# Summary of Minnow trapping component of the SD 91/UNBC eDNA project

2021 Season

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UNBC/SD 91

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Photos on cover page (clockwise from left):
Orin Albertson and Cale Haines, NVSS working on Clear Creek;
Nathan Kozak and Orin Albertson, NVSS, measuring chinook on Dog Creek;
Val Detwiller, local landowner, at Moss Creek.
All photos by Barry Booth.

# Project Overview

This report is a component of an overarching environmental DNA (eDNA) project headed by Dr. Brent Murray at UNBC in collaboration with School District (SD) 91. The material presented in this report includes all minnow trapping conducted under the prevue of the UNBC/SD91 eDNA project as well as additional minnow trapping conducted by SD 91.

# Sampling Summary

We sampled 15 creeks at 74 different sampling locations[1] in 2021 (Table 1). All sampling, save for one day, was completed by Barry Booth and a crew of high school from Vanderhoof (NVSS) and a crew from Ft. St. James. Sampling was conducted by Casey Litton, NVSS on August 11, at Sites 4-12 on Clear Creek along with the same crew from NVSS. Sites were sampled from July 9 through to August 27. Due to a range of issues (COVID 19, forest fires and the extreme temperatures in June) minnow trapping was less frequent than expected.

Table 1. Sites sampled in 2021.

| Region | Water Body | Number of sites | Number of times creek was sampled[2] |
|---|---|---|---|
| Ft. Fraser | Dog Creek | 2 | 2 |
| " | Nine Mile Creek | 2 | 2 |
| " | Ormond Creek | 1 | 2 |
| " | Tatsutnai Creek | 2 | 2 |
| Ft. St. James | Nahounli Creek | 4 | 4 |
| " | Necoslie River | 1 | 2 |
| " | Sowchea Creek | 1 | 1 |
| Upper Nechako | Greer Creek | 2 | 1 |
| " | Swanson Creek | 2 | 1 |
| " | Twin Creek | 3 | 1 |
| Vanderhoof | Clear Creek | 29 | 3 |
| " | Knight Creek | 12 | 4 |
| " | Moss Creek | 4 | 2 |
| " | Murray Creek | 8 | 3 |
| " | Stoney Creek | 1 | 2 |

Most creeks were sampled on a small geographic scale (e.g., 1-4 sites in close proximity to one another). Three creeks, Knight, Clear and Murray, were sampled more extensively in 2021 in order to get a snapshot of fish distribution over a large section of these creeks.

## Clear Creek

Sampling on Clear Creek occurred in three distinct locations: at Bevan Geernaert's farm downstream of Braeside Road, two locations immediately downstream of Hwy 27, and 26 locations in proximity to the

[1] Maps of associated with the 2021 season can be found in Appendix 1.

[2] Please note that not each site on a given creek was sampled the number of times noted in this table.

planned outdoor classroom upstream of Hwy 27. Of these 26 locations, nine were below the main creek crossing and the remaining 17 were above it. With this effort, we were able to sample ~1 km of Clear Creek in the vicinity of the proposed classroom (~240 m below and ~780 m above the creek crossing; Figure 4).

### Knight Creek

Knight Creek was sampled at 12 sites in 2021 (Figure 5) and most of this sampling occurred on one day (July 28). Sampling during this time was restricted to ~250 m above Sackner Road due to low flow on Knight Creek. Above 250 m, Knight Creek was restricted to pools that were isolated from one another and from the lower sections of the creek.

### Murray Creek

Sampling on Murray Creek took place in most of the same locations as the 2020 sampling season. With the help of Guy Scharf, DFO Community Advisor, two ponds were also seined during 2021 (Figure 6). One pond is located just below the bridge on Erickson Road, and second is the 'new' overwintering pond ~ 460 m downstream of Erickson Road.

## Results from trapping

### Juvenile Chinook - overall

We caught a total of 79 chinook salmon during our trapping efforts. Chinook were caught in 8 of the 15 creeks that we sampled. Chinook caught ranged from 45 to 90 mm in length and weighed between 2 and 8 grams (Table 4). Locations of where chinook were caught on each creek can be found in Figures 9-11.

Table 2. Summary of chinook salmon caught during trapping season.

| | | | Length (mm) | | Weight (g) | |
|---|---|---|---|---|---|---|
| Creek | Site #'s where chinook were caught | Total # caught | Min | Max | Min | Max |
| Dog Creek | 1 | 49 | 45 | 75 | 2 | 8 |
| Nine Mile Creek | 1 | 4 | 50 | 70 | 2 | 4 |
| Ormund Creek | 1 | 2 | 65 | 70 | 4 | 5 |
| Tatsutnai Creek | 1 | 8 | 60 | 70 | 3 | 6 |
| Swanson Creek | 1,2 | 4 | 60 | 80 | 3 | 7 |
| Twin Creek | 2,3 | 3 | 45 | 75 | 3 | 6 |
| Knight Creek | 6 | 1 | 80 | 80 | 6 | 6 |
| Moss Creek | 2,4 | 8 | 55 | 90 | 2 | 4 |

Of note is that we did not catch chinook in Clear, Murray, or Greer Creeks in 2021, but did so in 2020. It is unclear as to why we did not catch chinook in these creeks this year. Trapping intensity as measured in soak time (# of hours traps were set) was much lower at these sites in 2021 comparted to 2020 (Table 3). Thus it may simply be that we did not trap enough to detect chinook in these three sites in 2021. One possible explanation for the absence of chinook at Site 1 on Murray Creek may have been because of the increased beaver activity in 2021 downstream of Site 1.

Table 3. Soak times between 2020 and 2021 at selected creeks

| | | Soak time (hours) | |
|---|---|---|---|
| **Creek** | **Site #** | **2020** | **2021** |
| Clear | 1 | 131.2 | 79.2 |
| Murray | 1 | 162.1 | 72.6 |
| Greer | 1 | 169.3 | 84.6 |

## Juvenile Chinook - selected creeks

### Ft Fraser Area

#### *Dog Creek*

Over two trapping sessions we caught 49 chinook in a small section of creek that extends from the downstream side of the Dog Creek Forest Service Road (FSR) to the confluence with the Nechako (Figure 9). This part of the creek represents only ~ 100 m of habitat but yielded the highest numbers of chinook caught anywhere in 2021. There are two issues at Dog Creek that deserve attention. First, there are two perched culverts at the Dog Creek FSR that clearly represent a barrier to upstream movement at lower water levels (Photo 1). Second, there is a small chute / waterfall below the culvert that may also act as a barrier to upstream movement at lower flows (Photo 2). Trapping was conducted on one day above the Dog Creek FSR in August (Site 2), but no chinook were caught at that time. Further exploration of this creek is recommended. Specifically, it would be valuable to determine if and when the chute/waterfall is a barrier to fish passage.

Photo 1. Perched culverts at Dog Creek FSR.
Photo by Barry Booth

Photo 2. Cascade/chute at upstream end of Reach 1 on Dog Creek. Photo by Barry Booth

### *Nine Mile Creek*

Chinook at Nine Mile Creek were caught ~ 4km upstream of the confluence with the Nechako River, indicating that there is likely a large amount of viable rearing chinook habitat on this creek (Figure 9). We trapped on one occasion above the perched culverts on Settlement Road at Nine Mile but did not capture any chinook during this session despite suitable habitat being present. It is likely that these culverts represent a fish passage barrier for further upstream movement of chinook, and should these be replaced, additional rearing habitat may become available further upstream.

### *Tatsutnai Creek*

On Tatsutnai chinook were caught at Site 1, ~ 700 m upstream of the confluence with the Nechako (Figure 9). Above this site there are no known fish passage barriers suggesting that the distribution of chinook could extend much further up this creek. We trapped on one occasion ~ 2.6 km upstream of Site 1 but did not capture any chinook during this session despite suitable habitat being present.

## Upper Nechako

### *Twin Creek*

The discovery of chinook at Site 3 on Twin Creek (Figure 10) indicates that there is at least 900 m of chinook rearing habitat on this creek. The removal of the perched culverts (Crossing 1134; Forsite 2018) and their

replacement with a bridge near the confluence with the Nechako in 2021 suggests that use of this reach of Twin Creek by juvenile chinook should increase in the coming years. Due to the high beaver activity above the Kenney Dam Road (KDR) noted in June, it is unclear if the removal of the culvert across the KDR (Crossing 1088, Forsite 2018) will result in increased use of this section of Twin Creek by chinook salmon.

### *Swanson Creek*

Chinook have been captured as far up as ~ 2.7 km from the confluence with the Nechako River (Figure 11, 12). Sites where chinook have been captured in 2020 and 2021 coincide with historical observations (Figure 12, Olmstread et al. 1980 and Arc Environmental 1998) suggesting that Swanson Creek continues to represent an important rearing creek for chinook in the upper Nechako. These observations merit further examination of the use of this creek by chinook, particularly in light of observations of the alteration of channel morphology in the lower section of the creek noted in 2021, as well as observed issues with livestock use in the same section of the creek.

## Vanderhoof Area

### *Knight Creek*

While only one chinook was caught on Knight Creek ,this one specimen suggests that at least portions of this creek represent rearing habitat for chinook (Figure 10). The completed restoration project on the upper section of this creek in late 2021 will likely improve the overall health of the lower section of this creek. However, the mis-aligned and undersized culverts that take Knight Creek under Sackner Road may limit the overall value of Knight Creek as chinook habitat.

### *Moss Creek*

Numerous chinook were caught on Moss Creek, some of which were located above the perched culvert that served as a crossing for a ranch access road near the confluence of Moss Creek with the Nechako River (Figure 11). As with Twin Creek, the removal of this culvert and its replacement with a bridge in late 2021, will likely result in the increased use of Moss Creek by juvenile chinook in the coming years.

## Other species caught

Overall, we caught a total of 1037 individuals from seven different species (Table 5).

Table 4. Total number of each species caught in minnow traps in each creek during trapping season.

| | Species caught | | | | | | |
|---|---|---|---|---|---|---|---|
| Water Body | Chinook Salmon | Rainbow Trout | Lake Chub | Northern Pike Minnow | Prickly Sculpin | Redside Shiner | Sucker |
| Dog Creek | 49 | 9 | - | - | - | - | - |
| Nine Mile Creek | 4 | 6 | - | - | - | - | - |
| Ormund Creek | 2 | 1 | - | - | 1 | - | - |
| Tatsutnai Creek | 8 | 7 | - | - | - | - | - |
| Nahounliu Creek | - | 3 | - | - | 7 | - | 13 |
| Necoslie River | - | - | - | 3 | 1 | - | - |
| Sowchea Creek | - | - | - | - | - | - | - |
| Greer Creek | - | - | - | - | - | - | 1- |
| Swanson Creek | 4 | 4 | - | - | - | 1 | 1 |
| Twin Creek | 3 | 3 | - | - | - | - | - |
| Clear Creek | - | 7 | 1 | - | - | - | 1 |
| Knight Creek | 1 | - | 59 | - | - | - | 719 |
| Moss Creek | 8 | 16 | - | - | - | - | - |
| Murray Creek | - | 11 | 31 | - | - | 2 | 23 |
| Stoney Creek | - | - | - | - | - | - | - |

Of note was the large number of creeks (10 out of 15) that support rainbow trout. Sites where rainbow trout were captured is presented in Table 5.

Table 5. Sites where rainbow trout were caught.

| Water Body | Sites |
|---|---|
| Dog Creek | 1,2 |
| Nine Mile Creek | 1,2 |
| Ormund Creek | 1 |
| Tatsutnai Creek | 1,2 |
| Nahounliu Creek | 1,2 |
| Swanson Creek | 1,2 |
| Twin Creek | 2,3 |
| Clear Creek | 14, 16, 20, 21 |
| Moss Creek | 2,4 |
| Murray Creek | 7,8 |

## Results from Seining on Murray Creek

The two seines from the lower pond (Pond 1/Site 2) yielded 6 suckers and one small rainbow trout (Figure 7). The upper pond (Pond 2/Site ) yielded 6 relatively large rainbow trout (Table 6, Photo 3).

Table 6. Results from seining on Murray Creek.

| | | Length (mm) | | |
|---|---|---|---|---|
| Pond/site | Species | Number | Min | Max |
| Pond 1/Site 2 | Sucker | 6 | 45 | 100 |
| | Rainbow Trout | 1 | 50 | 50 |
| Pond 2/Site 4 | Rainbow Trout | 6 | 170 | 270 |

Photo 3. One of the large rainbow trout caught in seine on July 28, 2021. Photo by Guy Scharf

## Observations related to water temperature on Clear and Murray Creeks

Our sampling period coincided with what has been called the 2021 Heat Dome. In late June and early July, air temperatures soared in northern BC to well above seasonal norms and exceeded 30°C on several days. During this time minnow trapping was suspended due to concerns related to fish health, but water samples for eDNA were obtained from selected sites during this time. Air and water temperatures were recorded during this session as per normal sampling protocols. Further, a HOBO data logger was placed in Murray Creek in ~50 m upstream of Site 8 on May 5, 2021. This data logger recorded water temperatures through to October 31, 2021.

On June 28 and July 22, we took water samples from three sites on Clear Creek (Figure 12) and recorded air and water temperatures at each site using alcohol thermometers (Table 7) . One June 28, the air temperature at all three sites was approximately 30 °C . Water in the upper sections of Clear Creek (Site 3, Figure 12) was 9 °C . These low temperatures are due to the fact that numerous springs emerge from the upper reaches of Clear Creek that deliver cold water at all times of the year. Water temperatures were noted to increase moving downstream, rising to 12 °C below the beaver ponds downstream of Highway 27 (Site 2, Figure 12), and to as high as 22 °C at Site 1 (Figure 12). We observed a similar trend in increases in water temperature outside the Heat Dome when the same sites were visited on July 22nd; however, water temperature differences were less pronounced at this time (Table 7). It is unclear why we noted this significant increase in water temperatures on June 28th, but the lack of overhead riparian cover from Site 2 downstream to Site 1 may have played a role in increases in water temperature as has been noted in numerous studies (e.g., Moore et al. 2005, Ryan et al. 2013).

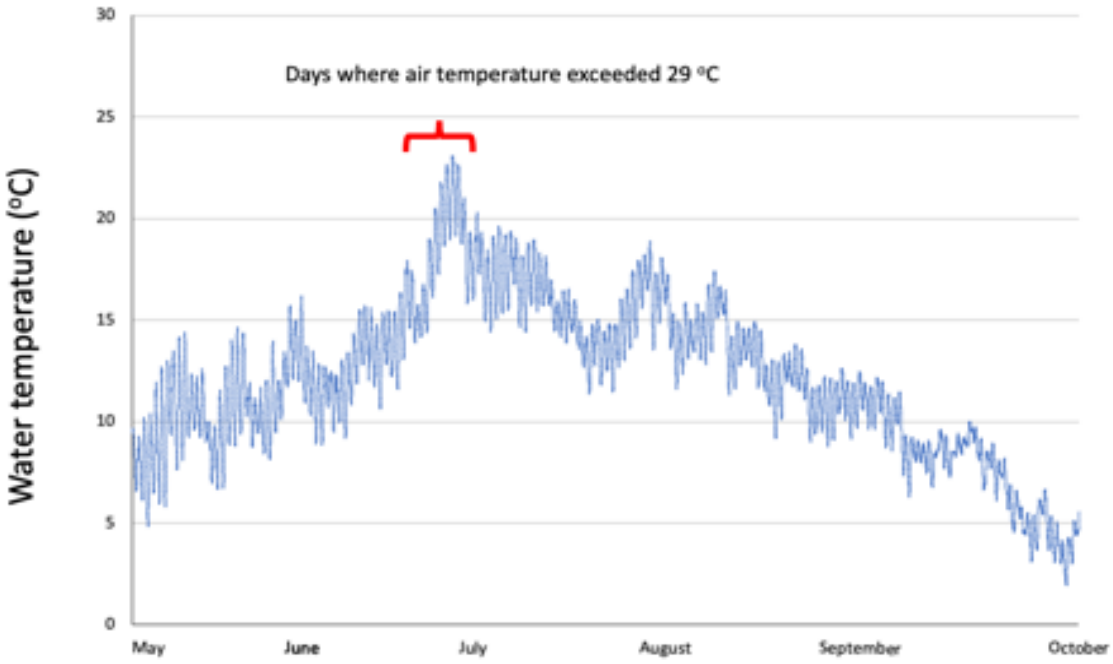
It is important to note that water temperatures in proximity to Site 8 on Murray Creek (Figure 6) also rose during this time period (Graph 1). Temperatures at this site rose from 15 °C prior to the onset of the Heat Dome, to a high of 22 °C when air temperatures were approximately 30 °C. This illustrates the effect of air temperature on water temperature, even at a site with adequate overhead riparian cover such as is present at Site 8. Had the water temperatures at Clear Creek been equivalent to that of Murray Creek (e.g., 15 °C vs 9 °C) at the time of the heat dome, it is possible that water temperatures at Site 1 on Clear Creek may have far

exceeded the 22 °C noted on June 28. This could have led to lethal, or sub-lethal temperatures for some species of fish.

Table 7. Air and Water temperatures from three sites on two days on Clear Creek

| June 28 | | | |
|---|---|---|---|
| Site | **Time** | Temp air ( °C) | Temp water (°C) |
| 1 | 11:30 | 30 | 22 |
| 2 | 12:25 | 31 | 12 |
| 3 | 12:45 | 31 | 9 |

| July 22 | | | |
|---|---|---|---|
| Site | **Time** | Temp air ( °C) | Temp water (°C) |
| 1 | 9:52 | 13 | 14 |
| 2 | 10:35 | 15 | 9 |
| 3 | 11:07 | 12 | 7 |




Graph 1. Water temperature profile at Site 8 on Murray Creek.
Data obtained with HOBO Pendant MX Water Temperature Data Logger

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# Appendix 1. Maps of associated with 2021 season

## 1a Trapping locations



## 1b Trapping locations where chinook salmon were caught



## 1c Water temperature data

# Figure 1. Ft. Fraser Sites


Ormond Creek


Dog Creek


Tatsutnai and Nine Mile Creeks

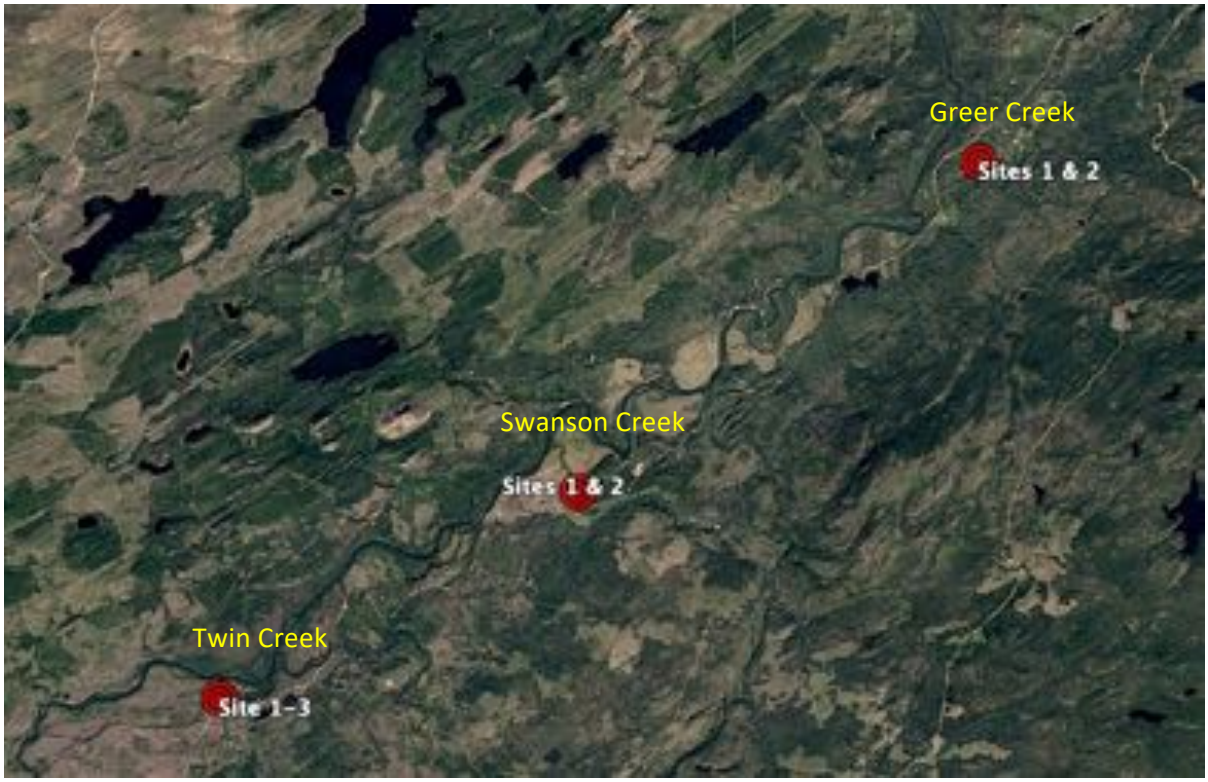
# Figure 2. Ft. St. James sites


Nahounli Creek


Necoslie River


Sowchea Creek

# Figure 3. Upper Nechako Sites




Swanson Creek

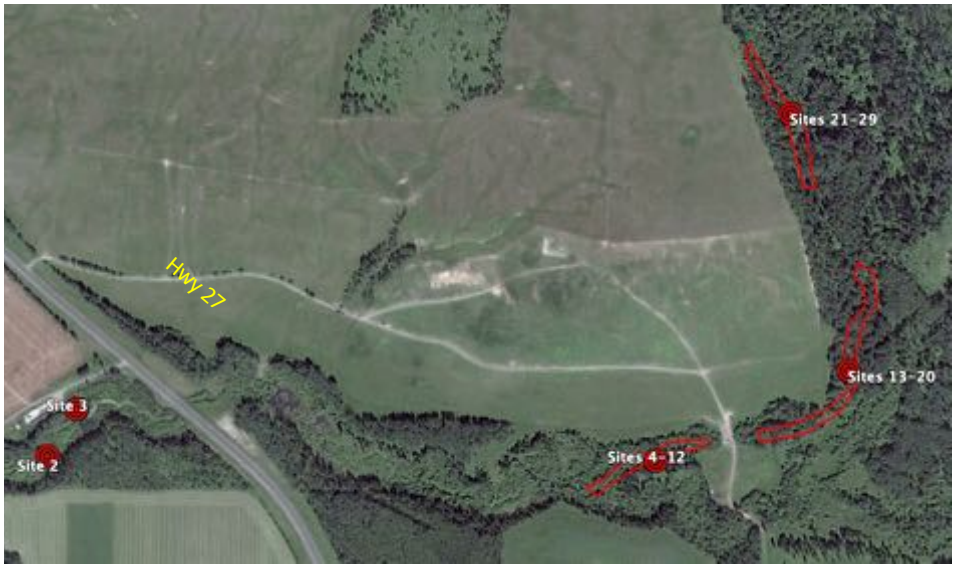

Twin Creek


Greer Creek

# Figure 4. Clear Creek



Nechako River



# Figure 5. Knight Creek


# Figure 6. Murray Creek


Upper Murray


Mid Murray



Lower Murray. Note that sites 2 and 4 are sites were seining occurred

# Figure 7. Moss Creek


# Figure 8. Stoney Creek


Figure 9. Sites where chinook salmon were caught
Ft. Fraser Creeks

Ormond Creek


Dog Creek


Tatsutnai Creek


Nine Mile Creek


Sites where chinook were caught are circled in yellow

Figure 10. Sites where chinook salmon were caught Upper Nechako Creeks

Twin Creek


Swanson Creek

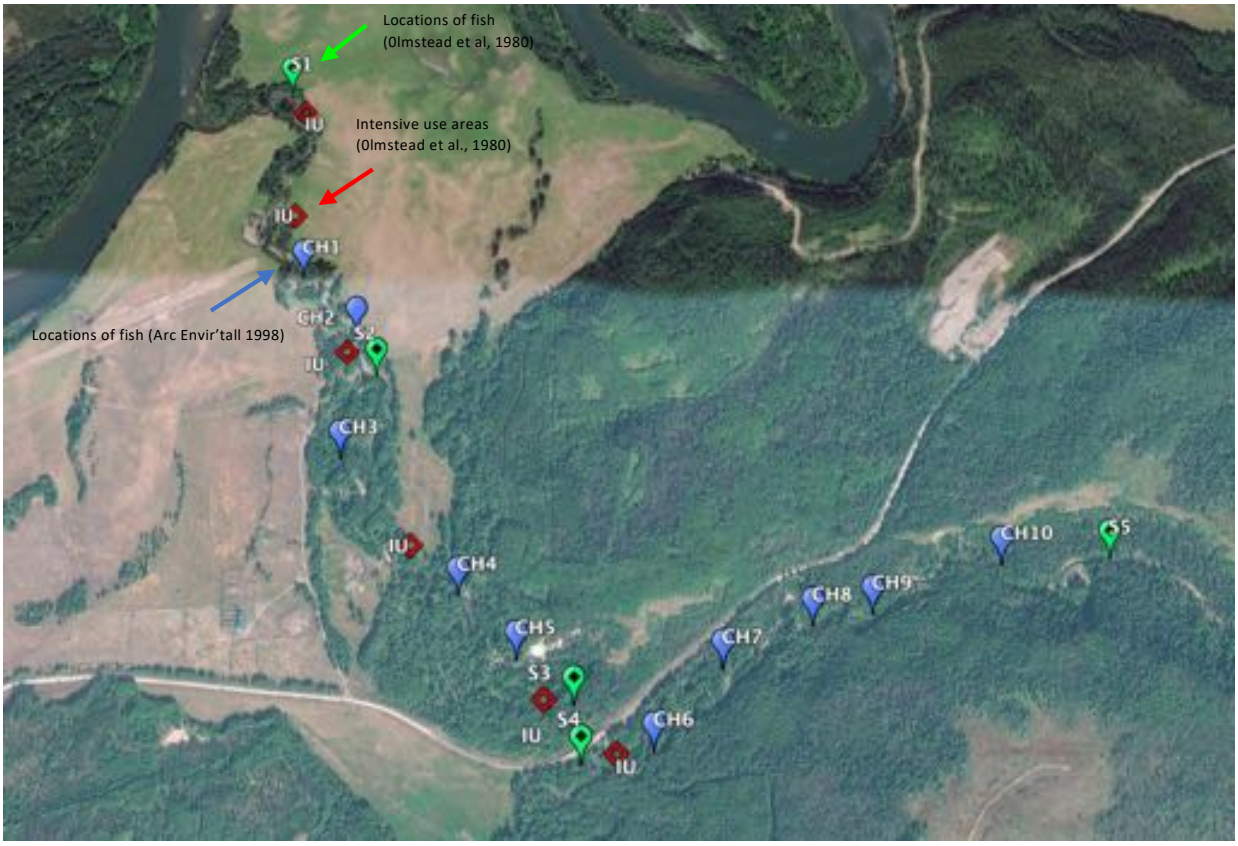

Figure 11. Sites where chinook salmon were caught, Vanderhoof Creeks

Knight Creek


Moss Creek

Figure 12. Chinook captures at recent Swanson Creek sites in relation to historic locations


Sites where chinook were caught in 2020 and 2021




Historic locations of chinook from Olmstead et al. 1980 and ARC Environmental 1998
Please note: locations are approximate. They were extracted from hard copies of maps of the above reports

# Figure 13. Water and air temperatures during 2021 heat dome at different sites on Clear Creek


Sites were visited from downstream to upstream (Sites 1-3)
Temperatures in yellow: June 28 – all taken between 11:30 and 12:45
Temperatures in orange: July 22- all taken between 9:52 and 11:07
Temperatures taken with alcohol thermometer