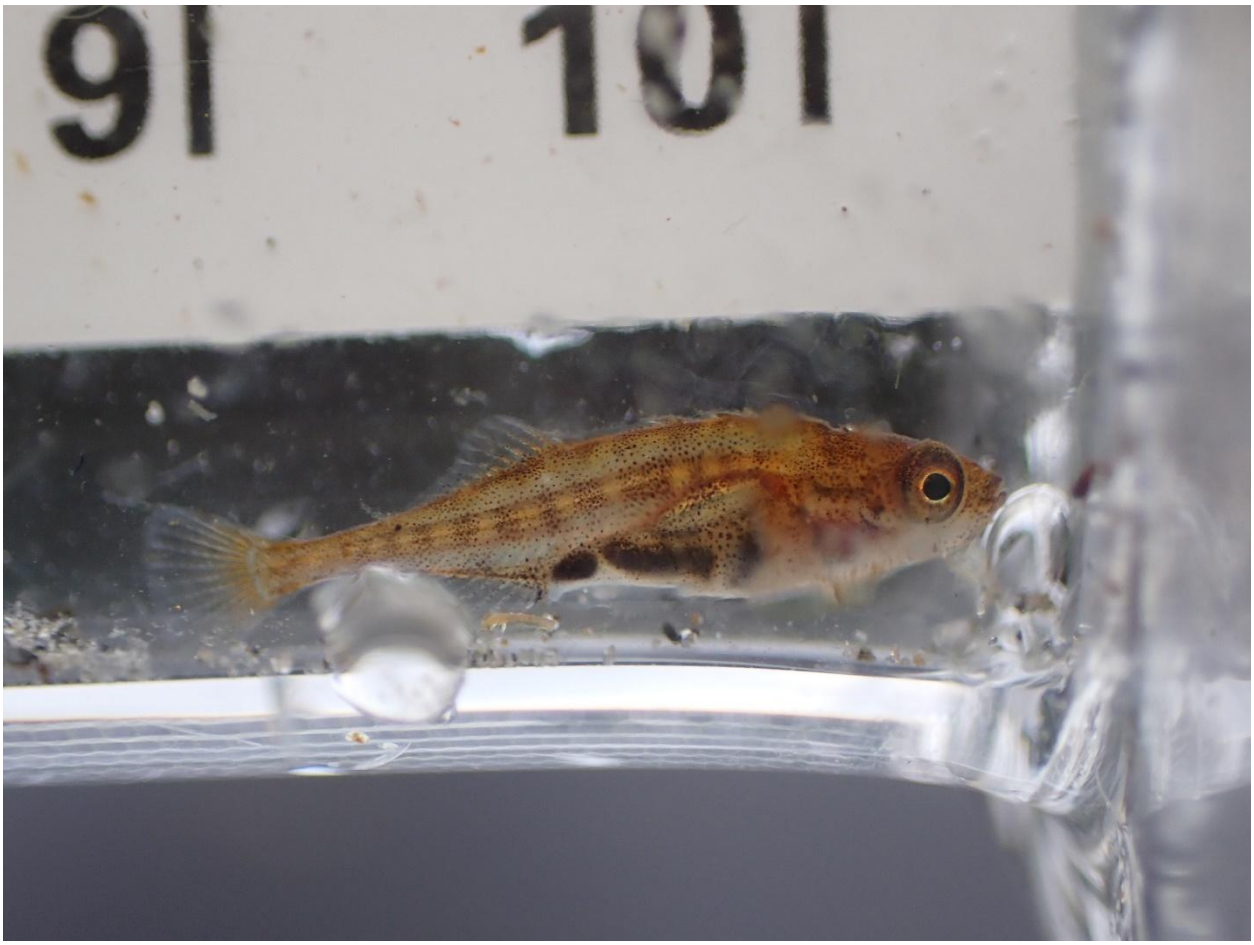


Figure 4: Photograph of juvenile Misty Lake Stickleback caught during the Misty Lake aquatic invertebrate survey. (Photo: Scott Gilmore)

Aquatic Invasive Species Survey:

A total of 14 aquatic plant species were identified as being high risk invaders for Vancouver Island, with nine being found on central and/or north Vancouver Island and five species found only on central and/or southern Vancouver Island (south of Campbell River) (Table 7). Of the nine species found on north Vancouver Island, five are high risk obligate wetland plants and four are facultative wetland plants considered priority invasive species by the Province of B.C. (B.C. Inter-Ministry Invasive Species Working Group, 2026). None of these invasive aquatic plant species were detected in Misty Lake at the time of the survey.

In-person visual surveys following up on iNaturalist sightings confirmed some species at other locations on North Vancouver Island. Policeman's Helmet (*Impatiens glandulifera*) was confirmed in Port Hardy and Port McNeil, Yellow Flag Iris (*Iris pseudacorus*) was confirmed in Sayward, and Purple Loosestrife (*Lythrym salicaria*) was confirmed in Campbell River (Table 7).

Table 7: Non-indigenous aquatic plants (10 obligate wetland (OBL; white background) and 4 facultative wetland (FACW; grey background)) identified as high-risk which are present on Vancouver Island. Three of the species were specifically searched for at other locations on north Vancouver Island (i.e., north of Campbell River) and confirmed present.

Species Name	Common name	Detected on N Van. Isl.	Nearest location	Confirmed Detection on N Van. Isl.
Callitriche stagnalis	Pondwater starwort	Yes	Sayward	
Egeria densa	Brazilian waterweed	No	Victoria	
Fallopia japonica	Japanese knotweed	Yes	Port McNeill	
Fallopia X bohemica	Bohemian knotweed	Yes	Sayward	
Impatiens glandulifera	Policeman's helmet	Yes	Port Hardy and Port McNeill	Yes
Iris pseudocaris	Yellow flag iris	Yes	Port McNeill and west island	Yes
Lycopus europaeus	Horehound/EU bugleweed	Yes	Campbell River	
Lysimachia punctata	Spotted loosestrife	Yes	Sayward	
Lythrum salicaria	Purple loosestrife	Yes	Campell River	Yes
Myosostis scorpioides	Water forget-me-not	Yes	Sayward	
Myriophyllum aquaticum	Parrot's feather	No	Victoria	
Myriophyllum spicatum	Hybrid watermilfoil	No	Victoria, Nanaimo	
Pontedaria crassipes	Water hyacinth	No	Victoria	
Potamogeton crispus	Curly pondweed	No	Nanaimo and Port Alberni	

Fish Survey:

A total of 177 MLS were caught across 262.33 trapping hours with an average catch per trap of 2.36 fish (range 0–25 fish per trap, Table 8). Out of the 30 traps set at the inlet stream sites, 13 had positive detections for MLS for a total of 63 individuals (Table 8 & 9). The inlet stream site closest to the lake (MLU2) captured stickleback in 20% of the traps with a CPUE of 0.082 ± 0.183 MLS/trap hour, site MLU4 had a 100% trapping rate and CPUE of 0.774 ± 0.525 MLS/trap hour and MLU5 had a 70% trapping rate with a CPUE of 1.25 ± 2.866 (Table 9). However, no MLS were captured at two inlet sites MLU1 and MLU3 (Table 8). A total of 28 MLS were caught in the outlet stream sites in 11 of the 20 traps set; MLS were detected at all sites with positive detections in 40 - 80% of the traps set (Tables 8 & 9). The lowest CPUE was at site MLOA1 at 0.270 ± 0.468 MLS/trap hour. In the lake, MLS were detected at all but one transect, for a total of 63 individuals in 12 of the 25 traps (Tables 8 & 9). Additionally, two fish species, Cutthroat Trout (*Oncorhynchus clarkii*) and Coho Salmon (*Oncorhynchus kisutch*), as well as unknown species of tadpoles and salamanders were caught in the minnow traps (Table 8).

Table 8: Minnow trap capture results from Misty Lake (MLL1-5), the inlet (MLU1-5) and outlet (MLOA1, MLOA2, MLOB1, MLOB2) from 15 to 16 September 2025. For site locations see Figure 1.

Date	Site	Trap number	Time set	Time recovered	Trap depth (m)	Stream wetted width (m)	Distance from shore (m)	Time in water (h:mins)	Total number of stickleback	Number and ID of bycatch
16-Sep-25	MLOA1	1	10:20	14:02	c. 1	3.5m		3:42	0	
16-Sep-25	MLOA1	2	10:20	14:02	c. 1	3.5m		3:42	1	
16-Sep-25	MLOA1	3	10:20	14:02	c. 1	3.5m		3:42	4	
16-Sep-25	MLOA1	4	10:20	14:02	c. 1	3.5m		3:42	0	
16-Sep-25	MLOA1	5	10:20	14:02	c. 1	3.5m		3:42	0	1 Cutthroat Trout
16-Sep-25	MLOA2	1	10:25	14:25	c. 0.5	6.6m		4:00	3	
16-Sep-25	MLOA2	2	10:25	14:25	c. 0.5	6.6m		4:00	1	1 Coho Salmon
16-Sep-25	MLOA2	3	10:25	14:25	c. 0.5	6.6m		4:00	3	
16-Sep-25	MLOA2	4	10:25	14:25	c. 0.5	6.6m		4:00	0	
16-Sep-25	MLOA2	5	10:25	14:25	c. 0.5	6.6m		4:00	1	
16-Sep-25	MLOB1	1	9:20	13:21	c. 1+	32.7m		4:00	2	
16-Sep-25	MLOB1	2	9:20	13:21	c. 1+	32.7m		4:00	2	2 Cutthroat Trout
16-Sep-25	MLOB1	3	9:20	13:21	c. 1+	32.7m		4:00	0	
16-Sep-25	MLOB1	4	9:20	13:21	c. 1+	32.7m		4:00	0	
16-Sep-25	MLOB1	5	9:20	13:21	c. 1+	32.7m		4:00	0	1 Cutthroat Trout
16-Sep-25	MLOB2	1	9:30	13:26	c. 0.5	7.8m		3:56	9	
16-Sep-25	MLOB2	2	9:30	13:26	c. 0.5	7.8m		3:56	0	
16-Sep-25	MLOB2	3	9:30	13:26	c. 0.5	7.8m		3:56	1	1 Cutthroat Trout
16-Sep-25	MLOB2	4	9:30	13:26	c. 0.5	7.8m		3:56	1	
16-Sep-25	MLOB2	5	9:30	13:26	c. 0.5	7.8m		3:56	0	1 Coho Salmon
15-Sep-25	MLU2	1	16:10	18:37	c. 0.3	3m		2:27	0	
15-Sep-25	MLU2	2	16:10	18:37	c. 0.3	3m		2:27	0	1 Cutthroat Trout
15-Sep-25	MLU2	3	16:10	18:37	c. 0.3	3m		2:27	0	1 Coho Salmon
15-Sep-25	MLU2	4	16:10	18:37	c. 0.3	3m		2:27	0	
15-Sep-25	MLU2	5	16:10	18:37	c. 0.3	3m		2:27	1	2 Cutthroat Trout, 1 Coho Salmon

Table 8: Minnow trap capture results from Misty Lake (MLL1-5), the inlet (MLU1-5) and outlet (MLOA1, MLOA2, MLOB1, MLOB2) from 15 to 16 September 2025. For site locations see Figure 1.

Date	Site	Trap number	Time set	Time recovered	Trap depth (m)	Stream wetted width (m)	Distance from shore (m)	Time in water (h:mins)	Total number of stickleback	Number and ID of bycatch
15-Sep-25	MLU1	1	15:15	19:15	c. 0.3	3m		3:00	0	
15-Sep-25	MLU1	2	15:15	19:15	c. 0.3	3m		3:00	0	
15-Sep-25	MLU1	3	15:15	19:15	c. 0.3	3m		3:00	0	
15-Sep-25	MLU1	4	15:15	19:15	c. 0.3	3m		3:00	0	
15-Sep-25	MLU1	5	15:15	19:15	c. 0.3	3m		3:00	0	
16-Sep-25	MLU3	1	12:00	16:24	c. 0.15	2.4m		4:24	0	
16-Sep-25	MLU3	2	12:00	16:24	c. 0.15	2.4m		4:24	0	1 Cutthroat Trout
16-Sep-25	MLU3	3	12:00	16:24	c. 0.15	2.4m		4:24	0	
16-Sep-25	MLU3	4	12:00	16:24	c. 0.15	2.4m		4:24	0	
16-Sep-25	MLU3	5	12:00	16:24	c. 0.15	2.4m		4:24	0	
16-Sep-25	MLU4	1	12:30	16:38	c. 1.5	2.7m		4:08	1	
16-Sep-25	MLU4	2	12:30	16:38	c. 1.5	2.7m		4:08	1	1 Coho Salmon
16-Sep-25	MLU4	3	12:30	16:38	c. 1.5	2.7m		4:08	4	
16-Sep-25	MLU4	4	12:30	16:38	c. 1.5	2.7m		4:08	6	
16-Sep-25	MLU4	5	12:30	16:38	c. 1.5	2.7m		4:08	4	
16-Sep-25	MLU5	1	11:40	15:20	unrecorded	28.8m		3:40	3	
16-Sep-25	MLU5	2	11:40	15:20	unrecorded	28.8m		3:40	0	
16-Sep-25	MLU5	3	11:40	15:20	unrecorded	28.8m		3:40	1	
16-Sep-25	MLU5	4	11:40	15:20	unrecorded	28.8m		3:40	2	
16-Sep-25	MLU5	5	11:40	15:20	unrecorded	28.8m		3:40	0	
16-Sep-25	MLU5	6	11:40	15:20	c. 0.4	4.4m		3:40	1	
16-Sep-25	MLU5	7	11:40	15:20	c. 0.4	4.4m		3:40	0	Unidentified tadpole
16-Sep-25	MLU5	8	11:40	15:20	c. 0.4	4.4m		3:40	3	
16-Sep-25	MLU5	9	11:40	15:20	c. 0.4	4.4m		3:40	11	1 unidentified tadpole, 2 unidentified salamanders
16-Sep-25	MLU5	10	11:40	15:20	c. 0.4	4.4m		3:40	25	

Table 8: Minnow trap capture results from Misty Lake (MLL1-5), the inlet (MLU1-5) and outlet (MLOA1, MLOA2, MLOB1, MLOB2) from 15 to 16 September 2025. For site locations see Figure 1.

Date	Site	Trap number	Time set	Time recovered	Trap depth (m)	Stream wetted width (m)	Distance from shore (m)	Time in water (h:mins)	Total number of stickleback	Number and ID of bycatch
17-Sep-25	MLL1	1	10:12	13:05	0.2–1.5		0	2:53	0	
17-Sep-25	MLL1	2	10:12	13:05	0.2–1.5		1.5	2:53	0	
17-Sep-25	MLL1	3	10:12	13:05	0.2–1.5		3	2:53	3	
17-Sep-25	MLL1	4	10:12	13:05	0.2–1.5		4.5	2:53	19	
17-Sep-25	MLL1	5	10:12	13:05	0.2–1.5		6	2:53	0	
17-Sep-25	MLL2	1	10:20	13:00	0.2–1.5		0	2:40	0	
17-Sep-25	MLL2	2	10:20	13:00	0.2–1.5		1.5	2:40	0	
17-Sep-25	MLL2	3	10:20	13:00	0.2–1.5		3	2:40	0	
17-Sep-25	MLL2	4	10:20	13:00	0.2–1.5		4.5	2:40	0	
17-Sep-25	MLL2	5	10:20	13:00	0.2–1.5		6	2:40	0	
17-Sep-25	MLL3	1	10:00	12:50	0.2–1.5		0	2:50	1	
17-Sep-25	MLL3	2	10:00	12:50	0.2–1.5		1.5	2:50	0	
17-Sep-25	MLL3	3	10:00	12:50	0.2–1.5		3	2:50	0	
17-Sep-25	MLL3	4	10:00	12:50	0.2–1.5		4.5	2:50	10	
17-Sep-25	MLL3	5	10:00	12:50	0.2–1.5		6	2:50	11	
17-Sep-25	MLL4	1	10:15	13:14	0.2–1.5		0	2:59	1	
17-Sep-25	MLL4	2	10:15	13:14	0.2–1.5		1.5	2:59	0	
17-Sep-25	MLL4	3	10:15	13:14	0.2–1.5		3	2:59	0	
17-Sep-25	MLL4	4	10:15	13:14	0.2–1.5		4.5	2:59	13	
17-Sep-25	MLL4	5	10:15	13:14	0.2–1.5		6	2:59	5	
17-Sep-25	MLL5	1	10:12	13:23	0.2–1.5		0	3:11	10	
17-Sep-25	MLL5	2	10:12	13:23	0.2–1.5		1.5	3:11	3	
17-Sep-25	MLL5	3	10:12	13:23	0.2–1.5		3	3:11	9	
17-Sep-25	MLL5	4	10:12	13:23	0.2–1.5		4.5	3:11	1	
17-Sep-25	MLL5	5	10:12	13:23	0.2–1.5		6	3:11	0	

Table 9: CPUE and percentage of traps with MLS detections

Site	CPUE ± STDEV	No. traps with positive detections	Detection (%)	Closest Site from Oke et. al 2017	Fall CPUE calculated from Oke et al. 2017	No. traps with positive detections	Detection (%)
MLOA1	0.270 ± 0.468	2/5	40	MOA34	0.976 ± 1.55	12/20	60
MLOA2	0.400 ± 0.335	4/5	80	-	-	-	-
MLOB1	0.174 ± 0.243	2/5	40	MOA32	1.326 ± 1.90	6/20	30
MLOB2	0.559 ± 0.975	3/5	60	-	-	-	-
MLU1	0	0/5	0	MIC1	0.121 ± 0.242	6/20	30
MLU2	0.082 ± 0.183	1/5	20	MIC2	0.057 ± 0.102	5/20	25
MLU3	0	0/5	0	-	-	-	-
MLU4	0.774 ± 0.525	5/5	100	MIA11	0.045 ± 0.146	1/20	5
MLU5	1.25 ± 2.148	7/10	70	MLS3	0.511 ± 1.03	14/20	70
All Lake (MLL1-MLL5)	1.164 ± 1.534	12/25	48	ML1	1.98 ± 2.88	14/20	70

Details of the fork length and weight of collected fish are given in Table 10.

Table 10: Weight and fork length of a sub-sample of Misty Lake Stickleback captured via minnow trap from Misty Lake (MLL), the inlet (MLU2, MLU4, MLU5) and outlet (MLOB1/2, MLOA1/2).

Fish number	Site	Weight (g)	Fork length mm	Fish number	Site	Weight (g)	Fork length mm
1	MLU2	2.5	63	31	MLU5	1.2	50
2	MLOB1/2	3.4	71	32	MLU5	1.2	49
3	MLOB1/2	4.5	81	33	MLU5	2.9	63
4	MLOB1/2	1.9	67	34	MLU5	1.2	50
5	MLOB1/2	0.8	46	35	MLU5	1.3	48
6	MLOB1/2	2.5	68	36	MLU5	1.4	54
7	MLOB1/2	2.6	69	37	MLU4	4.4	75
8	MLOB1/2	2.6	67	38	MLU4	2.9	65
9	MLOB1/2	1.7	61	39	MLU4	2	60
10	MLOB1/2	0.6	43	40	MLL	2.6	67
11	MLOB1/2	3	71	41	MLL	2	61
12	MLOA1/2	2.5	66	42	MLL	1.7	58
13	MLOA1/2	2.8	77	43	MLL	2.3	64
14	MLOA1/2	2.7	74	44	MLL	1.5	56
15	MLOA1/2	3.2	70	45	MLL	2	61
16	MLOA1/2	2.2	64	46	MLL	1.3	55
17	MLOA1/2	2	63	47	MLL	2.9	70
18	MLOA1/2	3.2	79	48	MLL	3.1	72
19	MLOA1/2	4.5	82	49	MLL	1.6	53
20	MLOA1/2	2.5	69	50	MLL	2	63
21	MLU5	5.1	74	51	MLL	2.6	68
22	MLU5	5.1	78	52	MLL	1.8	59
23	MLU5	1.5	53	53	MLL	1.4	54
24	MLU5	1	49	54	MLL	2.1	63
25	MLU5	2.8	64	55	MLL	2.2	62
26	MLU5	3.6	66	56	MLL	4.4	77
27	MLU5	2.6	61	57	MLL	n/a	52
28	MLU5	1	47	58	MLL	2.8	70
29	MLU5	0.8	43	59	MLL	1.6	58
30	MLU5	1.5	54	60	MLL	1.8	59

Diet Analysis:

A variety of aquatic invertebrates were identified in the stomach contents of MLS (Table 11). Fish stomachs were grouped based on the site of capture. A combined count for all fish captured in the inlet, lake and outlet areas is provided along with proportional

results shown in percentages (Table 12). Copepods were the most common organisms found in the stomach of MLS regardless of capture location. Insects were the second most dominant species in the stomachs of MLS from the inlet and outlet sites, while ostracods were the second most dominant organism in MLS from the lake.

A secondary examination of stomach contents for the purpose of looking for terrestrial species and species found in aquatic invertebrate sampling found the molluscs *Musculium*, *Ferrissia* and tiny *Planorbella trivolvis* along with the mayfly *Paraleptophlebia* all of which were collected in aquatic invertebrate sampling. The terrestrial species from the stomach contents included the wing of a fungus gnat from the genus *Mycomya* (Mycetophilidae) from MLOA (Figure 5A), a bark louse (Psocoptera) (Figure 5B), and lepidopteran caterpillar in MLU5 (Figure 5C), a globular springtail from the genus *Ptenothrix* and a centipede in MLU4 (Figure 5D & E). All of the terrestrial prey species are of riparian origin.

Table 11: Misty Lake Stickelback stomach contents counts grouped by collection location.

		Site name	MLOA	MLOB	MLU 2	MLU 4	MLU 5	MLL
		Total Stomachs	9	10	1	3	16	21
		Folsom Split#	**0**	**0**	**0**	**0**	**0**	**1**
Copepoda		Cyclopoida	**57**	**71**	**2**	**20**	**156**	**81**
		Calanoida	**3**	**106**	**0**	**0**	**0**	**94**
Crustacea	Cladocera	Bosmina sp.	**0**	**0**	**0**	**0**	**0**	**34**
		Chydoridae	**7**	**10**	**0**	**1**	**8**	**97**
		Daphnia sp.	**44**	**71**	**2**	**5**	**0**	**4**
		Sida sp.	**0**	**0**	**0**	**0**	**0**	**7**
	Ostracoda		**8**	**56**	**0**	**0**	**50**	**146**
	Amphipoda		**0**	**0**	**0**	**0**	**0**	**14**
	Isopoda		**0**	**2**	**0**	**0**	**3**	**0**
Mollusca	Bivalvia		**6**	**30**	**1**	**0**	**3**	**13**
	Gastropoda		**1**	**1**	**0**	**1**	**1**	**2**
	Gastropoda: Limpets		**0**	**0**	**0**	**0**	**0**	**13**
Insecta	Insects and Insects larvae		**68**	**65**	**8**	**46**	**87**	**68**
Parasitic type worms unknown ID			**8**	**5**	**3**	**1**	**23**	**1**
Annelida			**1**	**0**	**0**	**0**	**0**	**1**
Combined count			**202**	**417**	**16**	**74**	**331**	**574**
TOTAL #			**202**	**417**	**16**	**74**	**331**	**1148**

Table 12: Misty Lake Stickleback combined counts of stomach contents for each of the three broader locations MLU, MLO and MLL. For each identified group the proportion of the count is also presented as a percentage. When the percentage is between 10 and 20 it is highlighted in yellow, between 20 and 30 orange and over 30 red.

		Site name	MLU	MLO	MLL	MLU %	MLO %	MLL %
		Total Stomachs	19	20	21			
Copepoda		Cyclopoida	178	128	162	42.28	20.68	14.11
		Calanoida	0	109	188	0.00	17.61	16.38
Crustacea	Cladocera	Bosmina sp.	0	0	68	0.00	0.00	5.92
		Chydoridae	9	17	194	2.14	2.75	16.90
		Daphnia sp.	7	115	8	1.66	18.58	0.70
		Sida sp.	0	0	14	0.00	0.00	1.22
	Ostracoda		50	64	292	11.88	10.34	25.44
	Amphipoda		0	0	28	0.00	0.00	2.44
	Isopoda		3	2	0	0.71	0.32	0.00
Mollusca	Bivalvia		4	36	26	0.95	5.82	2.26
	Gastropoda		2	2	4	0.48	0.32	0.35
	Gastropoda: Limpets		0	0	26	0.00	0.00	2.26
Insecta	Insects and Insects larvae		141	133	136	33.49	21.49	11.85
Parasitic type worms unknown ID			27	13	2	6.41	2.10	0.17
Annelida			0	1	2	0.00	0.16	0.17
Combined count			421	619	1148			

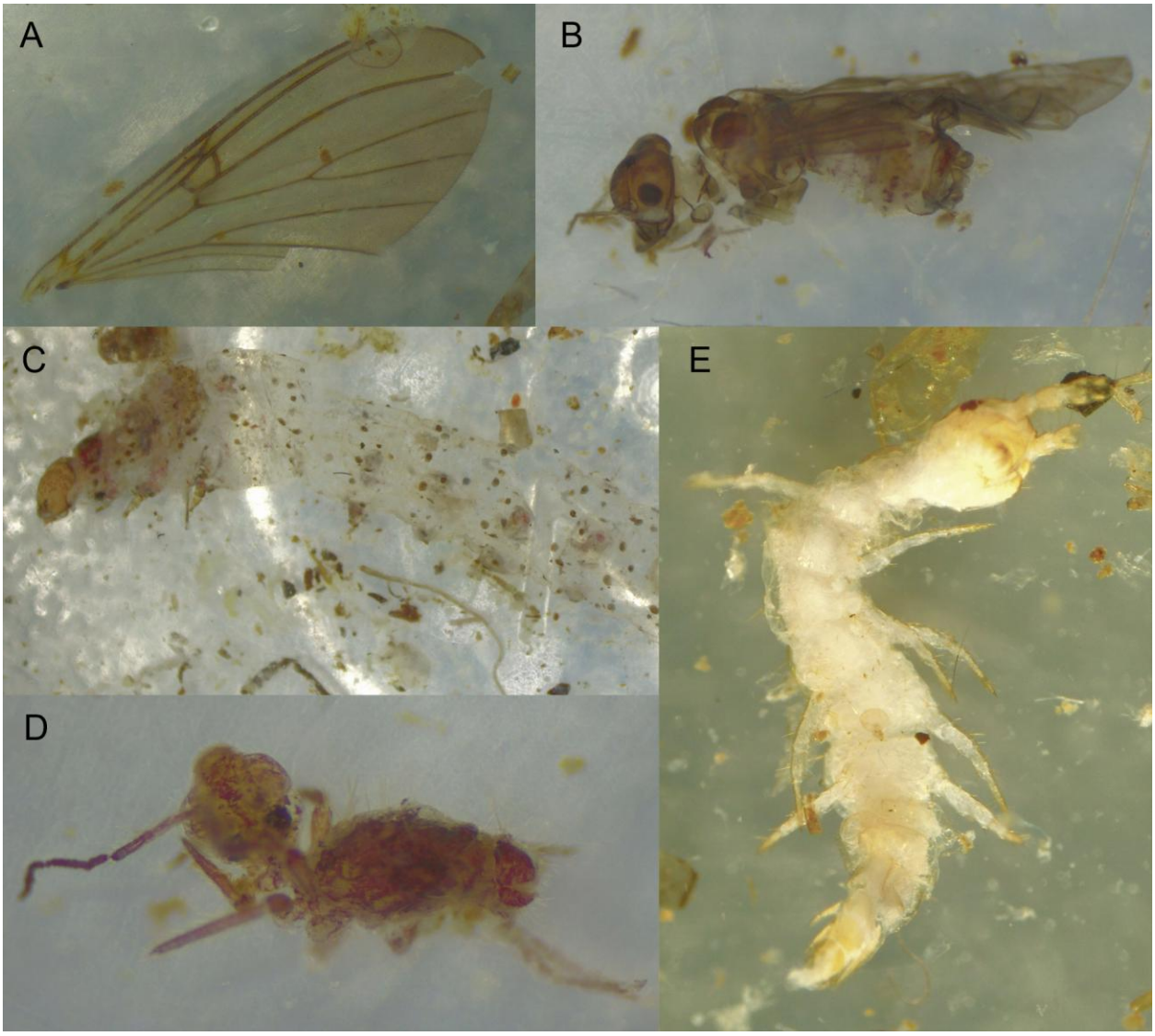


Figure 5: Terrestiral arthropods found in stomachs of Misty Lake Stickleback. A) wing of Mycomya (Mycetophilidae) from MLOA; B) Bark louse (Psocoptera) from MLU5; C) Lepidopterean caterpillar from MLU5; D) Ptenothrix globular springtail from MLU4 and E) Centipede from MLU4. (Photos: Scott Gilmore)

Parasite Survey:

No external parasites were detected on the sixty skin cell scrapings collected and preserved for parasite screening. To note, MLS are small and armoured, making it difficult to achieve consistent contact during scraping. Three captured MLS were seen with what appeared to be internal parasites. On one an *Eustrongylides tubifex* nematode worm infection was evident which led to odd growth on the lateral side of the fish (Figure 6). Two odd growths on the ventral surface of two different fish were excised and preserved for later examination. One appeared to be an aberrant fin growth

and the second was of unknown origin (possibly fungal). *Gyrodactylus* sp. was found on the skin surface of both of the excision samples (Figure 7).

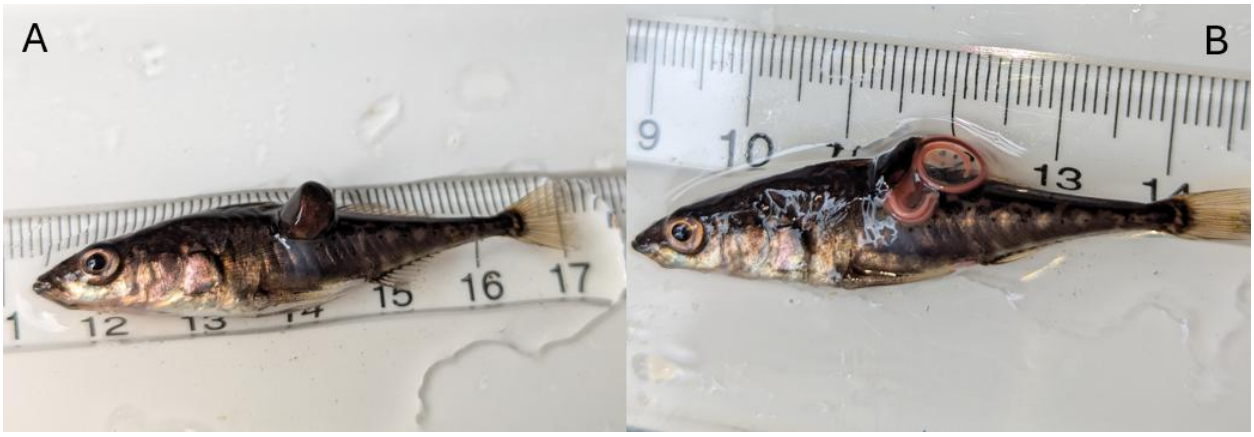


Figure 6: Misty Lake lentic stickleback with (A) growth on side of body containing the (B) nematode worm Eustrongylides tubifex. (Photos: Daniella LoScerbo)



Figure 7: Gyrodactylus sp. collected from skin of MLS (Photo: Scott Gilmore)

Biodiversity Survey:

The literature and database searches, as well as the observational survey study, revealed that Misty Lake Ecological Reserve and areas around Misty Lake and the inlet and outlet streams have high biodiversity. A total of 187 distinct taxa from 25 different classes are listed and of those, 130 taxa occur within the Misty Lake Ecological Reserve (Appendix A).

DISCUSSION

The recovery measures for Misty Lake Stickleback include developing and implementing a monitoring plan, which may include monitoring trends in abundance, hybridization rates, and habitat quality and quantity (Fisheries and Oceans Canada 2020). This study provides baseline habitat records within the Misty Lake watershed, allowing future monitoring efforts to assess changes in habitat quality. To address the need for monitoring of potential habitat quality changes the observational studies conducted here could be repeated without direct interaction with MLS. Habitat measures closely tied to biological requirements of MLS were chosen, such as vegetation surveys at the littoral zone edge where MLS spawn, and aquatic invertebrate samples alongside diet analyses.

Occupancy and Distribution

Misty Lake Stickleback are still present throughout the watershed at similar relative abundances as the 2017 sampling. There was variability in the catchability of the sticklebacks using minnow traps ranging from 0 to 100%, and CPUE ranged from 0 to 1.25 ± 2.148 stickleback per trap hour. The outlet sites' CPUE and percent positive detections were similar to those of Oke et al. (2017) fall catch rates (Table 9). Further, stickleback were detected at MLOB upstream and downstream of the forest road despite the upstream flooding caused by a collapsed log bridge (LoScerbo et al. 2026). The inlet stream site closest to the lake (MLU2) captured stickleback at similar catch rates as Oke et al. (2017), while MLU1, across the highway did not catch any stickleback in this study despite being only approximately 80 m upstream. In 2017, Oke et al. caught MLS in 30% of the traps set with a CPUE of 0.121 ± 0.242 MLS/trap hour at MLU1. Nevertheless, MLS were caught further upstream, where site MLU4 had a 100% of trap rate and CPUE of 0.774 ± 0.525 MLS/trap hour, which is higher than Oke et al. (2017) fall data, and MLU5 had a 70% trapping rate with a CPUE of 1.25 ± 2.866, which overlaps with the 2017 study (Table 9). Therefore, despite not catching stickleback at MLU1, it is not considered a true absence since catchability with minnow traps varies, and stickleback are additionally present upstream and downstream. Another site that did not catch stickleback was MLU3, which was not sampled in 2017. However, as with MLU1, this is not considered a true absence, and further sampling is required to conclude whether stickleback still occupy this inlet stream. At MLU5, 5 traps were placed on either side of the Misty Lake Main Forest Service Road. One side was flooded as the culvert was completely blocked resulting in distinctly different water levels on either side, and both sides had low oxygen nearing the threshold of hypoxia (Figure 2B, C, LoScerbo et al. 2026). Despite the potential movement and physiological barriers, Misty Lake Stickleback were caught on both sides of the road. Additionally, MLS were caught in the lake at all but one of the five transects, with positive detections varying from 40-80% in the transects that caught the fish, similar to the detection percentage of 70% by Oke et al. (2017). Furthermore, the CPUE's between the two sampling years overlapped, suggesting that the stickleback are still present in the lake at similar relative abundances.

Riparian habitat condition and ecological function

Riparian vegetation is important to the lake and streams for woody debris supply, bank stability, and for nutrient and food input from litter fall and insect drop (Fisheries and Oceans 2018, DFO 2020). The riparian surveys showed that the littoral habitat was a mix of shrub and herbaceous plants, with shrubs dominating in frequency, number, and coverage. Sweet Gale was the most dominant shrub and is known to grow in wetlands, bogs, marshes and lake margins. Sweet Gale and other native shrubs have been shown to support higher densities of stickleback compared to areas dominated by herbaceous plants, likely due to increased cover from predators (Hood et al. 2012). The density and growth pattern likely discourages AIS encroachment at the lake edge while providing MLS with both cover from predators and shade for temperature control of this important habitat. The lake was found to be rich in organic debris, as sampling for aquatic invertebrates was slowed due to frequent clogging of the dip net, requiring each sample to be slowly sifted to find and extract organisms from among the organic matter.

The tannic waters of Misty Lake are acidic (pH <6.28; LoScerbo et al. 2026), a freshwater condition synonymous with lower aquatic invertebrate biodiversity (Allard and Moreau 1987; Friday 1987; Spyra 2017). Additionally, due to the high amount of organic matter in the dip nets some species or individuals may have been missed in the sorting. Finding only 9 invertebrate taxa from 10 sampling sites likely reflects these conditions. *Hyalella,* the most common organism found in this study, is tolerant of acidic conditions, often absent in lakes with pH below 5.40, but present when the pH is >6.0 (Grapentine & Rosenberg 1992). In experimental conditions, populations of *H. azteca* decline when pH remains <5.8 due to young life stage being less tolerate of low pH (Grapentine & Rosenberg 1992). *Cragonyx richmondensis* is often collected with *Hyalella* but is confined to denser vegetation (Steele 1967). The marsh ramshorn snail (*Planorbella trivolvis*) and some members of the fingernail clam family (Sphaeriidae) are also known to be tolerant of acidic conditions (Hunter 1990, Rassam et al. 2021).

Analysis of diet composition found distinct differences in prey consumption between lotic MLS (MLU) and lentic MLS (MLL & MLO). Many of these differences can be related to habitat specificity of the prey. For example, Calanoid copepods are exclusively planktonic and while they can be found in streams (Sandercock & Scudder 1994), they tend to be more common in lakes (Santer 1998). Comparatively Cyclopoid copepods are primarily benthic and found in both lakes and streams. Calonoid copepods were found in the stomachs of lake and outlet stream MLS but not in inlet stream MLS, while Cyclopoid copepods were found in stomachs across all three locations. Most organisms identified in the stomach contents were too small to be captured by the invertebrate surveying methods used. However, larger organisms identified have a distinct overlap with specimens collected during invertebrate surveys. As examples, the molluscs *Musculium*, *Ferrissia* and tiny *Planorbella trivolvis* along with the mayfly

Paraleptophlebia were found in both stomach content analysis and during invertebrate sampling in Misty Lake. This suggests a strong possibility of using food resource surveys to infer habitat health as it relates to continued MLS occupancy. The diet of Threespine Sticklebacks is known to closely resemble the available food resource (Dukowska et al. 2009). However, since the diet of MLS are primarily composed of prey too small to be captured in the sample techniques used here, the resulting data have limitations. Additionally, no comparison was done in the inlet or outlet systems. Lastly, terrestrial invertebrates are also an important food resource for freshwater fish species (Allan et al. 2003). Within the small sample size of this study, terrestrial invertebrates were primarily found in MLS inlet stomachs, which is likely a result of the ratio of stream size to riparian interface creating higher allochthonous inputs (Baxter et al. 2005).

Threats and Emerging Risks

Many of the non-indigenous aquatic plant species listed in Table 7 are known to impact aquatic habitats and poses a significant risk to MLS. Specific impacts include altering water quality (e.g., Emery and Perry, 1996; Nichols and Shaw, 1996) and dissolved oxygen levels (e.g., Fleming and Dibble 2015), changing water temperature (e.g., Jones et al., 1996), clogging waterways (E.g. Navarro and Phiri 2000; Ramey, 2001), and drying up water bodies (e.g., Gopal, 1981). Furthermore, the unbaited minnow traps did not capture any crayfish, although crayfish sampling usually use baited traps (Egly and Keller 2025). The lack of detection of these species in Misty Lake does not mean absence and further monitoring and search effort is recommended. The Action Plan for MLS lists a broad strategy to “determine the distribution of key aquatic exotic, invasive or introduced species on Vancouver Island” (Fisheries and Oceans Canada 2020). This work would aid in understanding risk of invasion to Misty Lake for the various species, and successful eradication of invaders is more probable with early detection and a rapid response.

Parasites are not listed as a threat to MLS (Fisheries and Oceans 2018); however, they could be an emerging risk to the health of the fish. *Gyrodactylus* was detected on preserved excised skin specimens but was absent on slide scrapings, suggesting future parasite surveys should examine fish directly, as the techniques used in this study may have been unable to adequately capture them. Spread of gyrodactylid parasites increases with higher water temperatures as it increases the parasite’s fitness (Tepox-Vivar et al. 2022); thus more MLS could be exposed to this parasite if water temperature increases with climate change, an identified threat (Fisheries and Oceans 2018). No unusual parasites were detected as part of this study, however continued monitoring of this emerging risk should be undertaken.

CONCLUSION

This baseline survey provides the first comprehensive snapshot of riparian, littoral, and watershed-scale habitat conditions for the Misty Lake Lentic and Lotic Threespine

Stickleback (*Gasterosteus aculeatus*). Across the study area, riparian vegetation, aquatic invertebrates, fish distribution, diet composition, and parasite occurrence were documented using standardized field methods, establishing a consistent reference point for future monitoring. Key findings include the dominance of Sweet Gale (*Myrica gale*) along the riparian edge, the widespread presence of common aquatic invertebrate taxa such as the amphipod *Hyalella* and pea clam *Musculium*, and the continued occupancy of both inlet and outlet habitats by Misty Lake Stickleback. Diet analyses indicate reliance on a combination of aquatic and terrestrial prey, reflecting connectivity between riparian and aquatic food webs. No high-risk aquatic invasive plant species were detected during surveys, although their presence elsewhere on northern Vancouver Island highlights the importance of continued surveillance.

Despite the diverse and numerous studies presented here there are some limitations which need recognition. This work is a single-season snapshot with the majority of the sampling done on a single day. There are also spatial limitations, for example the riparian vegetation transects and aquatic invertebrate surveys were only conducted in one area of the lake and not in the surrounding watershed. Finally, temporal differences in surveys must also be noted, since the aquatic invertebrate surveys were conducted more than a month prior to collecting fish stomachs for analysis.

These results fulfill the primary objective of establishing a baseline dataset against which future changes in habitat condition, species composition, and ecological interactions can be assessed. While the findings are not intended to provide inference on temporal trends or causal mechanisms, they identify key components of the system that may be sensitive to environmental change, including riparian structure, prey availability, invasive species and continued occupancy of Misty Lake Stickleback in critical habitat. The standardized methods and spatially explicit sampling framework presented here will support repeatable monitoring efforts and facilitate direct comparison over time, contributing to ongoing assessment and management of Misty Lake Stickleback critical habitat.

Overall, the 2025 surveys confirm continued occupancy of Misty Lake Stickleback across sampled lake, outlet, and inlet habitats and establish a baseline for several habitat-related attributes, including riparian condition, prey availability, invasive species occurrence, and diet. The results do not provide evidence of temporal trends in habitat quality or abundance, but they establish a reference point against which future standardized surveys can be compared and identify localized habitat conditions, particularly at road crossings, that warrant continued monitoring. Future monitoring should, where possible, replicate sampling locations, methods, effort, and seasonal timing to distinguish changes in habitat condition from natural spatial and seasonal variability.

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APPENDIX A

Appendix A: Species records in Misty Lake and surroundings. Sources include iNaturalist, personal sightings, museum specimens and eBird. An asterisk (*) indicates species recorded in Misty Lake Ecological Reserve. < record from Misty Lake Ecological Reserve detailed description (date unknown)

Kingdom	Phylum	Class	Family	Species	Source	Reference no.
Animalia	Annelida	Clitellata		Hirudinea	iNaturalist*	26584402
Animalia	Arthropoda	Arachnida	Tetragnathidae	*Tetragnatha*	Visual*	Scott Gilmore
Animalia	Arthropoda	Insecta	Aeshnidae	*Aeshna eremita*	iNaturalist*	306129637
Animalia	Arthropoda	Insecta	Aeshnidae	*Aeshna umbrosa*	iNaturalist	315265516
Animalia	Arthropoda	Insecta	Baetidae	*Callibaetis*	iNaturalist*	307810746
Animalia	Arthropoda	Insecta	Belostomatidae	*Lethocerus americanus*	iNaturalist	304582789
Animalia	Arthropoda	Insecta	Bibionidae	*Bibio*	iNaturalist	283251399
Animalia	Arthropoda	Insecta	Caenidae	*Caenis*	Visual*	Scott Gilmore
Animalia	Arthropoda	Insecta	Cantharidae	*Dichelotarsus*	iNaturalist	283251368
Animalia	Arthropoda	Insecta	Chrysomelidae	*Donacia hirticollis*	iNaturalist*	304549817
Animalia	Arthropoda	Insecta	Chrysomelidae	*Galerucella nymphaeae*	iNaturalist*	26589426
Animalia	Arthropoda	Insecta	Cicadellidae	*Draeculacephala*	iNaturalist	304090748
Animalia	Arthropoda	Insecta	Cixiidae	Cixiinae	iNaturalist*	304090835
Animalia	Arthropoda	Insecta	Coenagrionidae	*Ischnura cervula*	iNaturalist*	228360320
Animalia	Arthropoda	Insecta	Corduliidae	Corduliidae	iNaturalist*	307538136
Animalia	Arthropoda	Insecta	Corduliidae	*Epitheca spinigera*	iNaturalist*	304612893
Animalia	Arthropoda	Insecta	Corduliidae	*Somatachlora*	Visual*	Scott Gilmore
Animalia	Arthropoda	Insecta	Elateridae	*Megapenthes caprella*	iNaturalist*	307810740
Animalia	Arthropoda	Insecta	Geometridae	*Sabulodes venata*	iNaturalist	228360276
Animalia	Arthropoda	Insecta	Gerridae	*Limnoporus notabilis*	iNaturalist*	304090909
Animalia	Arthropoda	Insecta	Gracillariidae	*Cameraria gaultheriella*	iNaturalist	110934641
Animalia	Arthropoda	Insecta	Leptophlebiidae	*Paraleptophlebia*	iNaturalist	306129633
Animalia	Arthropoda	Insecta	Libellulidae	*Leucorrhinia glacialis*	iNaturalist*	304609674
Animalia	Arthropoda	Insecta	Libellulidae	*Sympetra*	Visual*	Scott Gilmore

Kingdom	Phylum	Class	Family	Species	Source	Reference no.
Animalia	Arthropoda	Insecta	Limoniidae	*Austrolimnophila*	iNaturalist	283251436
Animalia	Arthropoda	Insecta	Noctuidae	*Protodeltote albidula*	iNaturalist	26578791
Animalia	Arthropoda	Insecta	Phryganeidae	*Banksiola crotchi*	iNaturalist*	307810745
Animalia	Arthropoda	Malacostraca	Astacidae	*Pacifastacus leniusculus*	iNaturalist	228355681
Animalia	Arthropoda	Malacostraca	Crangonyctidae	*Crangonyx richmondensis*	iNaturalist*	306129635
Animalia	Arthropoda	Malacostraca	Hyalellidae	*Hyalella*	iNaturalist	307810747
Animalia	Chordata	Actinopterygii	Cottidae	*Cottus asper*	UBC specimen*	BC83-329
Animalia	Chordata	Actinopterygii	Gasterosteidae	*Gasterosteus aculeatus*	iNaturalist*	111044681
Animalia	Chordata	Actinopterygii	Gasterosteidae	*Gasterosteus aculeatus*	iNaturalist	314476398
Animalia	Chordata	Actinopterygii	Salmonidae	*Oncorhynchus clarkii*	iNaturalist*	315354426
Animalia	Chordata	Actinopterygii	Salmonidae	*Oncorhynchus kisutch*	iNaturalist*	314474928
Animalia	Chordata	Actinopterygii	Salmonidae	*Oncorhynchus mykiss*	UBC specimen*	BC83-331
Animalia	Chordata	Actinopterygii	Salmonidae	*Salvelinus malma*	*<	
Animalia	Chordata	Amphibia	Ambystomatidae	*Ambystoma gracile*	iNaturalist	314474472
Animalia	Chordata	Amphibia	Ranidae	*Rana aurora*	iNaturalist*	229378594
Animalia	Chordata	Aves	Accipitridae	*Haliaeetus leucocephalus*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Alcendinidae	*Megaceryle alcyon*	ebird*	21-Mar-17
Animalia	Chordata	Aves	Anatidae	*Anas platyrhynchos*	ebird*	22-Mar-18
Animalia	Chordata	Aves	Anatidae	*Aythya affinis*	ebird*	22-Mar-18
Animalia	Chordata	Aves	Anatidae	*Aythya collaris*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Anatidae	*Branta canadensis*	ebird*	3-Apr-18
Animalia	Chordata	Aves	Anatidae	*Bucephala albeola*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Anatidae	*Lophodytes cucullatus*	ebird*	22-Mar-18
Animalia	Chordata	Aves	Apodidae	*Chaetura vauxi*	Visual*	Scott Gilmore
Animalia	Chordata	Aves	Bombycillidae	*Bombycilla cedrorum*	ebird*	24-Jun-23
Animalia	Chordata	Aves	Cathartidae	*Cathartes aura*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Certhiidae	*Certhia americana*	ebird*	9-Jul-24
Animalia	Chordata	Aves	Columbidae	*Patagioenas fasciata*	ebird*	18-Jul-06

Kingdom	Phylum	Class	Family	Species	Source	Reference no.
Animalia	Chordata	Aves	Corvidae	*Corvus brachyrhynchos*	ebird*	9-Apr-19
Animalia	Chordata	Aves	Corvidae	*Corvus corax*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Corvidae	*Cyanocitta stelleri*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Fringillidae	*Loxia curvirostra*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Fringillidae	*Spinus pinus*	ebird*	2-Jul-23
Animalia	Chordata	Aves	Gaviidae	*Gavia stellata*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Hirundinidae	*Hirundo rustica*	ebird*	10-Jul-25
Animalia	Chordata	Aves	Hirundinidae	*Stelgidopteryx serripennis*	ebird*	9-Apr-22
Animalia	Chordata	Aves	Hirundinidae	*Tachycineta bicolor*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Hirundinidae	*Tachycineta thalassina*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Icteridae	*Agelaius phoeniceus*	ebird*	8-Mar-23
Animalia	Chordata	Aves	Laridae	*Larus glaucescens*	ebird*	21-Mar-17
Animalia	Chordata	Aves	Pandionidae	*Pandion haliaetus*	ebird*	7-May-23
Animalia	Chordata	Aves	Paridae	*Poecile rufescens*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Parulidae	*Cardellina pusilla*	ebird*	24-Jun-23
Animalia	Chordata	Aves	Parulidae	*Geothlypis trichas*	ebird*	12-Sep-22
Animalia	Chordata	Aves	Parulidae	*Leiothlypis celata*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Parulidae	*Setophaga aestiva*	ebird*	3-Jun-23
Animalia	Chordata	Aves	Parulidae	*Setophaga coronata*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Parulidae	*Setophaga townsendi*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Passerellidae	*Junco hyemalis*	ebird*	21-Mar-17
Animalia	Chordata	Aves	Passerellidae	*Melospiza melodia*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Passerellidae	*Passerella iliaca*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Passerellidae	*Spizella passerina*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Picidae	*Leuconotopicus villosus*	ebird*	22-Mar-18
Animalia	Chordata	Aves	Picidae	*Sphyrapicus ruber*	ebird*	13-Mar-19
Animalia	Chordata	Aves	Podicipedidae	*Podiceps auritus*	ebird*	22-Mar-18
Animalia	Chordata	Aves	Podicipedidae	*Podilymbus podiceps*	ebird*	22-Mar-18
Animalia	Chordata	Aves	Rallidae	*Fulica americana*	ebird*	23-Sep-18
Animalia	Chordata	Aves	Regulidae	*Corthylio calendula*	ebird*	1-Apr-19

Kingdom	Phylum	Class	Family	Species	Source	Reference no.
Animalia	Chordata	Aves	Regulidae	*Regulus satrapa*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Scolopacidae	*Chalidris*	Visual*	Scott Gilmore
Animalia	Chordata	Aves	Scolopacidae	*Gallinago delicata*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Scolopacidae	*Phalaropus lobatus*	ebird*	12-Sep-22
Animalia	Chordata	Aves	Scolopacidae	*Tringa melanoleuca*	iNaturalist*	304604268
Animalia	Chordata	Aves	Trochilidae	*Selasphorus rufus*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Troglodytidae	*Troglodytes pacificus*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Turdidae	*Catharus guttatus*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Turdidae	*Catharus ustulatus*	ebird*	12-Sep-22
Animalia	Chordata	Aves	Turdidae	*Ixoreus naevius*	ebird*	6-Apr-06
Animalia	Chordata	Aves	Turdidae	*Turdus migratorius*	ebird*	21-Mar-17
Animalia	Chordata	Aves	Tyrannidae	*Empidonax difficilis*	ebird*	10-Jul-23
Animalia	Chordata	Aves	Vireonidae	*Vireo huttoni*	ebird*	18-Jul-06
Animalia	Chordata	Aves	Vireonidae	*Vireo swainsoni*	ebird*	12-Sep-22
Animalia	Chordata	Mammalia	Cervidae	*Cervus canadensis*	iNaturalist	318311380
Animalia	Chordata	Mammalia	Cervidae	*Odocoileus hemionus columbianus*	iNaturalist	229379133
Animalia	Chordata	Mammalia	Mustelidae	*Martes caurina*	iNaturalist	156728554
Animalia	Chordata	Mammalia	Ursidae	*Ursus americanus vancouveri*	iNaturalist	283252009
Animalia	Mollusca	Bivalvia	Margaritiferidae	*Margaritifera falcata*	iNaturalist	228301299
Animalia	Mollusca	Bivalvia	Sphaeriidae	*Musculium securis*	iNaturalist*	306129634
Animalia	Mollusca	Bivalvia	Unionidae	*Anodonta kennerlyi*	iNaturalist*	110934620
Animalia	Mollusca	Gastropoda	Arionidae	*Arion ater*	iNaturalist	229378534
Animalia	Mollusca	Gastropoda	Planorbidae	*Ferrissia rivularis*	iNaturalist*	325382708
Animalia	Mollusca	Gastropoda	Planorbidae	*Planorbella trivolvis*	iNaturalist*	229377742
Animalia	Mollusca	Gastropoda		Gastropoda	iNaturalist*	111044683
Animalia	Nematoda	Enoplea	Dioctophymidae	*Eustrongylides tubifex*	iNaturalist	333994418
Animalia	Platyhelminthes	Monogenea	Gyrodactylidae	*Gyrodactylus*	iNaturalist	326487394
Fungi	Ascomycota	Lecanoromycetes	Cladoniaceae	*Cladonia*	iNaturalist*	304609878
Fungi	Ascomycota	Lecanoromycetes	Parmeliaceae	*Menegazzia terebrata*	iNaturalist*	215504552
Fungi	Ascomycota	Lecanoromycetes	Parmeliaceae	*Usnea*	iNaturalist	26633513

Kingdom	Phylum	Class	Family	Species	Source	Reference no.
Fungi	Ascomycota	Lecanoromycetes	Peltigeraceae	*Peltigera*	iNaturalist	26584400
Fungi	Ascomycota	Lecanoromycetes	Physciaceae	Physciaceae	iNaturalist	26578793
Fungi	Ascomycota	Leotiomycetes	Mitrulaceae	*Mitrula elegans*	iNaturalist	283251838
Fungi	Ascomycota	Sordariomycetes	Hypocreaceae	*Hypomyces luteovirens*	iNaturalist	314476747
Fungi	Basidiomycota	Agaricomycetes	Russulaceae	*Lactarius scrobiculatus*	iNaturalist	314476574
Fungi	Basidiomycota	Pucciniomycetes	Pucciniastraceae	*Calyptospora ornamentalis*	iNaturalist	283015979
Plantae	Bryophyta	Bryopsida	Amblystegiaceae	*Campylium stellatum*	iNaturalist*	215504559
Plantae	Bryophyta	Bryopsida	Brachytheciaceae	*Brachythecium*	iNaturalist*	26589424
Plantae	Bryophyta	Bryopsida	Brachytheciaceae	*Kindbergia oregana*	iNaturalist*	156728663
Plantae	Bryophyta	Bryopsida	Bryaceae	*Ptychostomum pseudotriquetrum*	iNaturalist*	215504565
Plantae	Bryophyta	Bryopsida	Hypnaceae	*Hypnum dieckii*	iNaturalist*	215504558
Plantae	Bryophyta	Bryopsida	Mniaceae	*Leucolepis acanthoneura*	iNaturalist*	215504560
Plantae	Bryophyta	Bryopsida	Mniaceae	*Rhizomnium glabrescens*	iNaturalist*	215504556
Plantae	Chlorophyta			Chlorophyta	iNaturalist*	304560678
Plantae	Marchantiophyta	Jungermanniopsida	Frullaniaceae	*Frullania nisquallensis*	iNaturalist*	215504563
Plantae	Marchantiophyta	Jungermanniopsida	Pelliaceae	*Pellia neesiana*	iNaturalist*	304609779
Plantae	Tracheophyta	Liliopsida	Araceae	*Lysichiton americanus*	iNaturalist*	26583591
Plantae	Tracheophyta	Liliopsida	Asparagaceae	*Maianthemum dilatatum*	iNaturalist*	26583602
Plantae	Tracheophyta	Liliopsida	Cyperaceae	*Carex aquatilis*	iNaturalist*	304612242
Plantae	Tracheophyta	Liliopsida	Cyperaceae	*Carex oederi oederi*	iNaturalist*	304613227
Plantae	Tracheophyta	Liliopsida	Cyperaceae	*Schoenoplectus acutus*	iNaturalist*	304090715
Plantae	Tracheophyta	Liliopsida	Cyperaceae	*Scirpus microcarpus*	iNaturalist	315266638
Plantae	Tracheophyta	Liliopsida	Juncaceae	*Juncus arcticus*	iNaturalist*	304611739
Plantae	Tracheophyta	Liliopsida	Juncaceae	*Juncus articulatus*	iNaturalist*	304610580
Plantae	Tracheophyta	Liliopsida	Poaceae	*Poeae*	iNaturalist	26584382
Plantae	Tracheophyta	Liliopsida	Potamogetonaceae	*Potamogeton natans*	iNaturalist*	26588872
Plantae	Tracheophyta	Liliopsida	Potamogetonaceae	*Potamogeton nodosus*	iNaturalist*	304093552
Plantae	Tracheophyta	Magnoliopsida	Apiaceae	*Oenanthe sarmentosa*	iNaturalist*	156728378
Plantae	Tracheophyta	Magnoliopsida	Asteraceae	*Anaphalis margaritacea*	iNaturalist	26584399
Plantae	Tracheophyta	Magnoliopsida	Asteraceae	Asteraceae	iNaturalist	26584386

Kingdom	Phylum	Class	Family	Species	Source	Reference no.
Plantae	Tracheophyta	Magnoliopsida	Asteraceae	*Leucanthemum vulgare*	iNaturalist	26633550
Plantae	Tracheophyta	Magnoliopsida	Asteraceae	*Pilosella*	iNaturalist	26633552
Plantae	Tracheophyta	Magnoliopsida	Asteraceae	*Taraxacum officinale*	iNaturalist	26583627
Plantae	Tracheophyta	Magnoliopsida	Betulaceae	*Alnus rubra*	iNaturalist*	26578794
Plantae	Tracheophyta	Magnoliopsida	Boraginaceae	Cynoglossoideae	iNaturalist	283250871
Plantae	Tracheophyta	Magnoliopsida	Boraginaceae	*Myosotis sylvatica*	iNaturalist	283251118
Plantae	Tracheophyta	Magnoliopsida	Brassicaceae	*Rorippa palustris*	iNaturalist*	304090690
Plantae	Tracheophyta	Magnoliopsida	Cabombaceae	*Brasenia schreberi*	iNaturalist*	26578774
Plantae	Tracheophyta	Magnoliopsida	Caprifoliaceae	*Lonicera involucrata*	iNaturalist	26578775
Plantae	Tracheophyta	Magnoliopsida	Cornaceae	*Arctocrania*	iNaturalist	26583616
Plantae	Tracheophyta	Magnoliopsida	Cornaceae	*Cornus unalaschkensis*	iNaturalist*	26633527
Plantae	Tracheophyta	Magnoliopsida	Ericaceae	*Gaultheria shallon*	iNaturalist*	26578792
Plantae	Tracheophyta	Magnoliopsida	Ericaceae	*Rhododendron groenlandicum*	iNaturalist*	26578788
Plantae	Tracheophyta	Magnoliopsida	Ericaceae	*Rhododendron menziesii*	iNaturalist*	26578784
Plantae	Tracheophyta	Magnoliopsida	Ericaceae	*Vaccinium parvifolium*	iNaturalist*	26583605
Plantae	Tracheophyta	Magnoliopsida	Fabaceae	*Cytisus scoparius*	iNaturalist	26633546
Plantae	Tracheophyta	Magnoliopsida	Fabaceae	*Trifolium dubium*	iNaturalist	26584392
Plantae	Tracheophyta	Magnoliopsida	Fabaceae	*Trifolium pratense*	iNaturalist	26584394
Plantae	Tracheophyta	Magnoliopsida	Fabaceae	*Trifolium repens*	iNaturalist	26583644
Plantae	Tracheophyta	Magnoliopsida	Lentibulariaceae	*Utricularia macrorhiza*	iNaturalist*	26584388
Plantae	Tracheophyta	Magnoliopsida	Lentibulariaceae	*Utricularia vulgaris*	iNaturalist*	26588871
Plantae	Tracheophyta	Magnoliopsida	Menyanthaceae	*Menyanthes trifoliata*	iNaturalist*	304611843
Plantae	Tracheophyta	Magnoliopsida	Myricaceae	*Myrica gale*	iNaturalist*	26583606
Plantae	Tracheophyta	Magnoliopsida	Nymphaeaceae	*Nuphar polysepala*	iNaturalist*	26588873
Plantae	Tracheophyta	Magnoliopsida	Onagraceae	*Chamaenerion angustifolium*	iNaturalist	26583590
Plantae	Tracheophyta	Magnoliopsida	Onagraceae	*Epilobium ciliatum*	iNaturalist*	304089743
Plantae	Tracheophyta	Magnoliopsida	Orobanchaceae	*Castilleja miniata*	iNaturalist	176668395
Plantae	Tracheophyta	Magnoliopsida	Plantaginaceae	*Plantago lanceolata*	iNaturalist	26583642
Plantae	Tracheophyta	Magnoliopsida	Primulaceae	*Lysimachia europaea*	iNaturalist	32148599
Plantae	Tracheophyta	Magnoliopsida	Ranunculaceae	*Ranunculus repens*	iNaturalist	26583629

Kingdom	Phylum	Class	Family	Species	Source	Reference no.
Plantae	Tracheophyta	Magnoliopsida	Rosaceae	*Comarum palustre*	iNaturalist*	26583608
Plantae	Tracheophyta	Magnoliopsida	Rosaceae	*Physocarpus capitatus*	iNaturalist	304610724
Plantae	Tracheophyta	Magnoliopsida	Rosaceae	*Rosa nutkana*	iNaturalist*	169531775
Plantae	Tracheophyta	Magnoliopsida	Rosaceae	*Rubus parviflorus*	iNaturalist	26583635
Plantae	Tracheophyta	Magnoliopsida	Rosaceae	*Rubus spectabilis*	iNaturalist*	26583603
Plantae	Tracheophyta	Magnoliopsida	Rosaceae	*Sanguisorba officinalis*	iNaturalist*	304610824
Plantae	Tracheophyta	Magnoliopsida	Rosaceae	*Spiraea douglasii*	iNaturalist*	304088590
Plantae	Tracheophyta	Magnoliopsida	Salicaceae	*Salix*	iNaturalist	26583636
Plantae	Tracheophyta	Magnoliopsida	Viburnaceae	*Sambucus racemosa*	iNaturalist	283251314
Plantae	Tracheophyta	Pinopsida	Cupressaceae	*Thuja plicata*	iNaturalist*	26583610
Plantae	Tracheophyta	Pinopsida	Pinaceae	*Picea sitchensis*	iNaturalist	26578796
Plantae	Tracheophyta	Pinopsida	Pinaceae	*Pinus contorta*	iNaturalist*	26578789
Plantae	Tracheophyta	Pinopsida	Pinaceae	*Tsuga heterophylla*	iNaturalist*	26583618
Plantae	Tracheophyta	Polypodiopsida	Blechnaceae	*Struthiopteris spicant*	iNaturalist*	26633520
Plantae	Tracheophyta	Polypodiopsida	Dennstaedtiaceae	*Pteridium aquilinum pubescens*	iNaturalist*	307539004
Plantae	Tracheophyta	Polypodiopsida	Dryopteridaceae	*Dryopteris expansa*	iNaturalist	315265824
Plantae	Tracheophyta	Polypodiopsida	Equisetaceae	*Equisetum arvense*	iNaturalist*	304610445
Protozoa	Mycetozoa	Myxomycetes	Physaraceae	*Fuligo septica*	iNaturalist	314474190
Protozoa	Mycetozoa			Mycetozoa	iNaturalist	314474709