DWB Consulting Services Ltd.

Umam (Pygmy Whitefish) Surveys

2020 Final Report

Prepared for: Cheslatta Carrier Nation

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DWB Consulting Services Ltd. is pleased to submit this report for your review. This report has been prepared using sound technical and professional judgement, based on our knowledge and experience, applicable regulatory framework, industry best management practices, and current understanding of project conditions, design, and project setting.

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We do not represent, warrant, undertake or guarantee:

- That all project environmental-related information has been received.
- That regulations and standards of practices shall remain constant through the duration of the project.
- That the use of guidance in the report will lead to any particular outcome or result; or, in particular,
- That by using the guidance in the report, the client will be approved by the contract holder for the applied works.

Special Thanks

This expedition was only made possible by the support provided by the Cheslatta Carrier Nation and the Nechako Environmental Enhancement Fund. We are extremely grateful to the Cheslatta Carrier Nation for involving us in their search for Umam in the Cheslatta Lake Reservoir and for continuing to support projects that determine the status of this culturally important, and ecologically enigmatic, species. We especially owe thanks to Mr. Mike Robertson, Mr. James Rakochy, and Chief Corrina Leween of the Cheslatta Carrier Nation for providing us with logistical information, field crews, boat transport, and, perhaps most importantly, traditional information regarding the historical whereabouts of Umam in the Cheslatta Lake watershed and greater Nechako Reservoir area. Funding for this Project was made possible by the Nechako Environmental Enhancement Fund, Rio Tinto, and the Province of British Columbia.

We also owe a special thanks to our stellar field crew, Mr. Dan Thompson, Mr. Ron Hudson, and Mrs. Evelyn Hudson for their support and for sharing their local knowledge of the region. Their input resulted in additional survey sites that provided valuable information regarding the current status of Umam habitat in the Cheslatta Lake system.

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1.0 INTRODUCTION

DWB Consulting Services Ltd. (DWB) was retained by Cheslatta Carrier Nation (CCN) to provide technical support for pygmy whitefish (*Prosopium coulterii*) surveys within the Cheslatta Lake watershed. Pygmy whitefish, hereafter referred to as its traditional Cheslatta name “Umam”, were a historically important food source for the Cheslatta people prior to the construction of the Kenney Dam in 1952 which subsequently resulted in the flooding of Cheslatta Lake. The headwaters of the Cheslatta River, which is a major tributary of Cheslatta Lake, receives regulated flows year-round from the Skins Lake spillway on the Nechako Reservoir.

Since the establishment of the reservoir system, Cheslatta elders have voiced concerns regarding the increasing difficulty in detecting Umam populations in the region. In response, CCN proposed a survey of Umam populations in their territory based on community and elder observations of Umam presence in the Cheslatta Lake watershed. Survey sites were strategically selected based on information provided by CCN and survey methods were adapted from previous surveys conducted on Umam populations in British Columbia (BC) and the Pacific Northwest. To narrow the geographical search and increase the potential for detection, the field surveys focused on targeting tributaries of Cheslatta Lake in early October when Umam have historically been observed spawning in the region. Habitat assessments and water quality sampling were also completed. The 2020 Final Report summarizes the methods and results of these surveys and provides recommendations for further sampling based on the findings.

1.1 BACKGROUND

1.1.1 Cultural History

Prior to the construction of the Nechako Reservoir, the Cheslatta Lake and surrounding systems were part of the CCN traditional fishing grounds. Historically, the Umam were a very important food source for the Cheslatta people. The early October spawning of Umam coincided with the annual char harvest. CCN elders recalled watching huge, swirling schools of Umam that would jump into the air, churn lake waters, and produce an almost roaring splashing noise. The Cheslatta people would jump into their dugout canoes and rush to the regular Umam spawning sites to quickly set nets upon receiving news of these schooling events. Harvested Umam were impaled whole through the gills onto willow sticks and placed on racks or roofs to dry (Figure 1). The elders recall when harvest years for Umam were poor, when harvest years were abundant, and how excited they were when the Umam schooled. Preserving Umam populations has remained a priority for the Cheslatta people since annual flooding and siltation events have impacted Cheslatta Lake.

Figure 1. Chief Louie Family at Cheslatta Lake with Racks of Umam Drying in the Background, December 1911

1.1.2 Historical Observations

CCN elders have noticed that Umam have all but disappeared when compared to their harvesting experiences prior to the reservoir (Section 1.1.1) and there are concerns this may be due to impacts to Umam habitat within the Cheslatta River and Lake systems as a result of unnatural flows discharged from the Skins Lake Spillway. Little information is known about the present-day distribution of Umam populations within the territory of the CCN. However, CCN have documented cases of Umam observed in the region within the past 8 years. For example, in September, 2012, Umam were observed swimming upstream in the Upper Cheslatta Falls (Figure 2; M. Robertson 2020a, pers. comm.).

Figure 2. Potential Umam Observed Migrating Upstream in Upper Cheslatta Falls on September 22, 2012 (LEFT; The Pumpkin Provides Scale) and Potential Umam Observed in Tahtsa Narrows in October 2019 (RIGHT).

Umam can be mistaken for juvenile mountain whitefish (*Prosopium williamsoni*), which also occupy the Cheslatta Lake system (see Section 1.1.3); however, the CCN pointed out that migrating mountain whitefish are typically larger during spawning.

In October 2019, a CCN boat operator captured a potential Umam in Tahtsa Narrows, which is part of the greater Nechako Reservoir; during this time, the boat operator observed many Umam specimens scattered along the shoreline of Tahtsa Narrows (Figure 3; M. Robertson 2020c, pers. comm.).

A desktop review determined that Umam were documented in Hallett and Tahultzu Lakes in July 1978, which are approximately 21 km (Hallett) and 28 km (Tahultzu) northeast of Cheslatta Lake (MOE 2018). Umam were also documented in the Nechako River, downstream of the Cheslatta and Murray Lake systems, in April 1998 (MOE 2018).

1.1.3 Biology and Life-History

Umam are a salmonid that tend to inhabit cold, deep lakes and mountain streams, typically at temperatures <10˚C (McPhail 2007). Like other members of the family *Salmonidae*, Umam have a small adipose fin located on their dorsal side between the dorsal fin and the caudal fin. Very little is known about the physiological and life-history characteristics of present-day Umam populations in the Cheslatta Lake Reservoir. In British Columbia, Umam generally mature in 2 - 3 years, range in size between 6.5 - 25 cm depending on the population, and live an average of 3 (for males) – 8 years (for females; McPhail 2007). Like most whitefish species, Umam are generally silvery-white in colour on their sides, white on their belly, and are brownish to olive in colouration on the upper body. Their head is rounded with an overhanging mouth and a large eye, typically greater in diameter than snout length.

Umam share Cheslatta Lake with two other whitefish species: mountain whitefish (*Prosopium williamsoni*) and lake whitefish (*Prosopium clupeaformis*; MOE 2018). Lake Whitefish are typically larger than Umam at an average size of 50 cm and have wider, fatter bodies that are easy to differentiate from the profile of an Umam. In contrast, juvenile mountain whitefish can closely resemble Umam but there are some key morphological differences between the two, that can aid identification. The primary method of determining the difference between Umam and a mountain whitefish is the number of dorsal rays. Umam have 9-10 dorsal rays but have been reported to have as few as eight (McPhail and Zemlack 2000), whereas mountain whitefish have 11-15 dorsal rays. The anterior lateral line scales in Umam are also similar in size to the scales immediately above and below the lateral line, while the anterior lateral line scales in juvenile mountain whitefish are noticeably smaller than the scales immediately above and below the lateral line (McPhail 2007).

Umam spawn in inlet streams in late autumn or early winter (McPhail 2007) when water temperatures are expected to be <5˚C (McPhail 2007, Zemlak and McPhail 2006). Spawning is suspected of occurring at night in riffle habitat where there is coarse gravel (McPhail 2007). Umam populations in the Cheslatta Lake watershed have historically been observed spawning at the beginning of October (M. Robertson 2020b, pers. comm.).

Three populations of Umam are found in BC, including the Western Arctic, Pacific, and Southwestern Yukon Beringian. Neither of the populations that are the most likely to occur within the Skeena region (Pacific and Western Arctic) are presently classified as a species at risk. However, little is known about pygmy whitefish distribution in BC and their preference for cold water temperatures (<10˚C) and higher dissolved oxygen levels (5 mg/L) may make them particularly vulnerable to habitat degradation (Zemlak and McPhail 2006, McPhail 2007, COSEWIC 2016).

1.2 Survey Locations

All surveys were conducted on tributaries of Cheslatta Lake, including select locations on the Cheslatta River. To reach Cheslatta Lake from the Burns Lake community, take Highway 35 South to the François Lake ferry. Once across François Lake, follow Uncha Lake Road for approximately 12 km before turning right onto Binta Road; continue to follow Binta Road which turns into the Binta Forest Service Road North. After approximately 15 km after turning onto Binta Road, turn right again and follow the south side of Binta Lake for 17.5 km before turning right again onto an unnamed resource road. Roughly 6 km past this intersection, turn left onto another unnamed road that begins to decrease rapidly in elevation as Cheslatta Lake becomes visible in the distance. The boat launch at the lake is where the Project was staged each morning.

Survey sites were chosen based on CCN knowledge of Umam (Section 1.1.2) and Umam surveys conducted in Cheslatta Lake by CCN in partnership with Triton Environmental Consultants Ltd. (Triton) in 2007. No Umam were captured during the surveys in 2007; however, it was recommended that additional sampling should be completed at Knapp Creek, Ootsanee Creek and Sather Creek, as well as first-time sampling at 4 additional tributaries that were identified by CCN elder Pat Edmund as locations where Umam had been historically present (Triton 2008).

Two more sampling sites were added during the surveys in 2020 based on feedback provided by CCN field technicians. Unnamed Creek #4 was recommended as a high potential site by two of the CCN field technicians who regularly recreate on Cheslatta Lake (R. and E. Hudson 2020, pers. comm.). One of the CCN field technicians also recommended sampling locations at an area referred to as the Cheslatta River lower falls, between the Skins Lake Spillway and the Cheslatta River outlet on the west side of Cheslatta Lake, which is a popular fishing spot for locals (D. Thompson 2020, pers. comm.).

Refer to Figure 3 for an overview map of the tributaries that were included in the 2020 surveys.

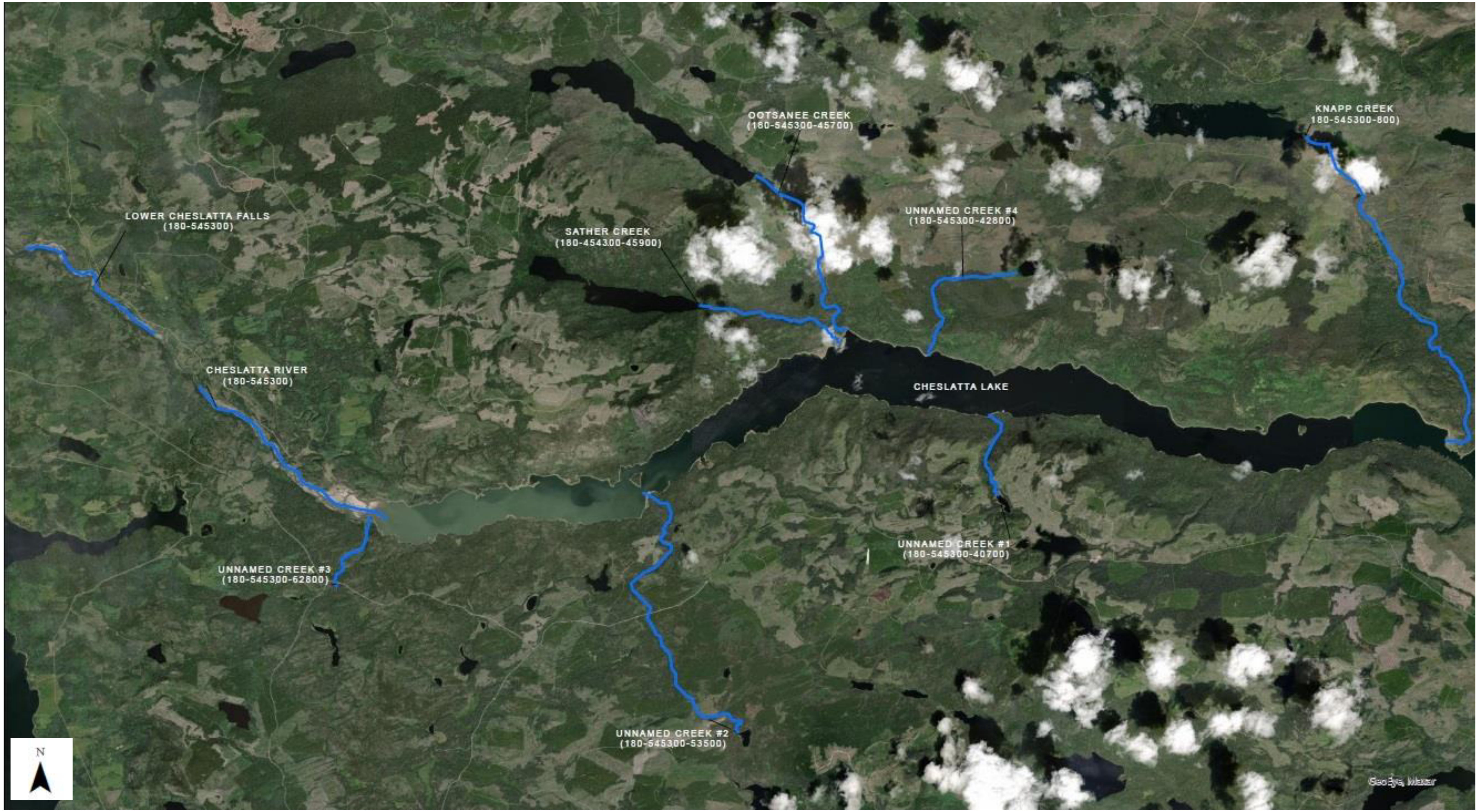

Figure 3. Cheslatta Lake Tributaries Assessed During the Surveys (Watershed Codes are in Brackets)

1.3 PROJECT OBJECTIVES

The objective of the surveys was to confirm the presence of Umam populations within the territory of the CCN and provide baseline information of this culturally significant species. Population identification is a critical first step for potential future management or rehabilitation initiatives for Umam habitat and species health. The opportunity to blend local Traditional Ecological Knowledge (TEK) with modern scientific sampling techniques was also considered a strong asset for this Project. This joint effort aimed to provide an example of how TEK can inform wildlife conservation management through the documented knowledge of CCN elders, especially for a species that is still widely considered enigmatic in BC.

The surveys also provided an opportunity for members of the CCN to receive further development and training in fish habitat assessment and sampling techniques.

1.4 REGULATORY APPROVALS

All survey methods were conducted in accordance with the Fish Collection Permit obtained from the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (No. SM20-611123). No permits under federal jurisdiction were required.

2.0 SURVEY METHODS

Outside of the spawning period, Umam primarily reside at deep depths in lake systems where location and capture of individuals can be unpredictable (Zemlak and McPhail 2006). However, Barnett and Paige (2007) demonstrated success in capturing schooling Umam during spawning in the Cedar River, a major tributary of the Chester Morse Lake reservoir in Seattle, Washington. Based on the results of these previous surveys, it was predicted that using a combination of methods to capture Umam in the Cheslatta Lake tributaries during spawning may narrow the geographical search area and increase the likelihood of detection. Therefore, surveys targeted tributaries of Cheslatta Lake between October 3 – 8, 2020, when Umam were anticipated to be spawning in the region (Section 1.1.3).

Passive methods were primarily used to reduce the likelihood of fish fatality; however, an electrofisher was used for short periods at select locations where risk to eggs or embryos was anticipated to be low. Bull trout (*Salvelinus confluentus*), a fall-spawning species that is blue-listed (Special Concern) in BC (CDC 2020), had not been previously documented in any of the reaches selected for assessment (MOE 2018). Sather and Ootsanee Creek were accessed off the road down to Cheslatta Lake, while all other tributaries were accessed by boat. Crew members were equipped with fish viewers, magnifying glasses, and species identification keys in anticipation of Umam captures. Fork length was measured for all fish captured and total capture numbers were summarized according to species. Estimates of abundance (i.e., Catch per Unit Effort) were not calculated as the results in this study did not satisfy the assumptions for catchability (Portt et al. 2006).

2.1 HOOP NET

A baited hoop net was deployed at two of the survey sites: the Cheslatta River outflow and Knapp Creek. In both cases, the net was set in water deep enough to cover the entrance but without being completely submerged so that it could be quickly located. The net was placed in the lake in close proximity to the outflow of Cheslatta River and Knapp Creek during the survey period; the outflow of these tributaries was chosen for hoop net installation due to accessibility (i.e., the bench did not immediately increase in depth) and availability of spawning habitat upstream. The wing walls and entrance to the trap were positioned facing the outflows but were installed outside the direct current (thalweg); this placement was chosen to attract Umam returning to the lake after spawning, while ensuring the entrance to the narrow outlets remained unobstructed and the trap did not collect debris flowing downstream. The hoop net was installed during the day and left overnight for a maximum period of 23.5 hours. The hoop net used in this study was 0.9 m in diameter with two 4.6 m panels and a mesh size of 6.35 mm.

2.2 Minnow Traps

Baited minnow traps were deployed at every survey site where water was flowing to capture Umam less than 150 mm in length. The traps were placed in pools outside of the direct current to ensure the traps could be fully submerged without additional stress to captured fish. Instream habitat features were targeted for minnow trap installation, including eddies and pools, piles of large woody debris (LWD), vegetation, and undercut banks. The minnow traps were installed during the day and left overnight for a maximum of 23.5 hours. The traps were never set for longer than a day to avoid bycatch and overstressing the fish. The following number of minnow traps were installed at each tributary over the survey period:

- Cheslatta River at Outflow: 8 from October 4 – 6, 2020,
- Cheslatta River, Lower Falls: 5 from October 7 – 8, 2020,
- Knapp Creek: 5 from October 5 – 7, 2020,
- Sather Creek: 6 from October 3 – 4, 2020, and October 7 – 8, 2020,
- Ootsanee Creek: 7 from October 3 – 4, 2020, and October 7 – 8, 2020,
- Unnamed Creek #1: 0 (creek was dry),
- Unnamed Creek #2: 2 from October 4 – 5, 2020,
- Unnamed Creek #3: 0 (creek was dry),
- Unnamed Creek #4: 0 (creek was dry)

Refer to Appendices B – F for overview maps that show where minnow traps were installed along each assessed tributary.

2.3 Electrofishing

Electrofishing transects were completed on Knapp Creek, Sather Creek, Ootsanee Creek, and Unnamed Creek #2 for the following duration (effort in seconds) and stream lengths:

- Knapp Creek: 275 seconds along 151 m,
- Sather Creek: 99 seconds along 25 m,
- Ootsanee Creek: 269 seconds along 75 m,
- Unnamed Creek #2: 323 seconds along 66 m

The electrofisher operated at a frequency of 30 Hz, a pulse of 4 m/s, and within a voltage range of 380 – 400. Electrofishing transects were selected at locations where favourable habitat existed, such as undercut banks and pools, while avoiding areas where suitable gravels for spawning were present. Water temperature remained above the acceptable threshold for electrofishing (5˚C) throughout the survey period (see Section 3.2). Refer for Appendices C – F for overview maps that show were electrofishing transects were conducted along the assessed tributaries.

2.4 Habitat Assessment

Stream habitat potential in the lower reach closest to the outlet was assessed using the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Site Card Field Guide* provided by the Resources Inventory Standards Committee (RISC; MOE 2001). RISC-standard stream cards were filled out, focusing primarily on channel and wetted width, pool depth, bankfull width, channel gradient, vegetation cover, crown closure, and bed material type. The length of stream channel that was assessed varied between 125 m (Unnamed Creek #1) and 925 m (Knapp Creek) depending on availability of time; therefore, habitat assessments for most of the tributaries should be considered preliminary. No habitat ratings were assigned for the Cheslatta River Outflow or Lower Falls, since these survey areas were small in relation to the size of the reach.

The following length of stream channel was assessed for each tributary, commencing from the outlet:

- Cheslatta River at Outflow: formal habitat assessment not conducted here,
- Cheslatta River, Lower Falls: formal habitat assessment not conducted here,
- Knapp Creek: 925 m,
- Sather Creek: 215 m,
- Ootsanee Creek: 300 m,
- Unnamed Creek #1: 90 m,
- Unnamed Creek #2: 250 m,
- Unnamed Creek #3: 125 m,
- Unnamed Creek #4: 100 m.

2.5 WATER QUALITY

Water quality measurements were collected at all tributaries where stream flow was present at the time of the surveys. Dissolved oxygen (DO), pH, and temperature values were compared to the BC Water Quality Guidelines (WQG), which are parameters that have been determined to be important for freshwater aquatic life (MOE 2019; MOE 2001). DO and pH were calibrated daily prior to the assessments.

3.0 SURVEY RESULTS

A total of 208 fish were captured between October 3 – 8, 2020, using a combination of minnow trap, hoop net, and electrofishing methods (see Section 2.0). **No Umam were captured during the surveys**. Lake chub (*Couesius lumbeus),* large-scale sucker (*Catostomus macrocheilus*), prickly sculpin (*Cottus asper*), rainbow trout (*Oncorhynchus mykiss*), and redside shiner (*Richardsonius balteatus*) were the only species captured. No fish mortalities were observed during retrieval at any of the site locations.

Section 3.1 summarizes the fish survey results and habitat characteristics for each tributary assessed. An overview of the water quality results, in comparison to the Provincial guidelines and Umam life-history requirements, are found in Section 3.2.

3.1 FISH AND HABITAT

3.1.1 Cheslatta River

The results of the fish species captured in the Cheslatta River Outflow from October 4 – 6, 2020, is summarized in Table 1.

Table 1. Total Fish Captured in the Cheslatta River Outflow from October 4 – 6, 2020

Fish Species	Scientific Name	Min Length (mm)	Max Length (mm)	Number Caught
Lake Chub	*Couesius lumbeus*	60	90	4
Prickly Sculpin	*Cottus asper*	75	95	8
Redside Shiner	*Richardsonius balteatus*	n/a	100	1
			Total Captured:	**14**

The Cheslatta River Outflow is a large area comprised of exposed sandbars and very little vegetation instream or along the channel embankments. All survey sites were within the lake inundation zone of the channel and were, therefore, exposed and comprised primarily of small gravels and fines. The crew did not observe any fish in the braided channels or pools within the outflow area. Electrofishing was avoided along this section due to the absence of cover and unfavourable survey conditions.

On October 8, 2020, a total of 1 prickly sculpin was captured at the Cheslatta River Lower Falls.

Due to the surveys being primarily confined to the outflow, and a small area at the lower falls, a habitat rating was not assigned. No water quality concerns were noted; however, the water temperature was above the preferred range for spawning Umam at the Cheslatta River Outflow (11.8 – 13.0 ˚C) and at the Cheslatta River Lower Falls (11.4 – 12.1 ˚C; Section 3.2; McPhail 2007). A complete summary of water quality measurements can be found in Section 3.2. An overview map of the fish capture results for the Cheslatta River according to survey site and methods can be found in Appendix B.

3.1.2 Knapp Creek

The results of the fish species captured in Knapp Creek from October 5 – 8, 2020, is summarized in Table 2.

Table 2. Total Fish captured in Knapp Creek from October 5 – 7, 2020

Fish Species	Scientific Name	Min Length (mm)	Max Length (mm)	Number Caught
Lake Chub	*Couesius lumbeus*	40	80	23
Large-scale Sucker	*Catostomus macrocheilus*	45	85	2
Prickly Sculpin	*Cottus asper*	25	90	11
Rainbow Trout	*Oncorhynchus mykiss*	50	140	10
Redside Shiner	*Richardsonius balteatus*	20	110	93
			Total Captured:	**139**

The assessed section of Knapp Creek had a mean channel width of 10.2 m and a mean wetted width of 7.5 m. A beaver dam is located approximately 500 m upstream of the outlet and may act as a barrier to fish trying to mobilize upstream; however, the dam may also enhance overwintering habitat for fish due to the formation of deep pools that have resulted from beaver activity. Large-scale sucker and rainbow trout were the only species captured upstream of the beaver dam during the surveys. Channel substrate was dominated by small gravels and cobbles, indicating good spawning potential throughout the surveyed areas of Knapp Creek; however, spawning potential improved upstream of the beaver dam. No redds were observed at the time of the surveys.

Deep pools and overhanging vegetation were noted throughout reach, particularly at site KC3 which yielded the highest number of fish caught compared to the other Project study sites after catching a total of 91 fish at that location (see Appendix C). The highest number of fish caught from electrofishing occurred at KC2 after a total of 9 fish were caught in riffle-pool habitat (see Appendix C). Overall, Knapp Creek was identified as having good rearing and overwintering potential for fish due to the presence of overhanging vegetation, deep pools, and perennial channel flows.

Based on the assessment, Knapp Creek was rated as providing **Important Habitat** for salmonid species. No water quality concerns were noted; however, water temperature ranged between 7.5 – 11.9˚C on survey days, which is above the preferred temperature range for spawning Umam (Section 3.2; McPhail 2007). A complete summary of water quality measurements for Knapp Creek can be found in Section 3.2. An overview map of the fish capture results for Knapp Creek, according to survey site and methods, can be found in Appendix C.

3.1.3 Sather Creek

The results of the fish species captured between October 7 – 8, 2020, is summarized in Table 3.

Table 3. Total Fish captured in Sather Creek from October 3 – 4, 2020, and October 7 – 8, 2020

Fish Species	Scientific Name	Min Length (mm)	Max Length (mm)	Number Caught
Prickly Sculpin	*Cottus asper*	50	90	12
Rainbow Trout	*Oncorhynchus mykiss*	60	140	12
			Total Captured:	**24**

The assessed section of Sather Creek had a mean channel width of 4.4 m and a mean wetted width of 3.8 m. Channel substrate was dominated by cobbles; although, small gravels were periodically found along some sections which resulted in a moderate rating for spawning potential. No redds were observed at the time of the surveys. Sather Creek provided moderate rearing potential for fish starting approximately 100 m upstream of the outlet due to the presence of some cover in the form of boulders and undercut banks. Low overwintering potential was noted throughout the surveyed sections of the reach, due to the absence of deep pools. The first 100 m of Sather Creek, from the outlet, was in the lake inundation zone and demonstrated fine sediments, low cover, and absence of deep pools; therefore, this section of the reach was designated as poor habitat for spawning, rearing, and overwintering. The gradient for the assessed section of the creek was 1 – 2 %.

Based on the assessment, Sather Creek was rated as providing **Important Habitat** for salmonid species. No water quality concerns were noted; however, water temperature ranged between 7.3 - 10˚C on survey days, which is above the preferred temperature range for spawning Umam (Section 3.2; McPhail 2007). Water quality measurements for Sather Creek can be found in Section 3.2. An overview map of the fish capture results for Sather Creek, according to survey site and methods, can be found in Appendix D.

3.1.4 Ootsanee Creek

The results of the of the fish species captured from October 3 – 4, 2020, and October 7 – 8, 2020, is summarized in Table 4.

Table 4. Total Fish captured in Ootsanee Creek from October 3-4, 2020, and October 7 – 8, 2020

Fish Species	Scientific Name	Min Length (mm)	Max Length (mm)	Number Caught
Lake Chub	*Couesius lumbeus*	60	90	2
Prickly Sculpin	*Cottus asper*	55	90	9
Rainbow Trout	*Oncorhynchus mykiss*	65	140	10
			Total Captured:	**21**

The assessed section of Ootsanee Creek had a mean channel width of 5.5 m and a mean wetted width of 4.3 m. Small gravel substrate was noted throughout the surveyed portion of the reach, which provides good spawning potential when combined with low gradients and perennial flows. No redds were observed at the time of the surveys. Rearing potential was considered moderate in Ootsanee Creek due to the limited availability of pools and cover in the form of bank undercutting. The absence of deep pools indicated poor overwintering potential. The first 100 m of Ootsanee Creek from the outlet was in the lake inundation zone and was characterized by fine sediments, low cover, and absence of deep pools; therefore, this section of the reach was designated as poor habitat for spawning, rearing, and overwintering. The gradient for the assessed section of the creek was 0 – 1.5 %.

Based on the assessment, Ootsanee Creek was rated as providing **Important Habitat** for salmonid species. No water quality concerns were noted; however, water temperature ranged between 6.8 – 9.9˚C on survey days, which is above the preferred temperature range for spawning Umam (Section 3.2; McPhail 2007). Water quality measurements for Ootsanee Creek can be found in Section 3.2. An overview map of the fish capture results for Ootsanee Creek, according to survey site and methods, can be found in Appendix E.

3.1.5 Unnamed Creek #1

No flow was observed at Unnamed Creek #1 (WSC: 180-545300-40700) on October 5, 2020. Further investigation determined that the stream has likely been dry for a prolonged period of time since the channel was heavily vegetated and lacking clear channelized connectivity to Cheslatta Lake. The creek became inconsistently channelized and difficult to segregate from slope erosion after 90 m of following it upstream from the outlet. The slope increased to 17% within 30 m upstream of the outlet, which would act as a barrier for some fish species. Standing, burnt timber indicated the area had been disturbed by wildfire.

Due to the absence of flow and inconsistent channel morphology, no fish surveys were conducted and no water quality measurements were collected at this location.

3.1.6 Unnamed Creek #2

The results of the fish species captured from October 4 – 5, 2020, is summarized in Table 5.

Table 5. Total Fish Captured in Unnamed Creek #2 from October 4 – 5, 2020

Fish Species	Scientific Name	Min Length (mm)	Max Length (mm)	Number Caught
Prickly Sculpin	*Cottus asper*	n/a	55	1
Rainbow Trout	*Oncorhynchus mykiss*	60	140	9
			Total Captured:	**10**

The assessed section of Unnamed Creek #2 had a mean channel width of 6.2 m and a mean wetted width of 3.7 m. No connectivity to Cheslatta Lake was observed at the time of the surveys. Water was observed disappearing underground approximately 67 m from the outlet; downstream of this location, the creek was still channelized but lacked flow. Spawning potential in Unnamed Creek #2 was determined to be moderate due to the presence of small gravels; however, the absence of perennial flow to Cheslatta Lake could be a deterrent. No redds were observed during the surveys. The presence of some deep pools and LWD cover likely provided moderate rearing potential in the creek. Overwintering potential was determined to be poor due to the absence of deep pools and perennial flows to Cheslatta Lake. The gradient for the assessed section of the creek was 3.5 – 6.0 %.

Based on the assessment, Unnamed Creek #2 was rated as providing **Important Habitat** for salmonid species. No water quality concerns were noted; however, water temperature ranged between 9.1 – 9.4˚C on survey days, which is above the preferred temperature range for spawning Umam (Section 3.2; McPhail 2007). Water quality measurements for Unnamed Creek #2 can be found in Section 3.2. An overview map of the fish capture results for Unnamed Creek #2, according to survey site and methods, can be found in Appendix F.

3.1.7 Unnamed Creek #3

No flow was observed at Unnamed Creek #3 (WSC: 180-545300-62800) on October 4, 2020. A well-established channel approximately 3.4 m in width was present and dominated by small gravels and fine sediment. Large deposits of fine sediment and gravels created large side channel bars closer to the outet. Depressions were observed in the channel, indicating deep pools existed when the creek was flowing. Cover for fish was present in the form of embankment undercutting and vegetation cover along the side channel bars and along the embankments. Sections of the channel were damp, suggesting the channel had been flowing recently. Overall, Unnamed Creek #3 was identified as having poor spawning potential for fall/winter-spawners (such as Umam) but potentially good spawning potential for spring-spawners (e.g., rainbow trout), moderate rearing potential, and no overwintering potential due to the absence of perennial flows.

Based on the assessment, Unnamed Creek #3 was rated as providing **Important Habitat** for salmonid species, especially for spring-spawners. Due to the absence of flow at the time of the assessment, no fish surveys were conducted and no water quality measurements were collected.

3.1.8 Unnamed Creek #4

No flow was observed at Unnamed Creek #4 (WSC: 180-545300-42800) on October 6, 2020; however, this creek was added to the survey itinerary based on CCN's observations that this reach had flowed in mid-July in previous years (R. and E. Hudson 2020, pers. comm.). Pooled water was observed in the channel indicating the creek had recently been flowing this season; the mean wetted width was 1.9 m. A well-established channel had a mean channel width of 5.1 m and was dominated by cobbles and boulders. Boulders, embankment undercutting, and some overhanging vegetation and LWD provided cover for fish. Overall, Unnamed Creek #4 was identified as having poor spawning potential due to a low quantity of small gravels, moderate rearing potential due to the presence of sufficient cover, and no overwintering potential due to the absence of perennial flows. The gradient for the assessed section of the creek was 7 %.

Based on the assessment, Unnamed Creek #4 was rated as providing **Marginal Habitat** for salmonid species. Due to the absence of flow at the time of the assessment, no fish surveys or water quality measurements were completed.

3.2 WATER QUALITY

Water quality measurements were collected at all tributaries where stream flow was present at the time of the surveys. Refer to Table 6 for a complete summary of the results.

Table 6. Water Quality Results for Conductivity, Dissolved Oxygen (DO), pH, and Temperature (Temp)

Tributary	Date	Time Collected	Conductivity µs/cm	DO (mg/L)	pH	Temp (˚C)
Sather Creek, 30 m upstream of outlet	03-Oct-20	late morning	104.2	5.57	6.79	9.8
Ootsanee Creek, 100 m upstream of outlet	03-Oct-20	late morning	136.5	7.02	7.33	9.9
Ootsanee Creek, 90 m upstream of outlet	04-Oct-20	9:00 AM	135.5	5.93	7.89	9.6
Sather Creek, 90 m upstream of outlet	04-Oct-20	10.01 AM	103.2	5.44	7.30	10.0
Cheslatta River Outflow, 200m upstream of outlet	04-Oct-20	12:12 PM	56	6.22	8.15	13.0

Tributary	Date	Time Collected	Conductivity µs/cm	DO (mg/L)	pH	Temp (˚C)
Unnamed Creek #3	04-Oct-20	No flow present at the time of surveys				
Unnamed Creek #2, 168 m upstream of outlet	04-Oct-20	2:27 PM	85.5	6.36	7.82	9.4
Cheslatta River Outflow, 195 m upstream of outlet	05-Oct-20	late morning	51.4	4.44	7.97	12.3
Unnamed Creek #2, 160 m upstream of outlet	05-Oct-20	12:23 PM	81.5	6.84	7.64	9.1
Unnamed Creek #1	05-Oct-20	No flow present at the time of surveys				
Knapp Creek, 310 m upstream of outlet	05-Oct-20	3:07 PM	121.8	6.30	8.31	11.9
Cheslatta River Outflow, 195 m upstream of outlet	06-Oct-20	9:30 AM	52.7	6.75	8.09	11.8
Knapp Creek, 500 m upstream of outlet	06-Oct-20	1:15 PM	128.34	8.31	8.77	10.4
Unnamed Creek #4	06-Oct-20	No flow present at the time of surveys				
Knapp Creek, 500 m upstream of outlet	07-Oct-20	11:10 AM	126.4	5.28	8.33	7.5
Cheslatta River Lower Falls	07-Oct-20	4:52 PM	48.7	7.52	8.02	12.1
Ootsanee Creek, 168 m upstream of outlet	08-Oct-20	9:24 AM	125	8.05	7.90	6.8
Sather Creek, 125 m upstream of outlet	08-Oct-20	9:51 AM	94.6	5.59	7.23	7.3
Cheslatta River Lower Falls	08-Oct-20	11:34 AM	48.3	8.19	7.90	11.4

DO was compared to the instantaneous minimum BC WQG, which represents the lowest instantly measured level that should be consistently maintained to meet the life-history requirements of aquatic life (MOE 2019). All assessed tributaries met the BC WQG DO minimum for all aquatic life stages other than buried embryo and alevin (5 mg/L; MOE 2019) and met the DO concentrations that are preferred by Umam (>5 mg/L; COSEWIC 2016), except for the Cheslatta River Outflow on October 5, 2020 (Table 6). However, DO was notably higher at the Cheslatta River Outflow on October 4, 2020 (6.22 mg/L) and October 6, 2020 (6.75 mg/L). None of the tributaries met the BC WQG DO minimum for buried embryo and alevin life stages (9 mg/L; MOE 2019), which suggest that DO levels may not have been ideal for fall spawning at the time the measurements were collected. It is important to note that DO is influenced by a variety of environmental cues, particularly temperature (MOE 1997); therefore, DO concentrations in the tributaries may have changed as seasonal conditions progressed towards cooler temperatures.

Conductivity and pH were found to be within the natural range of variability suitable for freshwater systems in BC. All tributaries met the BC WQG recommendations for pH range in freshwater systems (pH 6.5 – 9.0; MOE 2019).

At the time of the surveys, Sather Creek, Ootsanee Creek, Unnamed Creek #2, and Knapp Creek were within the preferred water temperature range for Umam (<10 ˚C; McPhail 2007, COSEWIC 2016) when measurements were collected in the morning (Table 6). However, none of the tributaries were found to be within the preferred temperature range for spawning whitefish (Table 6), which is considered <5˚C for Umam (McPhail 2007, COSEWIC 2016) and <6˚C for mountain whitefish (MOE 2001). The lowest temperature measured was 6.8˚C in Ootsanee Creek on the last day of the surveys (Table 6).

4.0 DISCUSSION OF RESULTS

Umam were not captured in any of the tributaries that were assessed during the surveys (Section 3.1), which may have been influenced by water temperature at the time the surveys were conducted (Section 3.2). Umam are classified as cold-water stenotherms, which means they are a species that are restricted to cold-water temperatures to meet the physiological requirements necessary for survival and reproduction (Magnuson et al. 1979, Guzzo et al. 2017). The spawning period for other Umam populations has varied between September – January, which biologists believe is associated with cooler water temperatures (<5˚C; Zemlak and McPhail 2006, McPhail 2007, COSEWIC 2016). Early October was identified as an important spawning period for Umam in the Cheslatta Lake watershed based on CCN traditional knowledge which include relatively recent observations (Section 1.1.2). However, the water quality results suggest that water temperature may have been too warm to trigger spawning behaviour in Umam at the time of the assessments (Section 3.2).

Survey crews may have just missed the window for spawning on account of natural variation in the stream environment (Deacy et al. 2019, Uno 2016). However, reservoir dynamics may have also influenced the probability of detecting Umam, especially if functional spawning habitat has been impacted over the long-term, resulting in lower Umam populations. Stream habitat fragmentation and water quality (particularly, temp and DO) have been identified as concerns for Umam as a result of dams in the Columbia Basin (Utzig and Schmidt 2011). During the 2020 surveys, crews did observe sediment deposition at the outlet of Knapp Creek, Sather Creek, and Ootsanee Creek, resulting in channel constriction where fish would be expected to enter the tributary during spawning (see Appendix A for photos). The extent to which reservoir dynamics may have impacted Umam populations in Cheslatta Lake was outside the scope of this assessment; however, further study is recommended to better understand the potential impacts of the reservoir on functional spawning habitat for Umam (Section 5.0).

5.0 RECOMMENDATIONS

Umam were not captured during the surveys in 2020. However, field crews were able to determine which Cheslatta Lake tributaries had the highest Umam spawning potential based on the results of the fish surveys and preliminary habitat assessments. Water temperatures observed outside the preferred range for spawning Umam may have provided some explanation for the absence of Umam during the assessments, especially since survey strategies relied on Umam spawning behaviour.

Based on these results, additional Umam surveys are recommended using the following guidelines and strategies:

1. Concentrate future survey efforts on the tributaries that demonstrated the best potential spawning habitat for Umam, which includes Knapp Creek, Sather Creek, and Ootsanee Creek. Based on historical observations, survey effort should also be extended to the upper falls section of the Cheslatta River (Section 1.1.2). To increase efficiency, efforts could be focused on Knapp and Sather Creek which are both accessible by road.
2. Increase the use of trap nets in Cheslatta Lake, which was the most successful live trap method used in the Dina Lake population (Zemlak and McPhail 2006). Gill nets have also been documented as successful but result in higher fatalities (Zemlak and McPhail 2006). Lake traps may be more successful when set below the epilimnion and thermocline layers (Zemlak and McPhail 2006), but some experimentation may be required.

3. Targeting Umam during stream spawning may still be valuable with the following adjustments incorporated into survey procedures:
    - Expand the surveys to include multiple late fall and early winter sessions to increase the potential of detecting spawning Umam, or
    - Monitor stream temperature and DO conditions and initiate surveys when conditions are within the preferred range for spawning,
    - Expand habitat assessments of each stream to further explore the quality of upstream habitat and closely monitor stream connectivity to Cheslatta Lake to ensure habitat fragmentation is not occurring for Umam.
4. Conduct future surveys at other watershed locations within the traditional territory of the CCN where Umam have been recently observed, such as the Tahtsa Narrows (Section 1.1.2).
5. If Umam populations are low, environmental DNA (eDNA) methods could be utilized to increase the likelihood of detection during future sampling. This method relies on water samples to test for DNA presence of a target organism, regardless of whether the organism is captured using conventional methods (Hobbs and Helbing 2021). However, the eDNA method still has limitations that would have to be carefully considered during survey planning.

Continuing to encourage everyone in the CCN community to share and document their potential Umam observations in the Cheslatta Lake system, and greater region, will also be an important tool that aids future planning.

6.0 CLOSURE

The 2020 Umam surveys were completed in accordance with the plan outlined in the initial proposal. Additional sites were added in the field, as time permitted, based on the feedback provided by CCN. No Umam were captured during the surveys; however, habitat assessment objectives were achieved. In addition, DWB provided training and mentorship for aquatic survey methods, while CCN Technicians provided valuable leads on additional sampling sites (e.g., Unnamed Creek #4 and Cheslatta River, Lower Falls) that increased the opportunity for Umam detection. Overall, the results of the surveys provide compelling evidence for further sampling in the future.

7.0 REFERENCES

7.1 Literature Cited

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7.2 Personal Communications

D. Thompson. 2020. Cheslatta Carrier Nation / Field Technician and Local Recreationist. Field communication documented on October 7, 2020.

M. Robertson. 2020a. Cheslatta Carrier Nation / Policy Advisor. Email communication and photo documentation provided on May 7, 2020.

M. Robertson. 2020b. Cheslatta Carrier Nation / Policy Advisor. Email communication provided on September 11, 2020.

M. Robertson. 2020c. Cheslatta Carrier Nation / Policy Advisor. Email communication and photo documentation provided on October 29, 2020.

R. and E. Hudson. 2020. Cheslatta Carrier Nation / Field Technicians and Local Recreationists. Field communication documented on October 6, 2020.

Appendix A
Survey Photographs

Photo 1. Oct 3 – Facing downstream at the outlet of Sather Creek.

Photo 2. Oct 3 – Where the channel narrows at the outlet of Sather Creek.

Photo 3. Oct 3 – Sather Creek, facing downstream at the road crossing.

Photo 4. Oct 3 – Deep pool habitat observed in Ootsanee Creek downstream of the road crossing.

Photo 5. Oct 3 – Where Ootsanee Creek starts to fan out before entering Cheslatta Lake.

Photo 6. Oct 3 – A baited minnow trap set in Ootsanee Creek.

Photo 7. Oct 4 – Rainbow trout captured during an electrofishing survey in Sather Creek.

Photo 8. Oct 4 – Assessing the dry channel of Unnamed Creek #3.

Photo 9. Oct 4 – The stream was observed flowing underground in Unnamed Creek #2 before reaching the outlet.

Photo 10. Oct 4 – Facing upstream of Unnamed Creek #2 where water was still actively flowing.

Photo 11. Oct 4 – The Cheslatta River outflow, where the river fans out before entering Cheslatta Lake.

Photo 12. Oct 5 – Field crews installing a hoop net in the Cheslatta River at the outlet.

Photo 13. Oct 5 – Standing at the beaver dam on Knapp Creek, approximately 500m upstream from outlet.

Photo 14. Oct 6 – Good spawning habitat observed approximately 850m upstream of the Knapp Creek outlet.

Photo 15. Oct 6 – Knapp creek fans out into several, narrow channels at the outlet.

Photo 16. Oct 6 – Field technicians measuring and identifying fish species caught in Knapp Creek.

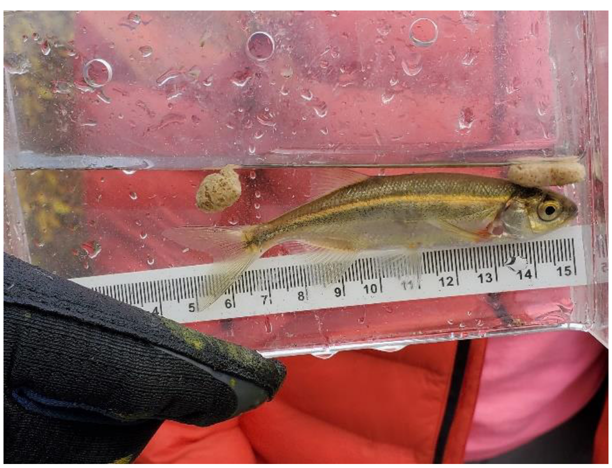

Photo 17. Oct 6 – Redside shiner caught in minnow trap just downstream of beaver dam on Knapp Creek.

Photo 18. Oct 6 – Assessing the dry channel of Unnamed Creek #4 (affectionately nicknamed "Evelynn's Creek" by crew members).

Photo 19. Oct 6 – Assessing the dry channel of Unnamed Creek #4 (affectionately nicknamed "Evelynn's Creek" by crew members) at the outlet.

Photo 20. Oct 7 – Largescale sucker captured in the hoop net at the outlet of Knapp Creek.

Photo 21. Oct 7 – Lake chub captured in the hoop net at the outlet of Knapp Creek.

Photo 22. Oct 7 **–** Redside shiner captured in the hoop net at the outlet of Knapp Creek.

Photo 23. Oct 8 – Cheslatta River at the lower falls where minnow traps were set.

Photo 24. Oct 8 – Prickly sculpin captured in a minnow trap in the Cheslatta River at the lower falls.

Appendix B
Cheslatta River Outflow Survey Sites

Cheslatta River Outflow Survey Sites

0 40 80 160 Meters

1:2,500

N

Tributary Channel

Survey Method

Hoop Net

Minnow Trap

Survey Sites: CR1-CR5

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Appendix C

Knapp Creek Survey Sites

Knapp Creek Survey Sites

0 40 80 160 Meters

1:2,500

N

Electrofishing Transect
Tributary Channel
Beaver Dam

Survey Method
Hoop Net
Minnow Trap

Survey Sites: KC1-KC8

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Appendix D

Sather Creek Survey Sites

Sather Creek Survey Sites

0 20 40 80 Meters

1:1,500

N

Electrofishing Transect
Tributary Channel

Survey Method
Minnow Trap

Survey Sites: SC1-SC7

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Appendix E

Ootsanee Creek Survey Sites

Ootsanee Creek Survey Sites

0 40 80 160 Meters

1:2,500

N

Electrofishing Transect
Tributary Channel

Survey Method
Minnow Trap

Survey Sites: OC1- OC5

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Appendix F

Unnamed Creek #2 Survey Sites

Unnamed Creek #2 (WSC:180-545300-53500) Survey Sites

0 40 80 160 Meters

1:2,500

N

Electrofishing Transect

Tributary Channel

Survey Method

Minnow Trap

Survey Sites: UC 2-1

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