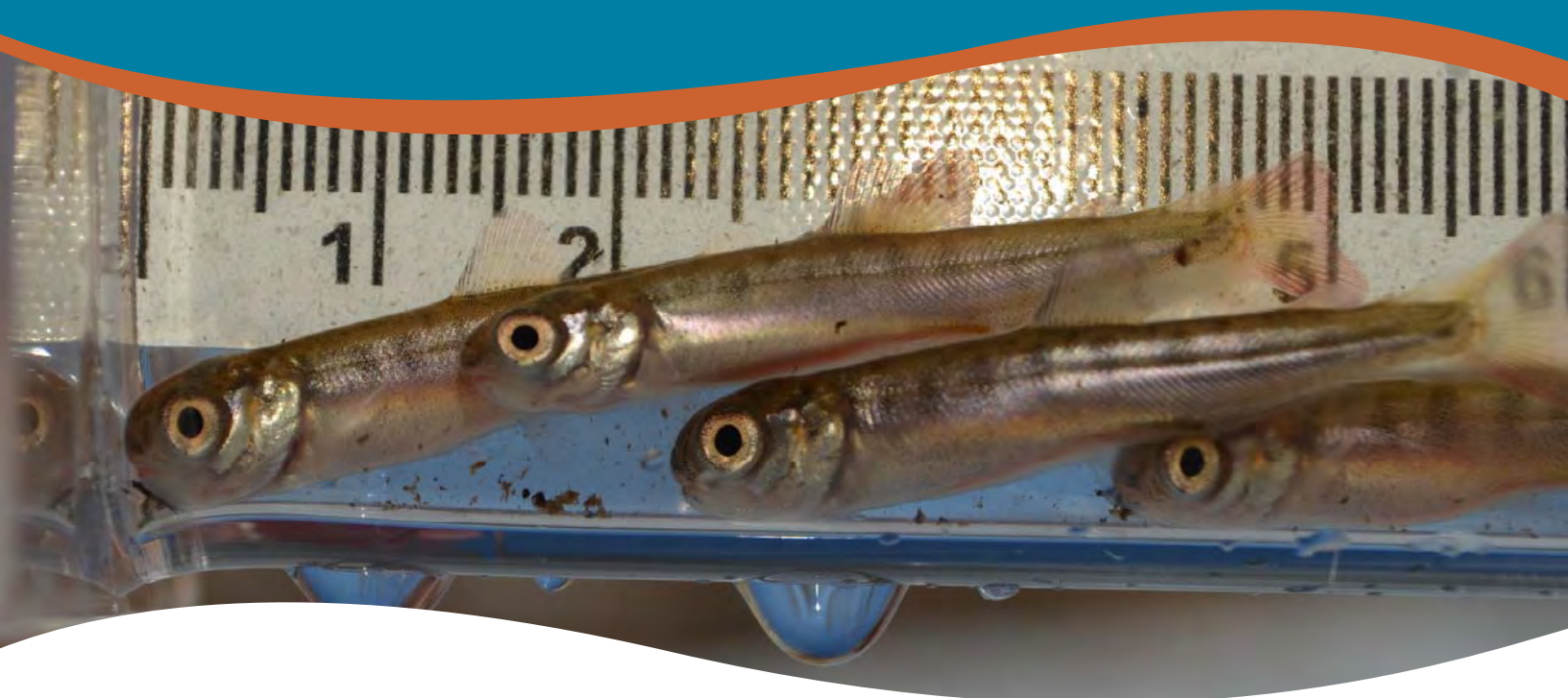


# Klondike River Chinook Restoration and Instream Incubation Trial (2019)



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## EXECUTIVE SUMMARY

Tr'ondëk Hwëch'in prepared a Chinook salmon stock restoration plan for the Klondike River watershed during early 2018 that recommended an instream incubation trial be conducted on the Klondike River. The current project aimed to test the feasibility of instream egg incubation as a restoration tool for Klondike River Chinook and to collect information to help long-term Chinook restoration plans for the watershed. This project involved the following components: water temperature monitoring, monitoring juvenile Chinook presence, an aerial survey for spawning Chinook, instream egg incubation, and hatching success monitoring.

Water temperature monitoring was completed in combination with the instream incubation component of the project and involved the collection of continuous water temperature data at a number of sites in the main channel of the Klondike River and a groundwater-fed channel adjacent to the Tr'ondëk Teaching and Learning Farm (the Farm Channel). As expected, the groundwater channel was colder than the mainstem of the river during the summer, but considerably warmer during the winter months. Juvenile monitoring was conducted in July 2019 to improve baseline information on juvenile habitat in the Farm Channel and to compile information on length and weight of juvenile Chinook throughout the summer.

A spawning Chinook aerial survey was conducted by helicopter on July 25, 2019, to identify areas for egg planting, evaluate Chinook salmon numbers, and find source areas for broodstock collection. The instream egg incubation component of the project involved constructing artificial redds at each site with available stream substrate to mimic natural conditions. Broodstock for the project was collected in the Klondike River and eggs and milt were transported to each site for planting. A cumulative total of 7,857 eggs were planted at 11 sites: three in the Klondike River, four in the North Klondike River, and four sites in the groundwater-fed Farm Channel. Eggs were planted using three methods: Whitlock-Vibert boxes, custom-designed closed mesh bags, and directly into the substrate using egg insertion pipes. Success monitoring was conducted periodically between October 2019 and April 2020 to assess the rate of development of the planted eggs and to determine survival at all sites. The success monitoring indicated a mean hatching success of 40% across all sites, but individual survival estimates by incubator were highly variable and ranged from 0 to 95%. Sites in the North Klondike River had the best overall success with a mean survival rate of 74%, followed by the Klondike River mainstem with 38% and the finally the Farm Channel with 13% success. Emergence success based on the original number of eggs planted was equivalent to hatching success at the sites monitored (40%) and was equally variable with a range of 0 to 80% emergence. Emergence success was highest in the North Klondike River (66%), followed by the Klondike River mainstem (Rock Creek, 33%) and the Farm Channel (26%). The emergence success data from the Klondike River mainstem sites were the most variable ranging from 0% to the highest emergence recorded during the project (80%).

The current project provided information on the merits of instream egg incubation as a restoration tool for Klondike River Chinook and provided new information on the timing of development for incubating eggs and alevin. The lessons learned during this trial project are useful for the planning of the 2020/2021 project, which will aim to plant eggs in different habitats with varying site conditions (e.g., water temperature) to further assess egg survival and development rates.

ACKNOWLEDGEMENTS

Natasha Ayoub and Alice McCulley of the Tr’ondëk Hwëch’in (Fish and Wildlife Manager) contributed to all aspects of this project including portions of the fieldwork. Tamara Dickson also played a key role in the fieldwork component of the project. Trix Tanner (Salmonid Enhancement Program – Department of Fisheries and Oceans Canada) assisted with project permitting and provided advice on overall project direction. Lee Whalen of Dawson City rented his jetboat to the field crew, which was instrumental in site accessibility. TransNorth Helicopters provided aircraft support for the aerial survey and broodstock collection efforts. We would also like to thank the Tr’ondëk Hwëch’in youth and Elders who accompanied us on our field site visits. Funding for this project was provided by the Yukon River Panel’s Restoration and Enhancement Fund.

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## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	OBJECTIVES.....	3
<b>2</b>	<b>METHODS .....</b>	<b>4</b>
2.1	WATER TEMPERATURE MONITORING.....	4
2.2	JUVENILE MONITORING .....	4
2.3	AERIAL SURVEY FOR SPAWNING CHINOOK.....	6
2.4	INSTREAM EGG INCUBATION.....	8
2.4.1	Site Preparation .....	8
2.4.2	Spot Velocity Measurements .....	8
2.4.3	Broodstock Collection.....	10
2.4.4	Egg Fertilization.....	10
2.4.5	Egg Deployment.....	10
2.5	SUCCESS MONITORING .....	11
<b>3</b>	<b>RESULTS AND DISCUSSION .....</b>	<b>12</b>
3.1	WATER TEMPERATURE MONITORING.....	12
3.2	JUVENILE MONITORING .....	13
3.3	AERIAL SURVEY FOR SPAWNING CHINOOK.....	16
3.4	INSTREAM EGG INCUBATION.....	18
3.4.1	Site Preparation .....	18
3.4.2	Spot Velocity Measurements .....	18
3.4.3	Broodstock Collection.....	19
3.4.4	Egg Fertilization and Deployment .....	19
3.4.5	Success Monitoring.....	20
3.4.5.1	Hatching Success .....	20
3.4.5.2	Emergence Success.....	23
3.4.5.3	Development Rates .....	23
<b>4</b>	<b>CONCLUSION.....</b>	<b>25</b>
<b>5</b>	<b>LITERATURE CITED.....</b>	<b>26</b>



## LIST OF APPENDICES

<b>APPENDIX A</b>	<b>PHOTOGRAPHS.....</b>	<b>A-1</b>
<b>APPENDIX B</b>	<b>FISH SAMPLING DATA.....</b>	<b>A-2</b>

## LIST OF TABLES

Table 1.	Summary of juvenile Chinook minnow trap sampling and catch per unit effort (CPUE) in the Farm Channel and Klondike River mainstem in July 2019. ....	13
Table 2.	Spot velocity measurements collected at planting sites using a Swoffer velocimeter, July 29, 2019. ....	18
Table 3.	Summary of 2019 egg planting in the Klondike River. ....	20
Table 4.	Summary of hatching success in Whitlock-Vibert boxes and closed mesh bags in the Klondike and North Klondike rivers. ....	21
Table 5.	Summary of emergence success in the closed mesh bags in the Klondike and North Klondike rivers. ....	23

## LIST OF FIGURES

Figure 1.	Daily average surface water temperature from representative egg planting sites in the Farm Channel, Klondike and North Klondike rivers from July 30, 2019, through to April 29, 2020. ....	12
Figure 2.	Klondike River juvenile Chinook fork length frequencies from July 2019 (n=105). ....	14
Figure 3.	Summary of egg hatching success data collected in the Klondike River watershed during 2019/2020 as compared to consistently collected data in the Teslin River (EDI Environmental Dynamics Inc. 2017, 2018b, 2019c, 2020b, c) and Takhini River (EDI Environmental Dynamics Inc. 2020d) watersheds. ....	22

## LIST OF MAPS

Map 1.	Overview of project area.....	2
Map 2.	Juvenile Chinook monitoring locations in the Klondike River. ....	5
Map 3.	Aerial Chinook spawning survey extent.....	7
Map 4.	Broodstock collection and instream egg incubation sites in the Farm Channel and Klondike and North Klondike rivers in 2019. 9	
Map 5.	Juvenile Chinook monitoring results in the Klondike River during 2019.....	15
Map 6.	Chinook spawning aerial survey results. ....	17



## 1 INTRODUCTION

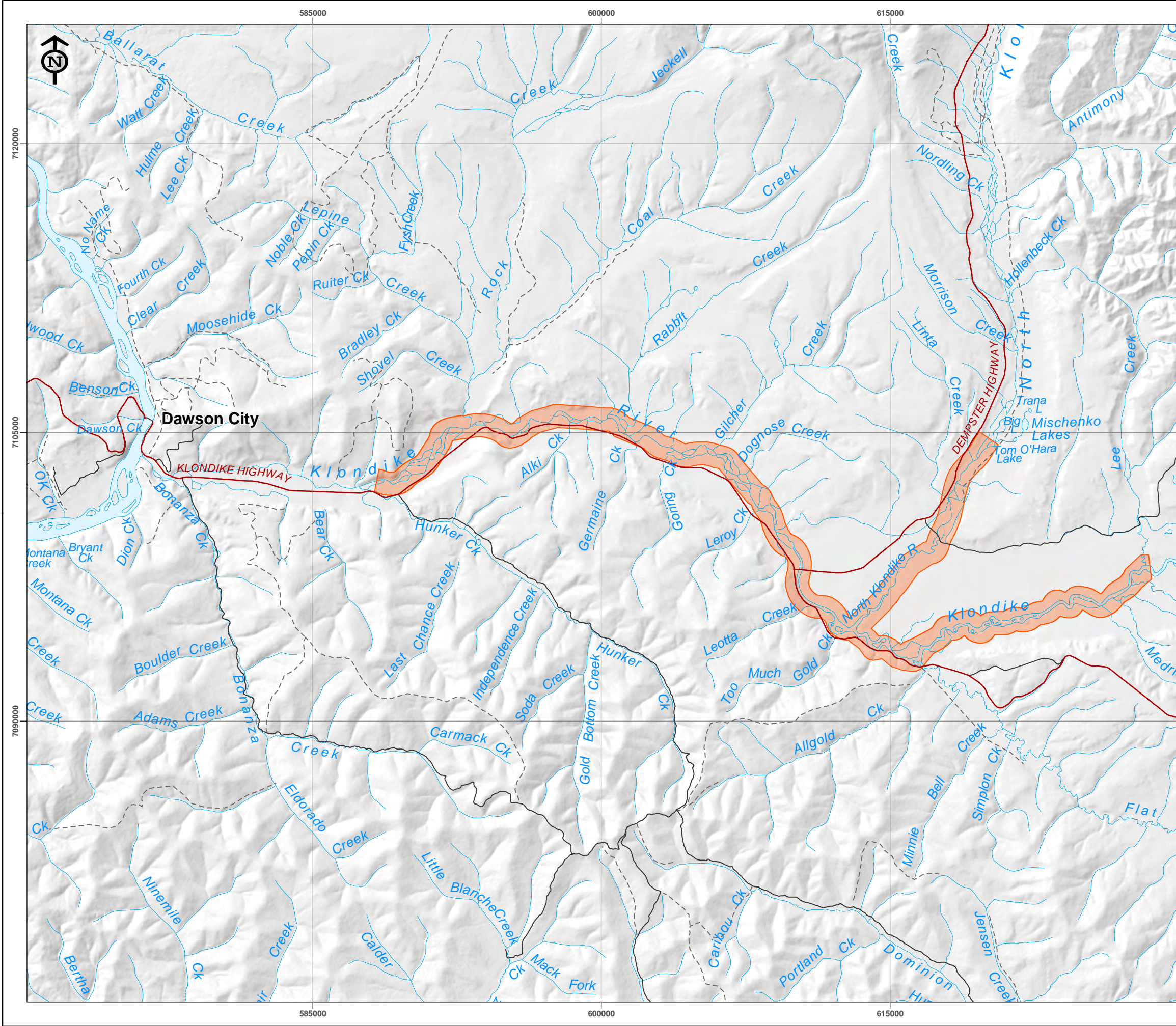
Tr'ondëk Hwëch'in (TH) citizens are physically, culturally, and spiritually connected to the Yukon River salmon fishery. This fishery has been a major contributor to the traditional economy since the early days of the TH, or People of the River, who have historically focused salmon harvest at the confluence of the Yukon and Klondike Rivers, or Tr'ochëk. As a primary stakeholder in subsistence and commercial salmon fisheries, TH has a vested interest in the health of salmon stocks found within their Traditional Territory. Chinook salmon (*Oncorhynchus tshawytscha*, hereafter referred to as Chinook) in the Klondike River have faced declining populations for decades and the TH have been involved with and have supported salmon restoration projects in their Traditional Territory.

The Klondike River is the highest priority candidate for stock restoration due to the cultural connection for the TH. Klondike River Chinook have been impacted both during and after the Klondike Gold Rush due to large scale dredging, placer mining and associated hydroelectric developments. As a result, the TH prepared a Chinook stock restoration plan for the Klondike River watershed during early 2018 (EDI and TH 2018). The restoration plan recommended that an instream incubation trial be conducted on the Klondike River over the near-term, with a medium-term goal to develop some form of an incubation facility or small-scale hatchery in the watershed. The first year (Year 1) of the instream incubation trial took place in 2018/2019. The results of Year 2 of the project (2019/2020) are described in this report (Map 1).

The methods used for the instream incubation component of the 2019/2020 project closely followed those from Year 1 of the project as well as those currently being used by Teslin Tlingit Council (TTC) on Deadman Creek and Morley River within the Teslin River watershed in southern Yukon. The project results will be used to further determine the feasibility of such methods for stock restoration in the Yukon River watershed, and to collect information about the timing and rate of egg and alevin development. This method is innovative in its application for stock restoration and is very much a work in progress, particularly with the development of approaches to determine success given that measuring survival beyond the alevin stage is challenging. However, the stewardship opportunities of such a project and ability to use results for guiding future restoration initiatives are cornerstones of this project. Alongside the instream incubation trial, the TH are collecting information to facilitate the development of a small-scale incubation facility in the Klondike watershed in the near future. Information on size of juvenile Chinook salmon during the summer can be combined with the results of the incubation trial to plan an incubation facility that is ecologically relevant and produces fry that are as similar in size as possible to wild juveniles.

During Year 1 of the project (2018/2019), a cumulative total of 8,136 eggs were planted at six sites in the Klondike River with five sites in the main channel and a single site in the Farm Channel (a small groundwater-fed channel). Success monitoring indicated a mean hatching success of 61% across all sites, but individual survival estimates by incubator were highly variable and ranged from 16.5-95%. Survival to fry emergence was available using the closed mesh bag for a single site in the Farm Channel and was found to be relatively high (91%). Consistent information was not available for the main channel sites because conditions were not conducive to allowing closed mesh bags to remain in place through the spring freshet period. Methods and results for Year 2 (2019/2020) are described in the following sections.





### Map 1. Overview of project area

**Legend**

- Highway
- Secondary Road
- Trails
- Project Area

**Data Sources**  
Digital Elevation Model and 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) [www.geomatics.yukon.ca](http://www.geomatics.yukon.ca).

Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc., 2019 was obtained using Garmin GPS technology.

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## 1.1 OBJECTIVES

The overall objective of this project was to collect information to inform TH's plans for some form of incubation facility on the Klondike River in the coming years. The project also provided a unique learning opportunity to test egg planting as a method for restoring Chinook stocks elsewhere in the Yukon River watershed and to provide training opportunities to TH citizens and staff. The specific objectives of the project were to:

- plant up to 13,000 fertilized Chinook eggs into the Klondike River to collect information on egg survival in various habitats and determine the timing of egg development including hatching and emergence;
- conduct a juvenile Chinook sampling program during the summer of 2019 to collect data on habitat utilization by juveniles and changes to fish length and weight over the summer months; and,
- provide local capacity building and technical training for TH citizens and employees.



## 2 METHODS

### 2.1 WATER TEMPERATURE MONITORING

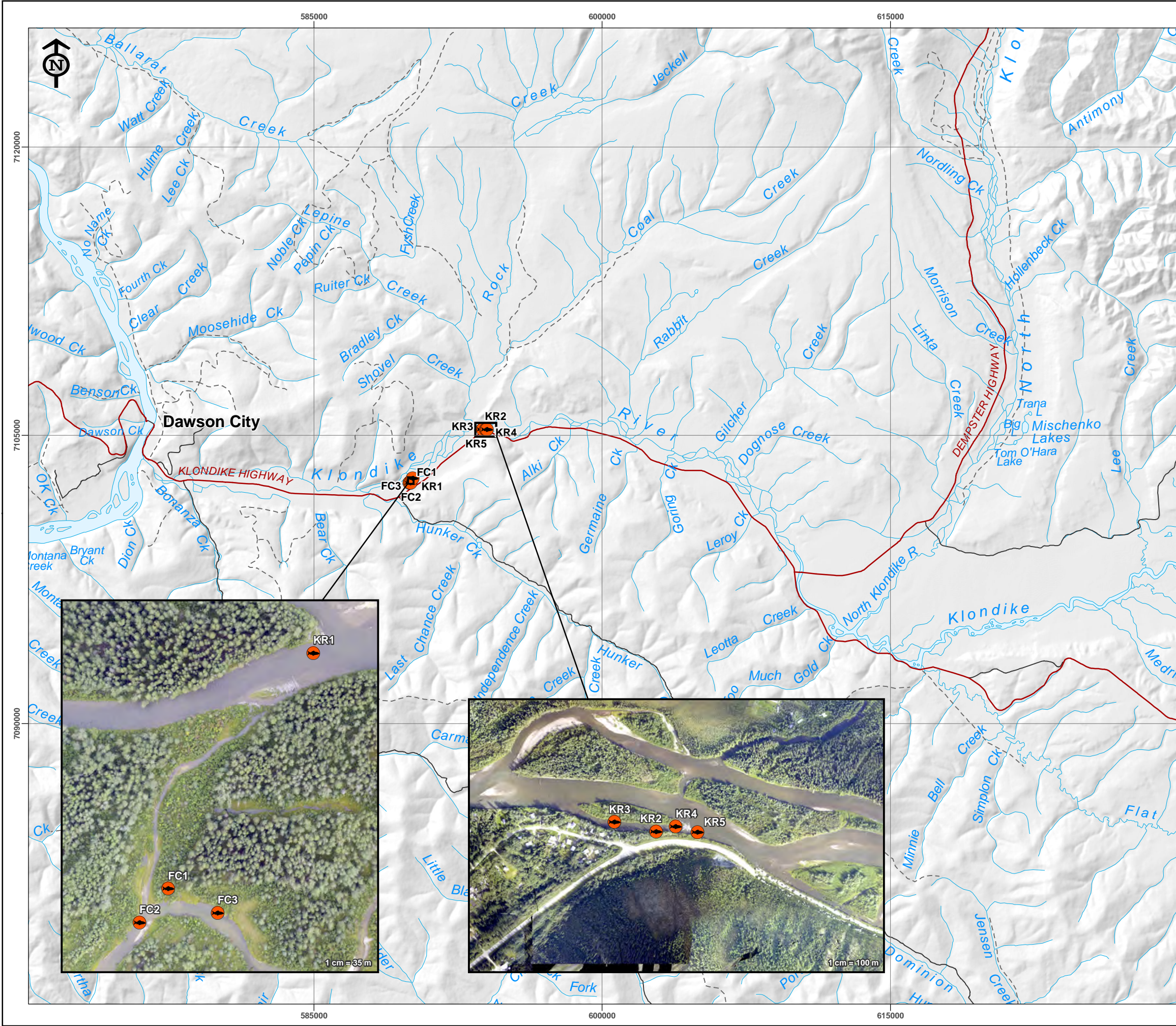
Water temperature monitoring involved deploying water temperature loggers at representative egg planting sites as well as a nearby surface water monitoring location. The surface water location provided a means to obtain water temperature data prior to the removal of all egg incubation media. This logger was downloaded on a few occasions during the fall of 2019 to calculate accumulated thermal units (ATUs; the cumulative temperature units or degree days) and plan the timing of the success monitoring field investigations in October 2019. The remaining loggers were retrieved in combination with the additional success monitoring field visits during the winter and spring of 2019/2020.

### 2.2 JUVENILE MONITORING

Sampling for juvenile Chinook was conducted in the Klondike River and the area known as the Farm Channel, which is a small groundwater-fed channel in the slough behind the TH C-7B settlement land parcel, located across from the Dawson City airport. The objective of this component of the project is to continue to collect presence/absence information on juvenile Chinook in the Farm Channel and to collect data on juvenile Chinook length and weight during the summer months.

Sampling was conducted July 3 and 4, 2019, under a Scientific Fish Collection Licence issued by Fisheries and Oceans Canada (DFO) (Map 2). Three minnow traps were set at each of eight stations. All traps were baited with Yukon River origin salmon roe and left to soak overnight as per Yukon River Panel protocols. Field crews measured water quality parameters (water temperature, pH, specific conductance, and dissolved oxygen) for each station along with water depth and a general habitat description. Digital photos were collected at all sampling stations along with GPS co-ordinates and set and pull times. Upon retrieval of the traps, fish were counted and identified to species, with a minimum of 10 individuals of each species from each trap measured for fork length.





### Map 2. Juvenile Chinook monitoring locations in the Klondike River

**Legend**

- Juvenile Chinook Monitoring Locations
- Highway
- Secondary Road
- Trails

0 5 10 15  
Kilometres

Map Scale = 1:200,000 (printed on 11 x 17)  
Map Projection: NAD 1983 UTM Zone 7N



**Data Sources**  
Digital Elevation Model and 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) [www.geomatics.yukon.ca](http://www.geomatics.yukon.ca).

Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc., 2019 was obtained using Garmin GPS technology.

Aerial imagery provided by Great River Air. (Collected August 8 - 10, 2018).

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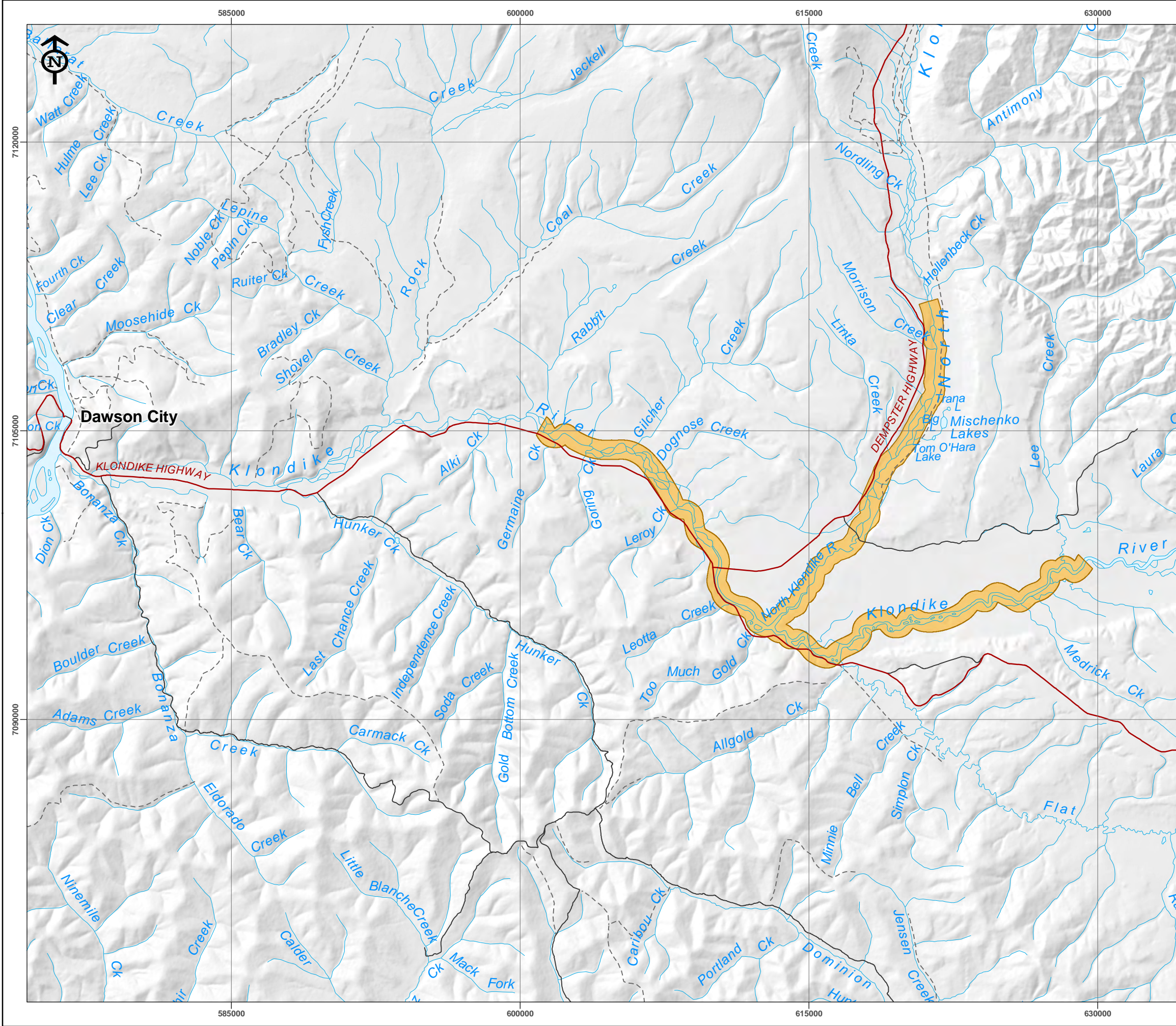


### 2.3 AERIAL SURVEY FOR SPAWNING CHINOOK

An aerial survey for spawning Chinook was completed along the Klondike River on July 25, 2019. The survey extended from Goring Creek upstream to Lee Creek on the Klondike River and on the North Klondike River from the confluence with the mainstem Klondike upstream to a point 10 km above the former North Fork intake (Map 3).

The primary objective of this survey was to locate potential broodstock collection areas and egg planting sites, as well as to determine site access for these project components. During the survey, observers were located in the front and back seats of the helicopter. The pilot positioned them over the river for the best possible vantage point, at approximately 40 to 45 m above ground level. Surveys were completed in an upstream manner and observers wore polarized glasses to reduce glare. Redds and adult Chinook were counted, photographed and locations recorded with an iPad (Avenza Maps) and GPS.





Map 3. Aerial Chinook spawning survey extent

- Legend**
- Highway
  - Secondary Road
  - - - Trails
  - Survey Extent



**Data Sources**  
Digital Elevation Model and 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) [www.geomatics.yukon.ca](http://www.geomatics.yukon.ca).

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## 2.4 INSTREAM EGG INCUBATION

This project underwent a Yukon Environmental and Socio-economic Assessment Board (YESAB) project review during the summer of 2018. As a result, DFO issued a Scientific Fish Collection Licence for broodstock collection and an Introduction, Transplant and Transport (ITT) permit for the broodstock transportation and subsequent egg planting in the Klondike and North Klondike rivers during July 2019.

The instream egg incubation (egg planting) component of the project involved four stages: (1) site preparation and spot velocity measurements (Sections 2.4.1 and 2.4.2), (2) broodstock collection (Section 2.4.3), (3) egg fertilization (Section 2.4.4), and (4) egg deployment (Section 2.4.5).

### 2.4.1 SITE PREPARATION

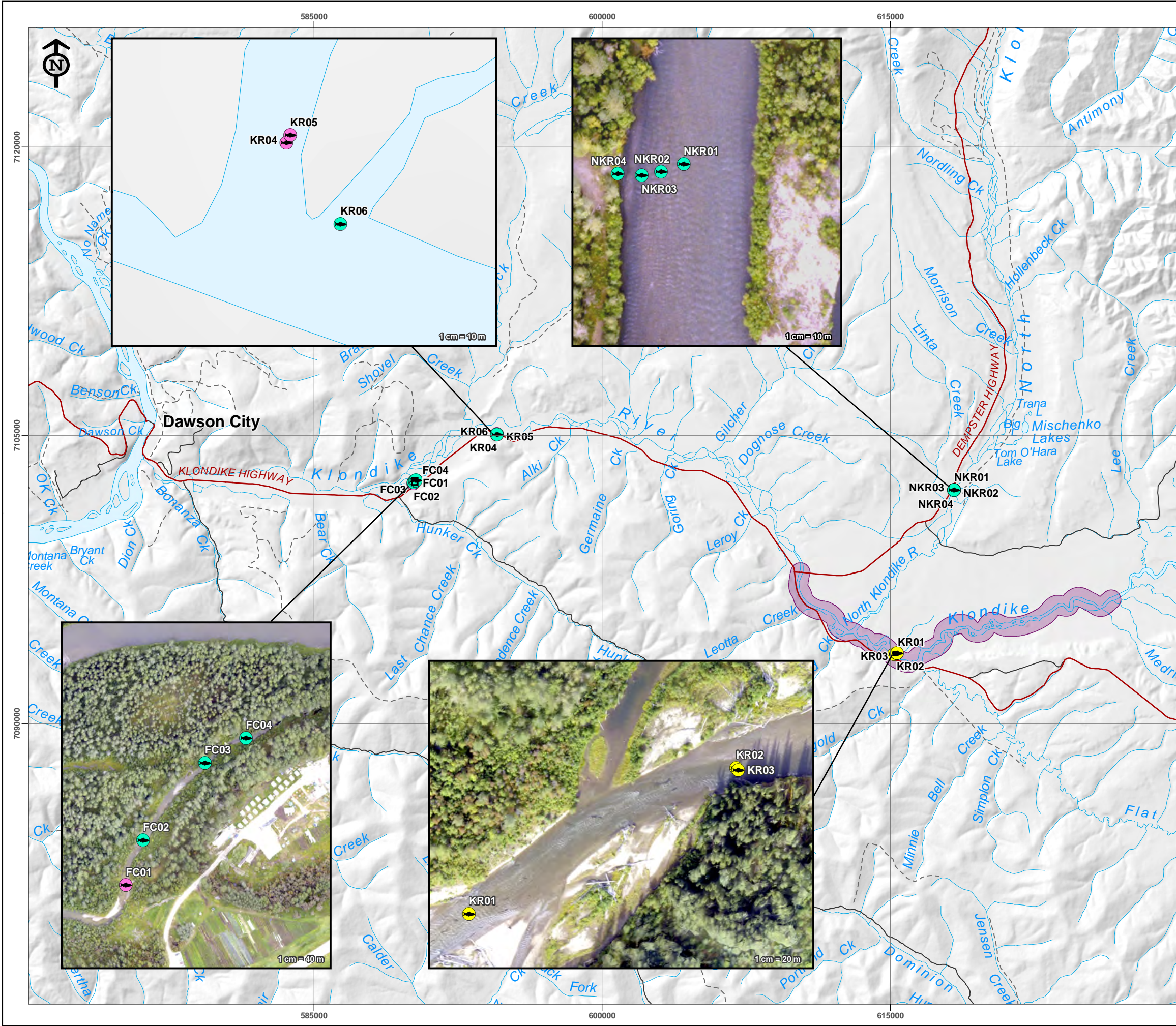
During the 2019/2020 project, a combination of previously used and newly identified sites were planted (Map 4). Where previously used sites had favourable conditions — high success rates, ease of accessibility and favorable ice conditions — new sites were clustered with the previously used site to increase the number of planting sites and number of eggs planted. In 2019, eggs were planted at 11 sites: three in the Klondike River (KR04, KR05, KR06), four in the North Klondike River (NKR01 to NKR04), and four sites in the Farm Channel (FC01 to FC04).

At all egg planting sites, cleaning of the substrate (by digging into and raking the streambed with hand tools) was required to mimic natural redd construction and to prepare each site for egg planting. No natural Chinook redds were found close to the planting sites; therefore, no natural redds were disturbed during this process. GPS co-ordinates were collected at all sites and a rock with a unique combination of colored flagging tape was placed on each prepared site to facilitate locating sites during monitoring. The final step of site preparation was to move all cleaned substrate to the sides of the deployment area between the two egg insertion pipes; eggs were then planted in this trench (Section 2.4.4).

### 2.4.2 SPOT VELOCITY MEASUREMENTS

Spot velocities were collected using a Swiffer velocity meter at representative egg planting sites at the time of egg planting. Measurements were collected at 60% of the water depth (standard for stream discharge measurements) and directly above the bed with the latter providing a more adequate representation of intra-substrate flow. This information will also be used to compare success rates of each planting site to see if there is a correlation with flow rates.





### Map 4. Brood stock collection and instream egg incubation sites in the Farm Channel, Klondike River and North Klondike River, 2019.

#### Legend

##### Egg Incubation Site

- 2018
- 2018 and 2019
- 2019

- Highway
- Secondary Road
- Trails
- Brood Stock Collection Area

0 5 10 15  
Kilometres

Map Scale = 1:200,000 (printed on 11 x 17)  
Map Projection: NAD 1983 UTM Zone 7N

**Data Sources**  
Digital Elevation Model and 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) [www.geomatics.yukon.ca](http://www.geomatics.yukon.ca).

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### 2.4.3 BROODSTOCK COLLECTION

Broodstock collection was conducted on the Klondike River from July 27 to 29, 2019. Access to the Klondike River during broodstock collection involved the use of a small jetboat and helicopter. All Chinook salmon captured were measured from mid-eye to fork and snout to fork, sexed, and sampled for scales and genetics (paired auxiliary processes); scale and genetic samples were provided to DFO for analysis. Fish not suitable for broodstock were released promptly, while those used for broodstock were temporarily placed in holding tubes/bags to allow for eggs and milt to be collected simultaneously.

---

### 2.4.4 EGG FERTILIZATION

When enough males and females were captured to conduct an egg take, each fish had its vent carefully wiped dry and the eggs or milt were collected in sterilized, dry plastic containers. Eggs were enumerated by weight to obtain an estimate of the total number collected. Eggs and milt were kept in a clean dark cooler with an ice pack to keep cool until fertilization.

Matrix spawning was used, whereby the eggs from females are separated into batches with each batch fertilized by milt from an individual male. Egg fertilization was conducted close to each egg planting site to reduce the amount of handling and transport. An umbrella was set up over the work area to provide shelter from the rain and sun during the fertilization and water hardening process. After being fertilized, the eggs were flushed clean with stream water and allowed to water harden for 20 minutes before being loaded into the various incubation media for planting in the stream.

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### 2.4.5 EGG DEPLOYMENT

Egg deployment involved a combination of three planting methods including Whitlock-Vibert boxes, closed mesh bags and egg insertion pipes. Whitlock-Vibert boxes, a commercially available incubator box, were each loaded with 200 fertilized eggs and buried in the planting site.

Two types of closed fine mesh bags were used during the 2019 project. Small mesh bags, in a half moon shape with the zipper along the outside edge, were approximately 30 cm x 15 cm. The large mesh bags, rectangular boxes in shape, were approximately 30 cm x 15 cm x 10 cm. The mesh bags mimic natural conditions and provide a surrogate for monitoring the survival of eggs planted via the egg insertion pipes, since those eggs cannot be monitored. The mesh bags are designed to evaluate the fate of all eggs and alevin, since the fine mesh bags contain all the eggs, alevin and juveniles. Both types of fine mesh bags were filled with substrate using a shovel and buried in the planting site. An egg insertion pipe was used to place a predetermined number of eggs into each bag. Once the eggs were inserted in the bag, the pipe was carefully removed, the zipper on the bag closed and the whole bag buried at the site.

One egg insertion pipe, which places eggs freely into the substrate, was used at two of the sites. Egg insertion pipes provide a more rapid method of planting eggs; however, the eggs are not contained and obtaining a quantitative estimate of survival is not possible. The number of eggs planted using the pipe was dependent upon available eggs and substrate conditions, with deeper substrate allowing for more eggs to be planted.





Using the pipe, half of the eggs were placed into the substrate at a depth of approximately 25 cm below the riverbed, with the remainder deposited 5 to 10 cm closer to the bed surface.

All incubation media were marked with a colour combination of flagging tape unique to each planting site and sketched onto a site plan to facilitate success monitoring. Once eggs had been planted at each site, previously cleaned substrate was piled into a mound to protect the eggs and mimic the construction of a natural Chinook redd.

## 2.5 SUCCESS MONITORING

Success monitoring was conducted from late September 2019 through to late April 2020. The primary objective of this monitoring was to determine egg survival and timing of development in all incubation media at each site. As well, ongoing monitoring at each site allows for measuring survival through to the emergence stage.

The timing of the success monitoring was largely determined by ice conditions on the Klondike River and varied between each group of sites. Monitoring on the Klondike and North Klondike rivers took place between October 3, 2019, and April 30, 2020. The four sites in the Farm Channel were monitored the most frequently due to the ease of access and lack of ice throughout the winter. Monitoring of these sites occurred between September 29, 2019, and April 23, 2020.

At all sites, the Whitlock-Vibert boxes were retrieved to obtain a measure of hatching success whereas the closed mesh bags were used to determine emergence success. The initial plan was to leave the closed mesh bags in place through to the emergence period; however, the rate of development indicated that this would occur after freshet. The Klondike River is known to experience a very strong freshet, and it was unlikely that the incubation media in the main channel or large side channel sites of the Klondike River would remain in place through high spring flows. Therefore, all incubation media in the Klondike River sites were retrieved before freshet occurred (April 30, 2020).

Upon retrieval of the Whitlock-Vibert boxes, the contents were photographed and examined to determine survival. Obtaining an accurate measure of survival is dependent on being able to get an accurate count of the remaining dead eggs. Alevin are able to exit the incubator; therefore, an accurate count of dead eggs is the best estimate of survival to the alevin (hatching) stage. The closed mesh bags better represent survival to fry emergence, because alevin are unable to exit the bags. Following enumeration, any live alevin in the incubation media were released into the river substrate by excavating a small hollow in the streambed and allowing the alevin to burrow into the gravel. This was the case at all sites except in the Farm Channel, where a portion of the alevin retrieved were placed into a second closed mesh bag for more regular development monitoring in combination with site visits by school groups and community members.



### 3 RESULTS AND DISCUSSION

#### 3.1 WATER TEMPERATURE MONITORING

Water temperature loggers were buried in the substrate at 6 representative sites of the 11 egg planting sites, either placed in the closed mesh bag or attached to rebar pounded into the stream bed. The water temperature trends at sites FC01, FC03 and NKR04 are typical of areas influenced by groundwater. The temperature at these sites was colder during the summer than in areas dominated by surface flow; this pattern reversed during the fall and winter (Figure 1). Site KR06, located in a small groundwater seep, does not follow the same pattern; although it is groundwater influenced, it was the warmest site during planting and remained above 0°C during the winter months. The remaining sites were in areas dominated by surface flows and generally showed a cooling trend during the late summer and fall to temperatures very near freezing over the winter months. The temperature loggers deployed at sites KR04 and KR05 could not be retrieved; however, data from a nearby temperature logger in the mainstem Klondike River is presented as a surrogate for these sites. This surrogate logger is located approximately 5 km upstream of the egg planting sites and with no substantial tributary inputs within this area; therefore, the temperature regime differences between these two areas is expected to be minimal.

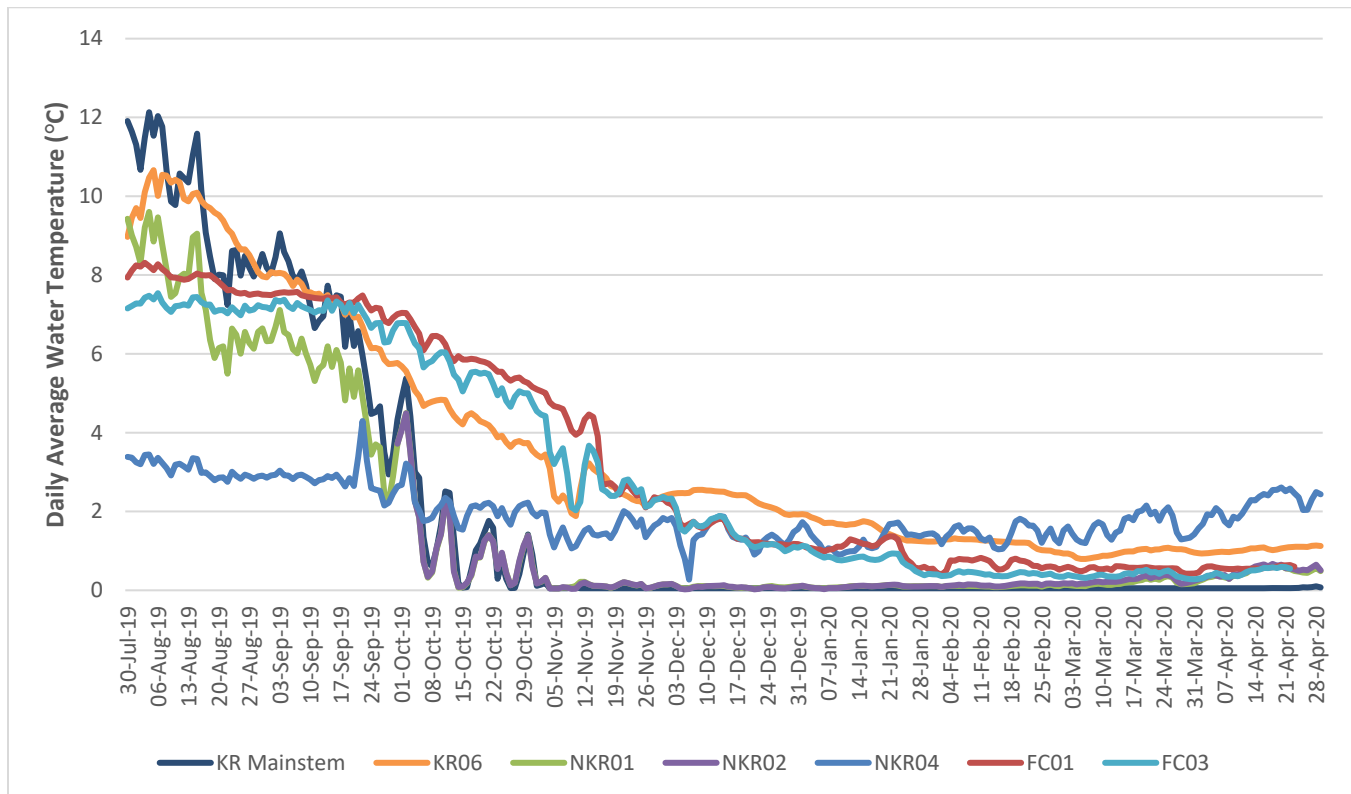


Figure 1. Daily average surface water temperature from representative egg planting sites in the Farm Channel, Klondike and North Klondike rivers from July 30, 2019, through to April 29, 2020.



### 3.2 JUVENILE MONITORING

The juvenile Chinook sampling event in July 2019 captured 295 fish of three species, with juvenile Chinook making up the bulk of captures (n=264; 89%; Table 1; Appendix B). Minnow trapping was the only sampling method used with no dipnetting taking place during the 2019 juvenile monitoring.

No juvenile Chinook were captured in the Farm Channel during sampling (Map 5); in contrast, 142 Chinook juveniles were captured in the Farm Channel during the July 23, 2018 sampling event. The lower number captured in 2019 may have been due to the low dissolved oxygen in the channel at the time of sampling, which averaged 6.3 mg/L. Water levels in the Klondike River were relatively low during this sampling event and may have contributed to the low dissolved oxygen levels and lack of juvenile Chinook captured in the channel.

Fork lengths for juvenile Chinook captured in 2019 ranged from 48 to 68 mm with an average of 59 mm (n=105, Figure 2). Weights for the sampled juvenile Chinook ranged from 1.4 to 3.8 grams and average 2.6 grams (n=105). This is consistent with the 2018 monitoring results when juvenile Chinook averaged 2.7 grams and ranged from 1.3 to 4.7 grams (EDI Environmental Dynamics Inc. 2019a).

**Table 1. Summary of juvenile Chinook minnow trap sampling and catch per unit effort (CPUE) in the Farm Channel and Klondike River mainstem in July 2019.**

Sampling Area	Number of Sites Sampled	Number of Traps Set	Species	Average CPUE (per 12 hours)	Total Captured
Farm Channel	3	9	NFC <sup>A</sup>	0	0
Klondike River	5	15	Chinook salmon	9.5	264
			slimy sculpin	1.1	30
			burbot	0.03	1

<sup>A</sup> NFC: no fish captured

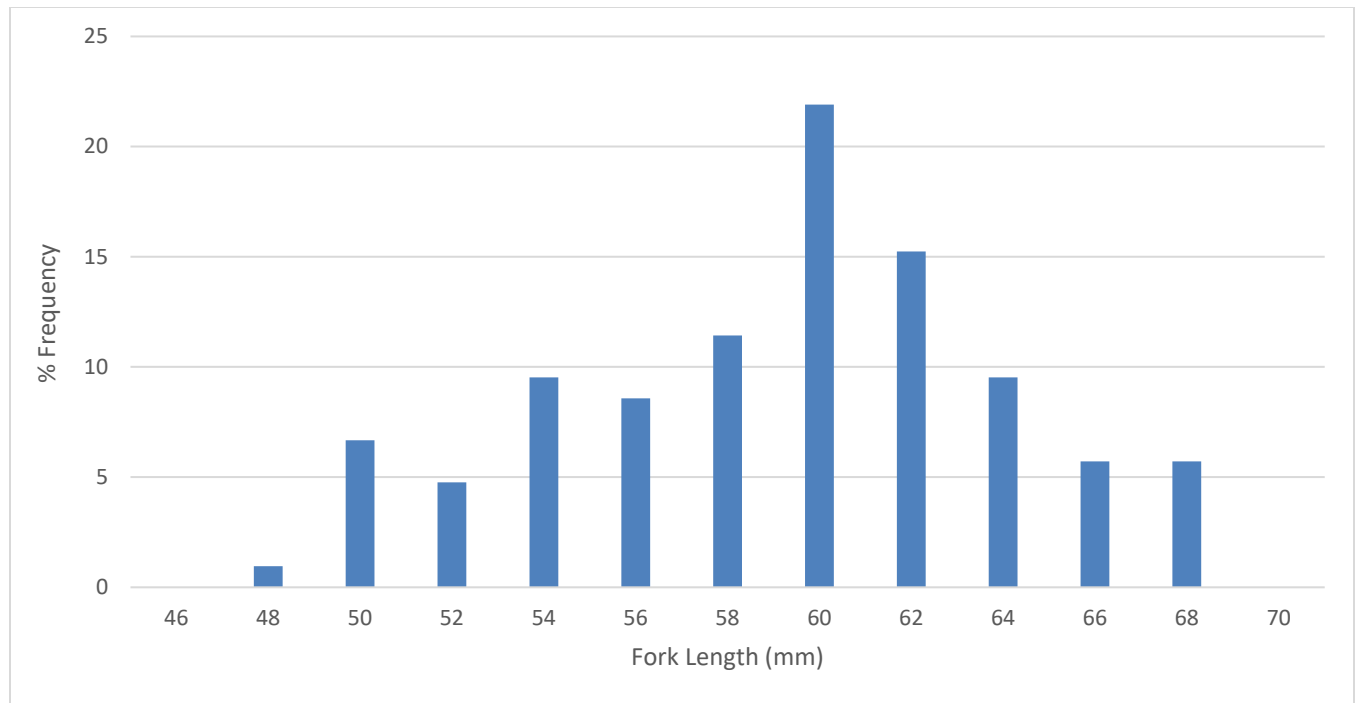
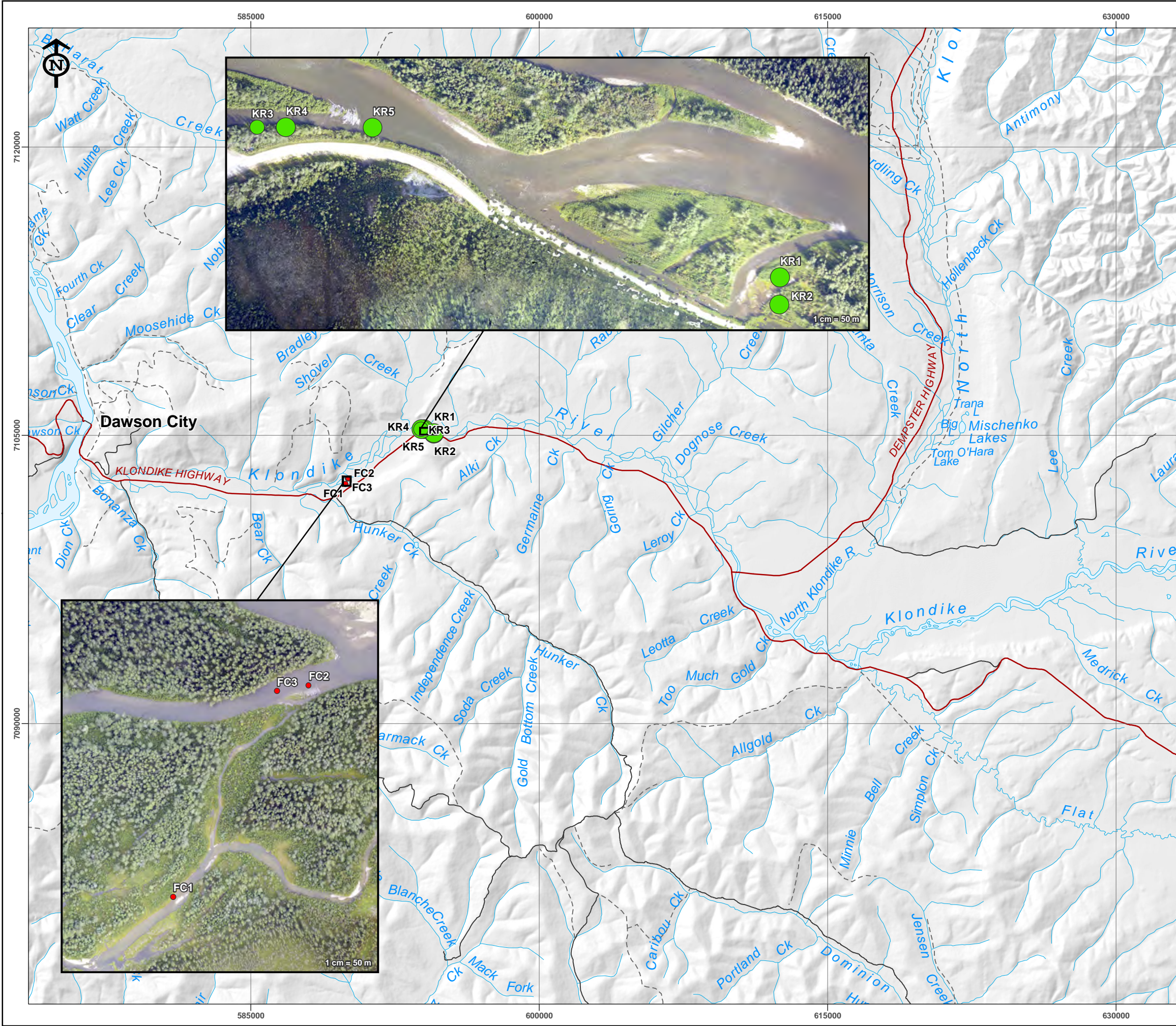


Figure 2. Klondike River juvenile Chinook fork length frequencies from July 2019 (n=105).





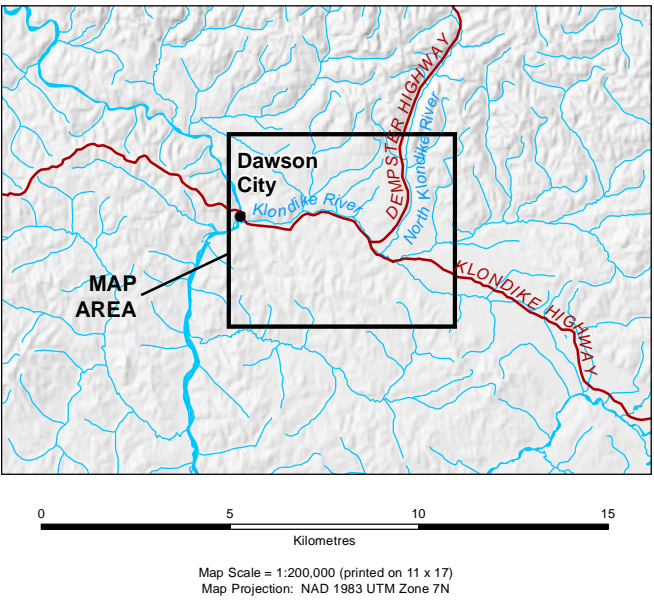
Map 5. Juvenile Chinook monitoring results in the Klondike River

**Legend**

— Highway  
— Secondary Road  
- - - Trails

**Juvenile Chinook Monitoring Results**  
CPUE (fish per 12 hours)

● 0  
● 0 - 1  
● 1 - 5  
● 5 - 20  
● > 20



**Data Sources**  
1:250,000 and 1:1,000,000 Topographic: Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:250,000 and 1:1,000,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) [www.geomaticsyukon.ca](http://www.geomaticsyukon.ca).

Project data is site specific. Survey data collected by EDI Environmental Dynamics Inc., 2019. Locations obtained using Garmin GPS technology.

Aerial imagery provided by Great River Air. (Collected August 8 - 10, 2018).

**Disclaimer**  
EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

Drawn: CT	Checked: BSc	Date: 2020-07-06
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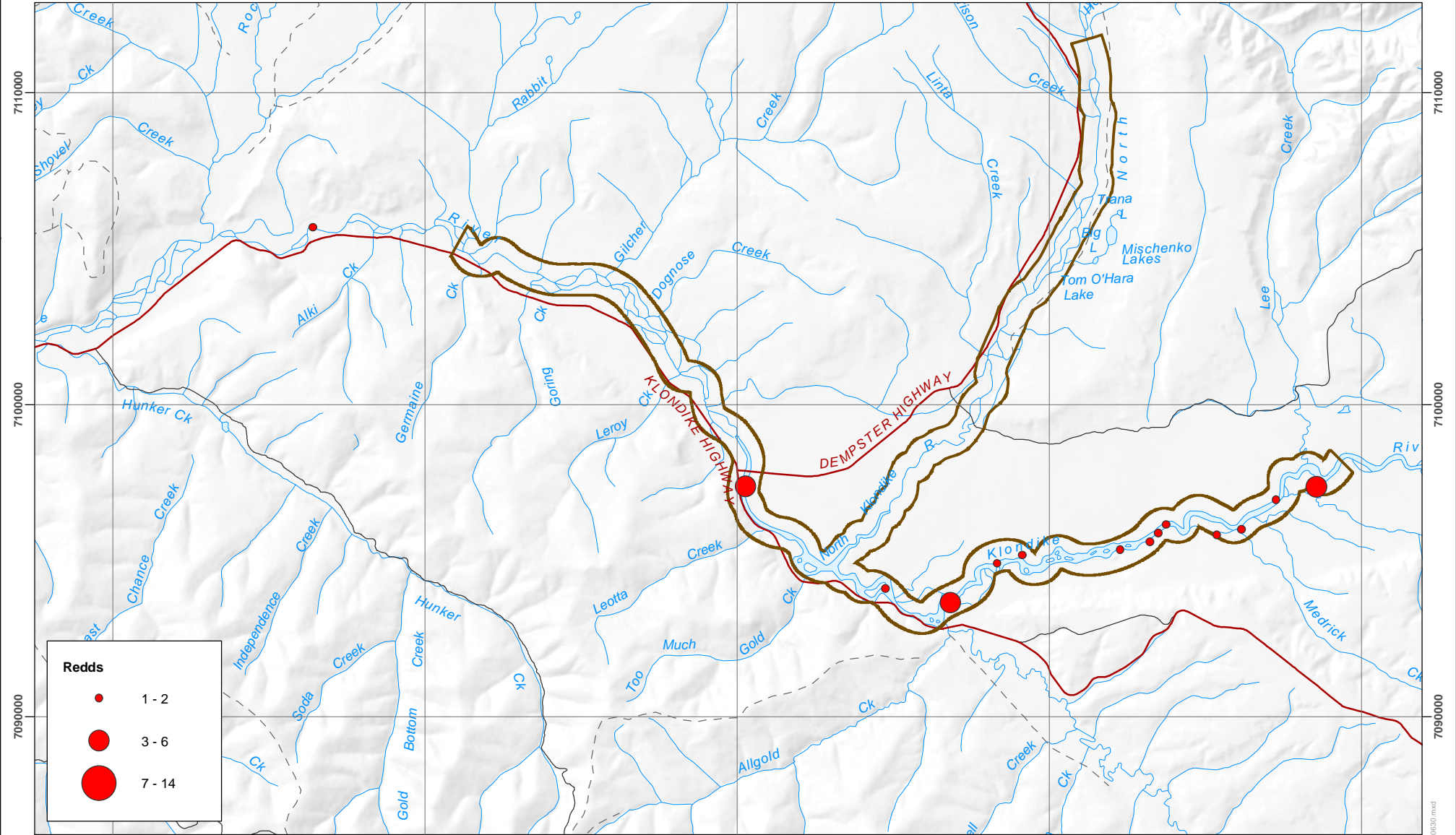
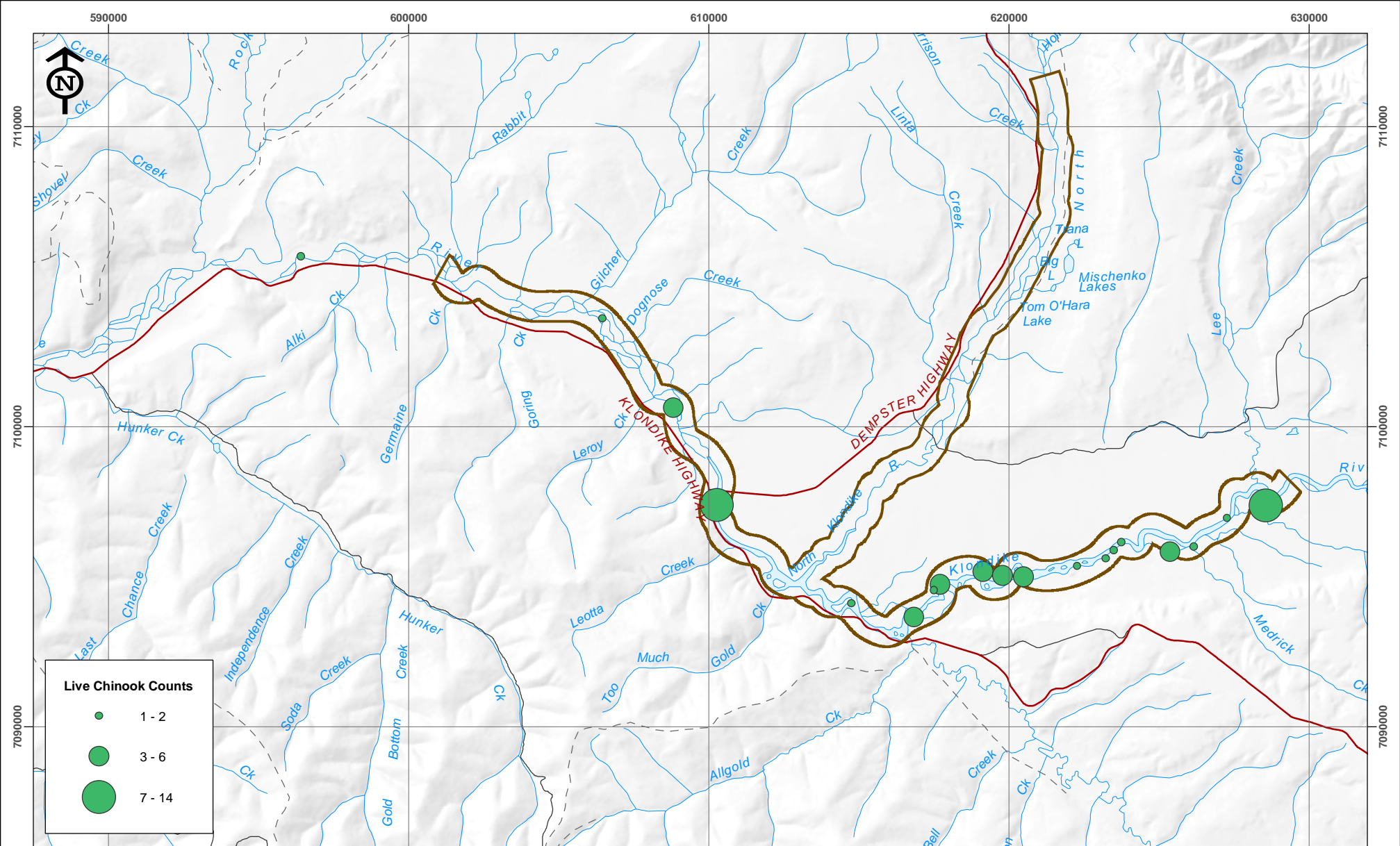




### 3.3 AERIAL SURVEY FOR SPAWNING CHINOOK

During the aerial survey for spawning Chinook conducted on July 25, 2019, observers recorded 23 Chinook redds and 68 Chinook spawners. Survey conditions were very good with clear skies, high visibility and relatively low flows (see photos in Appendix A). No Chinook salmon or redds were observed in the North Klondike River. Live Chinook and redds were observed on the Klondike River with the highest numbers documented in the upper portion of the survey area between the confluences of All Gold and Lee creeks (Map 5). A large cluster of 13 Chinook salmon was observed just upstream of the Dempster Highway bridge.

A survey on August 23, 2019, counted 52 redds and no spawners in the Klondike River, and five redds and no spawners in the North Klondike. This survey was timed with the end of the run to estimate the total number of redds (EDI Environmental Dynamics Inc. 2020a). Based on the condition of the fish and the number of fish and redds observed, the 2019 Klondike River Chinook salmon run appeared to be low in terms of numbers of spawning fish compared to previous years.



**Legend**

—

 Highway

—

 Secondary Road

- - -

 Trail

Aerial Survey Extent

**Map 6. Chinook spawning aerial survey results**

Data Sources  
1:250,000 and 1:1,000,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:250,000 and 1:1,000,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) [www.geomaticsyukon.ca](http://www.geomaticsyukon.ca).

Project data is site specific. Survey data collected by EDI Environmental Dynamics Inc., 2019. Locations obtained using Garmin GPS technology.

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0

2

4

6

8

10

Kilometres

Map Scale 1:175,000 (printed on 11 x 17)

Map Projection: NAD 1983 CSRS UTM Zone 7N

Drawn: CT

Checked: BSc

Date: 2020-07-06

**MAP AREA**



### 3.4 INSTREAM EGG INCUBATION

#### 3.4.1 SITE PREPARATION

The preparation of the 11 egg planting sites required two days to complete. The river substrate at all of the sites was found to be loosely compacted and was relatively straightforward to prepare for egg planting.

#### 3.4.2 SPOT VELOCITY MEASUREMENTS

Spot velocities were collected at all but two egg planting sites in the Klondike River. Two areas of the water column were measured for water velocity: just above the substrate (best indication of intra-substrate flow) and at 60% of the total water depth. Velocities at 60% of the water column ranged from 0.88 m/s to 1.00 m/s with an average of 0.94 m/s in the main channel Klondike River and North Klondike River (Table 2). The Farm Channel had considerably less flow, which ranged from 0.02 m/s to 0.09 m/s with an average of 0.05 m/s at 60% of the total water depth (Table 2).

**Table 2. Spot velocity measurements collected at planting sites using a Swoffer velocimeter, July 29, 2019.**

Site	Site Depth (m)	Velocity just above bed (m/s)	Velocity at 60% depth (m/s)
FC01	0.17	-	0.09
FC02	0.15	-	0.04
FC03	0.21	-	0.02
FC04	0.12	-	0.05
KR04	0.42	0.60	0.90
KR05	0.45	0.67	0.93
KR06	-	-	-
NKR01	0.55	0.64	1.00
NKR02	0.41	0.39	0.88
NKR03	0.52	0.68	0.99
NKR04	-	-	-





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### 3.4.3 BROODSTOCK COLLECTION

Seventeen adult Chinook were captured during broodstock collection. The individuals captured ranged from spent to ripe enough for the collection of eggs or milt. Most of the females captured were spent; locating suitable broodstock in 2019 proved to be very challenging. A helicopter was used on July 29 to access a group of spawners that had been observed upstream of the jet boat access during the aerial survey. Three spent females were captured in this area and a single large ripe female was captured which provided eggs for planting. In addition to the eggs collected from the ripe female (7,294), a smaller number of eggs (563) were collected from four mostly spent females (112, 285, 13, and 153 eggs). Milt was collected from a total of seven males, with five males used to fertilize the large female in small batches and two to three males used for fertilization of each small batch of eggs from the spent females.

Age, sex, and length data along with genetic samples were collected from 16 of the captured Chinook and were provided to DFO for analysis. Scale samples were analyzed by the Pacific Biological Station (PBS); results indicated that most of the captured Chinook were six year old fish (brood year 2013). Four Chinook were aged at five years (brood year 2015); a single fish was aged four years old (brood year 2015); and one at three years old (brood year 2016). Four samples could not be aged properly and are therefore excluded here. Of the Chinook salmon sampled during broodstock collection, nine were females and eight were males. Fork lengths ranged from 590 to 1130 mm with an average of 879 mm. Average fork length for females was larger at 989 mm compared to 755 mm for males.

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### 3.4.4 EGG FERTILIZATION AND DEPLOYMENT

Eggs were planted in the Farm Channel, Klondike and North Klondike rivers on July 29, 2019, using three methods: Whitlock-Vibert boxes to determine hatching success, closed mesh bags (insertion pipe in a bag) to determine emergence success, and egg insertion pipes to provide a means of planting extra eggs (Table 3). A total of 7,857 eggs were planted at the 11 sites with most of the eggs planted in Whitlock-Vibert boxes.

**Table 3. Summary of 2019 egg planting in the Klondike River.**

Area	Site	Whitlock-Vibert Box							Mesh Bag		Egg Insertion Pipe	Total
		1	2	3	4	5	6	7	1 <sup>A</sup>	2 <sup>B</sup>	1	
North Klondike River	NKR01	200	200						204			604
	NKR02	200	200						200			600
	NKR03	200	200						200			600
	NKR04								200			200
Klondike River (Rock Creek area)	KR04	200	200						200	200	125	925
	KR05	200	200						200	200	375	1,175
	KR06	200							165			365
Klondike River Farm Channel	FC01	112	285	13	153	200	200	127	199	200		1,489
	FC02	200	200						213			613
	FC03	200	200						241			641
	FC04	200	200						245			645
<b>Total</b>		<b>4,490</b>							<b>2,867</b>		<b>500</b>	<b>7,857</b>

<sup>A</sup> Small, half moon mesh bag.<sup>B</sup> Larger, rectangular mesh bag.

### 3.4.5 SUCCESS MONITORING

The success monitoring component of the project was completed in stages due to varying site conditions (ice) and temperature regimes (which inform appropriate monitoring event timing). The primary goal of the monitoring was to determine the egg hatching rate among sites, determine survival through to the fry emergence stage, and determine the rate of development.

#### 3.4.5.1 Hatching Success

Hatching success was highly variable between and within sites, ranging from complete failure to 95% success. The North Klondike River had the highest mean hatching success with 78.2%, followed by the Klondike River with 44.5% and the Farm Channel with 10% (Table 4).

Sites in the Farm Channel had the poorest hatching success, ranging from 0 to 32% (Table 4). During the monitoring trip on September 29, 2019, the site conditions in the channel had changed since the time of planting. At the lower flows observed during monitoring, a small log upstream of sites FC01 had diverted water around the two planting sites, allowing sediment to settle on the sites and water flow to be reduced. As a result, site FC01 had no hatching success. One of the Whitlock-Vibert (WVB) boxes planted at FC02 was removed during monitoring and the eggs were planted in a classroom aquarium. When the FC02 WVB box was removed from the Farm Channel, there was a 98% survival rate to the eyed egg stage. Site FC03 had the highest hatching success in the Farm Channel, with 32% and 23% hatching success in the two WVB planted. Site FC04 had 0% and 2.5% success.



Sites in the Klondike River had variable hatching success, ranging from 16 to 92.5% (Table 4). Specifically, site KR04 had hatching successes of 16% and 33.5%, while site KR05 had successes of 36% and 92.5%.

The sites on the North Klondike River had the highest hatching success across all sites. Hatching success ranged from 19% to 95%, with five of the six WVB having over 80% hatching success. Site NKR01 had the highest variability within a site with 19% and 81% hatching success in the two WVB planted. Sites NKR02 and NKR03 had less variability with 86.5% and 93% hatching success, and 94.5% and 95%, respectively.

Note that a small number of eggs were planted in small groundwater seeps near the Rock Creek (KR06) and North Klondike (NKR04) egg planting sites. Both of these sites had no measurable hatching success and are excluded from Table 4.

**Table 4. Summary of hatching success in Whitlock-Vibert boxes and closed mesh bags in the Klondike and North Klondike rivers.**

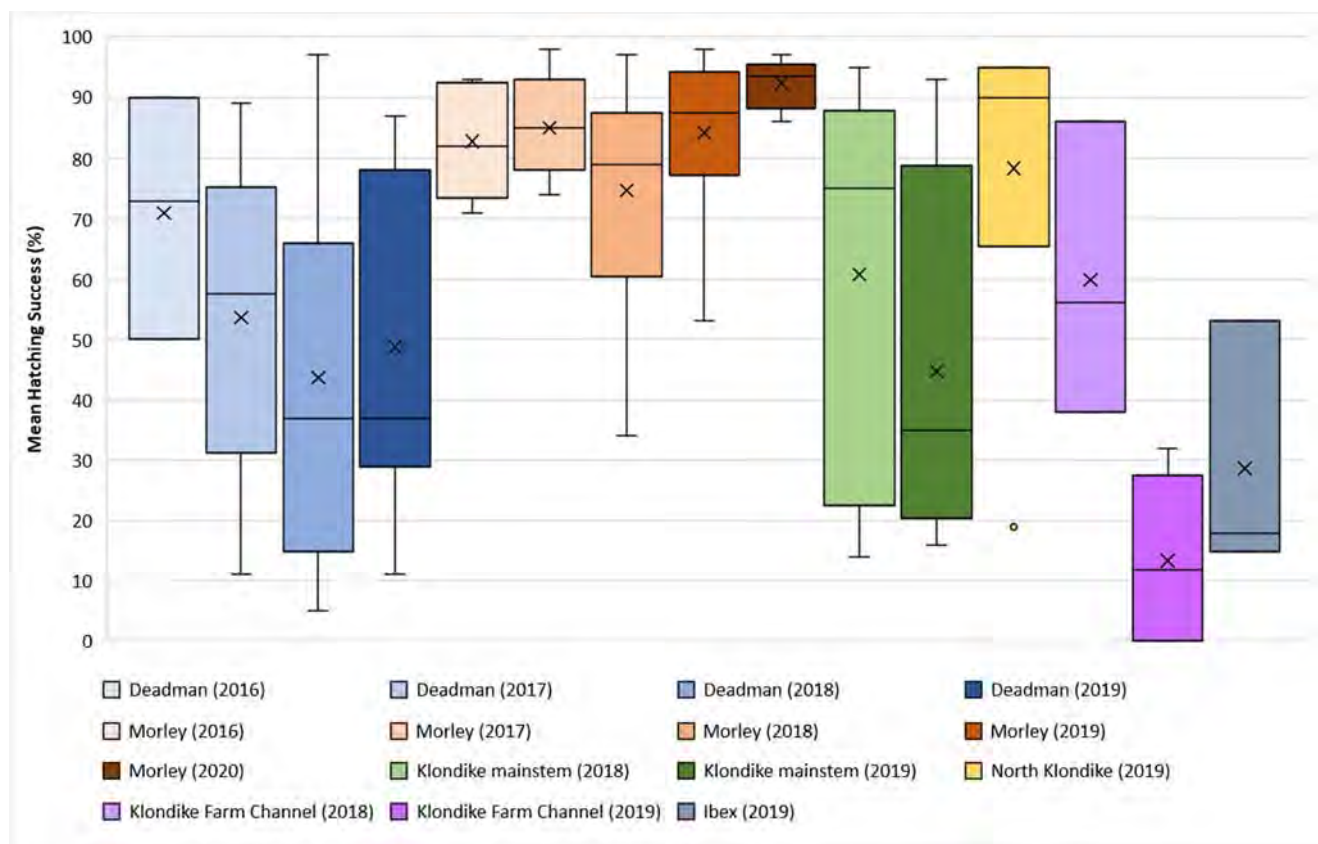
Site	Incubation Type <sup>A</sup>	Number of Eggs Planted	Inferred Hatching Success <sup>B</sup> (%)
FC01	Small Bag	199	0
	Small Bag	200	0
FC02	WVB	200	11.5
FC03	WVB	200	32.0
	WVB	200	23.0
FC04	WVB	200	0.0
	WVB	200	2.5
KR04	WVB	200	16.0
	WVB	200	33.5
KR05	WVB	200	36.0
	WVB	200	92.5
NKR01	WVB	200	81.0
	WVB	200	19.0
NKR02	WVB	200	86.5
	WVB	200	93.0
NKR03	WVB	200	94.5
	WVB	200	95.0

<sup>A</sup> WVB – Whitlock-Vibert box; Bag – closed mesh bag.

<sup>B</sup> Inferred hatching success assumes that any eggs not accounted for (live/dead eggs and live/dead alevin remaining in the box) successfully hatched and exited the WVB incubator.

The hatching success data on the Klondike River can be compared with data collected using consistent methods in the Teslin River (Deadman Creek, Morley River) and Takhini River (Ibex River) watersheds (Figure 3)<sup>1</sup>. Hatching success in the Klondike River mainstem was generally more variable than the other systems and can be viewed as intermediate compared to Morley River and Deadman Creek. Based on a limited amount of data, hatching success in the North Klondike River was relatively high compared to the other systems and similar to the Morley River, which was considered to be very good.

Conditions between the Klondike, North Klondike and Morley rivers are very different. Conditions in Morley River are known to be very good for incubation due to the river's location directly downstream of Morley Lake. This lake effect results in relatively little sediment transport as well as relatively warm water throughout the year, which limits ice coverage. Such conditions do not occur on the Klondike River and North Klondike River. In future years, ongoing data collection on egg survival in other systems will be provide continued comparisons such as those presented here.



**Figure 3.** Summary of egg hatching success data collected in the Klondike River watershed during 2019/2020 as compared to consistently collected data in the Teslin River (EDI Environmental Dynamics Inc. 2017, 2018b, 2019c, 2020b, c) and Takhini River (EDI Environmental Dynamics Inc. 2020d) watersheds.

<sup>1</sup> Boxplots are useful because they provide information about the distribution of the data. The 'X' indicates the mean value, the thick black bar indicates the median value and the box indicates the range between the first and third quartiles. The lines extending above and below the box show the extent of values within a maximum of 1.5 times the interquartile range above and below the first and third quartile. The interquartile range represents the middle 50% of the data, so 25% is above the third quartile and 25% is below the first quartile. Outliers are represented by a circle outside of the interquartile range.



### 3.4.5.2 Emergence Success

Conditions with the closed mesh bags are expected to provide a more accurate representation of egg survival over the Whitlock-Vibert boxes because the latter provides an artificial, less natural egg incubation media. Despite difficulties with planting large numbers of closed mesh bags, this metric is preferred for determining egg survival given that it closely replicates natural egg incubation conditions.

Emergence success was variable across all sites ranging from 0% to 80% emergence success. Sites at the North Klondike River had the highest emergence success (66.4%), followed by the Klondike River with 32.5%, and the Farm Channel with 26.3% (Table 5).

Emergence success at sites in the Farm Channel was similar to hatching success. Site FC02 had the lowest emergence success (15%) and Site FC03 had the highest emergence success (33.2%). Although Site FC04 had poor hatching success in the two WVB, the small bag had an emergence success of 30.6%.

Sites at the Klondike River had variable emergence success. At site KR04, the small bag had 0.5% emergence success and the large bag had no emergence. Conversely, KR05 had higher emergence success with 49.5% in the large bag and 80% in the small bag.

The emergence at the North Klondike River sites were relatively consistent across the three sites. Site NKR01 had an emergence success of 62.3%. Site NKR02 had the lowest success rate (60.5%), while site NKR03 had the highest success rate at 76.5%.

**Table 5. Summary of emergence success in the closed mesh bags in the Klondike and North Klondike rivers.**

Site	Incubation Type <sup>A</sup>	Number of Eggs Planted	Emergence Success
FC02	Small Bag	213	15.0
FC03	Small Bag	241	33.2
FC04	Small Bag	245	30.6
KR04	Small Bag	200	0.5
	Large Bag	200	0.0
KR05	Small Bag	200	80.0
	Large Bag	200	49.5
NKR01	Small Bag	204	62.3
NKR02	Small Bag	200	60.5
NKR03	Large Bag	200	76.5

<sup>A</sup> Bag – closed mesh bag.

### 3.4.5.3 Development Rates

Success monitoring provides an opportunity to assess the rate of egg and alevin development in comparison to the water temperature regime at each of the egg planting sites (see Appendix A for the various development stages across planting sites). Based on data from the Whitehorse Rapids Fish Hatchery, Yukon River Chinook typically hatch into alevin at 480 to 540 accumulated thermal units (ATUs) and emerge as fry at 900 to 1,000





ATUs (Alexco 2017). Results from the Deadman Creek Chinook Restoration Project in the Teslin River watershed (EDI 2017, 2018, 2019) have indicated that at near freezing water temperatures (below 1.6°C) there is base rate development; therefore, hatching and particularly fry emergence can occur at far fewer ATUs than in a hatchery setting. Data from the site visits on the Klondike River can be compared to the development rates observed in Deadman Creek to help inform TH's plans for an incubation facility on the Klondike River.

During the site visit on November 18, 2019, to the Farm Channel, the water temperature measured at the site was 2.4°C and most eggs appeared to be recently hatched at 679 ATUs. During the April 23, 2020, site visit, the water temperature was 0.6°C and the alevin appeared to be consistent with what published ATU data would suggest (Alexco 2017; 896 ATUs).

Site visits to the Klondike River main channel sites were not as frequent as to the Farm Channel due to more challenging ice conditions and site accessibility. However, hatching at site KR05 appeared to happen around approximately October 3, 2020, as indicated by the presence of recently hatched alevin observed during the monitoring trip. On April 27, 2020, advanced emergent fry were observed at 573 ATUs; this stage of development was advanced beyond what would be expected based upon the ATUs. The application of the 1.6 °C base rate development determined at Deadman Creek (EDI 2017, 2018, 2019) would result in an ATU equivalent of 873, which appears to correlate well with the stage of development observed.

Like the Klondike River, the North Klondike River sites were not monitored as frequently due to site accessibility. During the site visit on November 17, 2020, the water temperature was measured at 0.4°C and hatching appear to be just beginning at 444 ATUs. During the last monitoring trip on April 30, 2020, the water temperature was 2.4°C and crews observed alevin at 473 ATUs. This stage of development was advanced beyond what would be expected based upon the ATUs. The application of the 1.6 °C base rate development determined at Deadman Creek (EDI 2017, 2018, 2019) would result in an ATU equivalent of 751, which appears to correlate well with the stage of development observed.



## 4 CONCLUSION

This project provided information on the merits of instream egg incubation and provided new information on the timing of development for incubating eggs and alevin. Although the egg survival results obtained were variable within and between sites, a number of sites had hatching success values above 80%. Valuable lessons were learned during Year 2 of the project and will be used to better plan and execute future years of the project. An important component of future projects will be to select egg planting sites which are conducive to the monitoring of egg development and survival through to the fry emergence stage with an emphasis on main channel sites. Conducting such assessments in different habitats with varying water temperature regimes will help to further refine the knowledge of development timing gained during the project and will help to further TH's goal of a larger scale restoration project on the Klondike River in the future.



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# APPENDICES





## APPENDIX A      PHOTOGRAPHS

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Appendix Photo 1. Upstream view of the Farm Channel, July 29, 2019.



Appendix Photo 2. Juvenile Chinook monitoring in the Klondike River, July 4, 2019.





Appendix Photo 3. Juvenile Chinook captured in the Klondike River, July 4, 2019.



Appendix Photo 4. Survey conditions during the July 26, 2019 aerial survey with three visible Chinook redds.



Appendix Photo 5. Age, sex and length (ASL) data collection from Klondike River broodstock.



Appendix Photo 6. Collecting milt from Klondike River Chinook.





Appendix Photo 7. Egg take from Klondike River Chinook.



Appendix Photo 8. Enumerating eggs prior to planting.

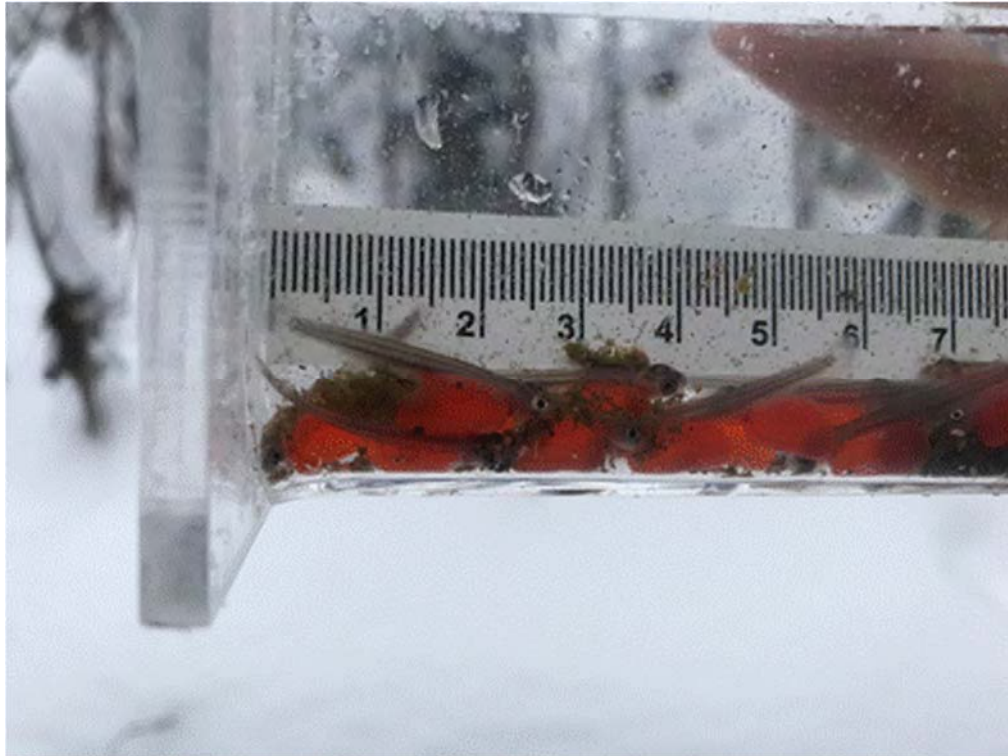


Appendix Photo 9. Fertilizing eggs (left) prior to planting in the Klondike River.



Appendix Photo 10. Alevin in the Farm Channel November 18, 2019, at 679 ATUs.





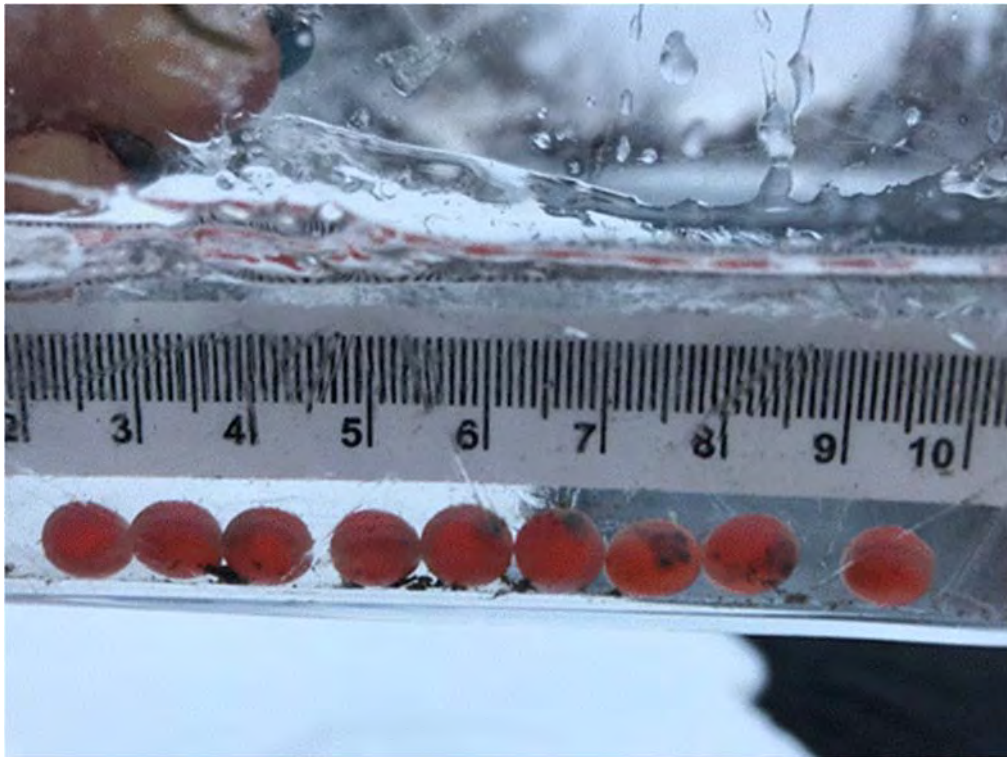
Appendix Photo 11. Alevin from the Farm Channel on November 21, 2019, at 687 ATUs.



Appendix Photo 12. Advanced alevin at site KR04 on April 27, 2020, at 573 ATUs.



Appendix Photo 13. Site conditions at site KR04, KR05 and KR06 on April 30, 2020.



Appendix Photo 14. Advanced eyed eggs from the North Klondike River on November 18, 2019, at 444 ATUs.



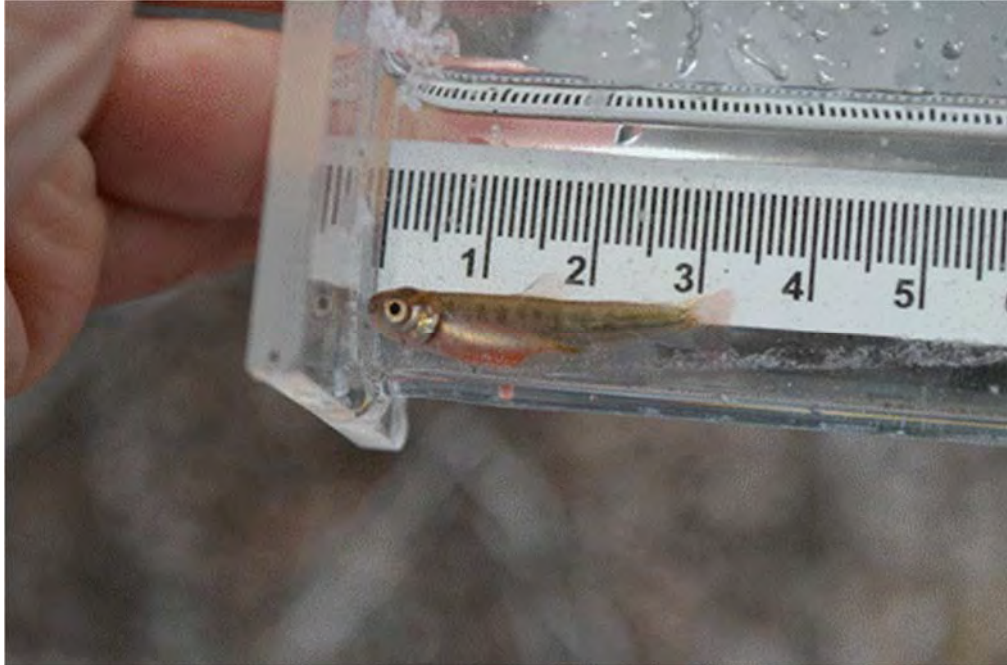


Appendix Photo 15. Site conditions in the North Klondike River on April 30, 2020, site NKR04 shown by blue flagging on the lower right.



Appendix Photo 16. Alevin from the North Klondike River on April 30, 2020, at 473 ATUs.





Appendix Photo 17. Advanced alevin from the North Klondike River sites on April 30, 2020, at 473 ATUs.



## **APPENDIX B      FISH SAMPLING DATA**

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Appendix Table B-1. Summary of fish sampling effort.

Site ID	Set Date & Time	Pull Date & Time	Temp (°C)	Dissolved Oxygen (mg/L)	Effort (hours)
FC3.1	2019-07-03 12:25	2019-07-04 9:45	5.9	6.28	21.33
FC3.2	2019-07-03 12:25	2019-07-04 9:45	5.9	6.28	21.33
FC3.3	2019-07-03 12:25	2019-07-04 9:45	5.9	6.28	21.33
FC2.1	2019-07-03 11:40	2019-07-04 9:55	5.9	6.28	22.25
FC2.2	2019-07-03 11:40	2019-07-04 9:55	5.9	6.28	22.25
FC2.3	2019-07-03 11:40	2019-07-04 9:55	5.9	6.28	22.25
FC1.1	2019-07-03 11:20	2019-07-04 10:05	5.9	6.28	22.75
FC1.2	2019-07-03 11:20	2019-07-04 10:05	5.9	6.28	22.75
FC1.3	2019-07-03 11:20	2019-07-04 10:05	5.9	6.28	22.75
KR1.1	2019-07-03 12:00	2019-07-04 10:10	12.7	10.29	22.17
KR1.2	2019-07-03 12:00	2019-07-04 10:10	12.7	10.29	22.17
KR1.3	2019-07-03 12:00	2019-07-04 10:10	12.7	10.29	22.17
KR2.1	2019-07-03 14:00	2019-07-04 11:20	12.8	10.25	21.33
KR2.2	2019-07-03 14:00	2019-07-04 11:20	12.8	10.25	21.33
KR2.3	2019-07-03 14:00	2019-07-04 11:20	12.8	10.25	21.33
KR3.1	2019-07-03 13:30	2019-07-04 12:00	12.8	10.25	22.50
KR3.2	2019-07-03 13:30	2019-07-04 12:00	12.8	10.25	22.50
KR3.3	2019-07-03 13:30	2019-07-04 12:00	12.8	10.25	22.50
KR4.1	2019-07-03 14:25	2019-07-04 12:30	12.8	10.25	22.08
KR4.2	2019-07-03 14:25	2019-07-04 12:30	12.8	10.25	22.08
KR4.3	2019-07-03 14:25	2019-07-04 12:30	12.8	10.25	22.08
KR5.1	2019-07-03 14:10	2019-07-04 13:20	12.8	10.25	23.17
KR5.2	2019-07-03 14:10	2019-07-04 13:20	12.8	10.25	23.17
KR5.3	2019-07-03 14:10	2019-07-04 13:20	12.8	10.25	23.17



Appendix Table B-2. Summary of fish capture data.

Site ID	Species	Fork Length (mm)	Weight (g)	Release condition
KR1.1	CH	60	2.1	Released Good
KR1.1	CH	65	2.6	Released Good
KR1.1	CH	62	2.3	Released Good
KR1.1	CH	55	1.8	Released Good
KR1.1	CH	53	1.6	Released Good
KR1.1	CH	63	2.8	Released Good
KR1.1	CH	60	2.7	Released Good
KR1.1	CH	66	3.2	Released Good
KR1.1	CH	68	3.4	Released Good
KR1.1	CH	62	3.3	Released Good
KR1.1	CH	-	-	Released Good
KR1.1	CCG	90	-	Released Good
KR1.3	CH	62	2.7	Released Good
KR1.3	CH	59	2.9	Released Good
KR1.3	CH	60	2.3	Released Good
KR1.3	CH	60	2.4	Released Good
KR1.3	CH	60	1.9	Released Good
KR1.3	CH	63	2.8	Released Good
KR1.3	CH	67	3.1	Released Good
KR1.3	CH	55	1.7	Released Good
KR1.3	CH	65	2.9	Released Good
KR1.3	CH	65	2.5	Released Good
KR1.3	CH	-	-	Released Good
KR2.1	CH	54	2.6	Released Good
KR2.1	CH	53	2.5	Released Good
KR2.1	CCG	70	-	Released Good
KR2.1	CCG	61	-	Released Good
KR2.2	BB	160	-	Released Good



Site ID	Species	Fork Length (mm)	Weight (g)	Release condition
KR2.2	CH	61	2.6	Released Good
KR2.2	CH	63	3	Released Good
KR2.2	CH	64	3.7	Released Good
KR2.2	CH	62	2.7	Released Good
KR2.2	CCG	84	-	Released Good
KR2.3	CH	61	2.7	Released Good
KR2.3	CH	64	3.4	Released Good
KR2.3	CH	55	3.4	Released Good
KR2.3	CH	55	2.2	Released Good
KR2.3	CH	57	2.6	Released Good
KR2.3	CH	53	2.2	Released Good
KR2.3	CH	59	2.9	Released Good
KR2.3	CH	57	2.6	Released Good
KR2.3	CH	62	2.8	Released Good
KR2.3	CH	51	2.3	Released Good
KR2.3	CCG	55	-	Released Good
KR2.3	CCG	66	-	Released Good
KR2.3	CH	-	-	Released Good
KR3.1	CH	64	3.4	Released Good
KR3.1	CH	59	2.7	Released Good
KR3.1	CH	60	3.4	Released Good
KR3.1	CH	58	2.6	Released Good
KR3.1	CH	67	3.6	Released Good
KR3.1	CH	59	3.4	Released Good
KR3.1	CH	59	3	Released Good
KR3.1	CH	58	2.8	Released Good
KR3.1	CH	60	2.9	Released Good
KR3.1	CH	48	2.1	Released Good
KR3.1	CCG	76	-	Released Good





Site ID	Species	Fork Length (mm)	Weight (g)	Release condition
KR3.1	CCG	83	-	Released Good
KR3.1	CCG	66	-	Released Good
KR3.1	CH	-	-	Released Good
KR3.2	CCG	60	-	Released Good
KR3.3	CH	52	2.1	Released Good
KR3.3	CH	54	2.5	Released Good
KR3.3	CH	52	1.9	Released Good
KR3.3	CCG	50	-	Released Good
KR3.3	CCG	77	-	Released Good
KR3.3	CCG	82	-	Released Good
KR3.3	CCG	71	-	Released Good
KR4.1	CH	60	2.4	Released Good
KR4.1	CH	50	2	Released Good
KR4.1	CH	67	3.2	Released Good
KR4.1	CH	60	2.9	Released Good
KR4.1	CH	61	2.5	Released Good
KR4.1	CH	60	2.5	Released Good
KR4.1	CH	50	2	Released Good
KR4.1	CH	68	3.5	Released Good
KR4.1	CH	60	3.3	Released Good
KR4.1	CH	60	2.6	Released Good
KR4.1	CCG	57	-	Released Good
KR4.1	CCG	75	-	Released Good
KR4.1	CCG	90	-	Released Good
KR4.1	CCG	62	-	Released Good
KR4.1	CCG	60	-	Released Good
KR4.1	CCG	60	-	Released Good
KR4.1	CCG	55	-	Released Good
KR4.1	CH	-	-	Released Good



Site ID	Species	Fork Length (mm)	Weight (g)	Release condition
KR4.2	CH	53	2.2	Released Good
KR4.2	CH	55	2.5	Released Good
KR4.2	CH	63	3.5	Released Good
KR4.2	CH	52	2.5	Released Good
KR4.2	CH	65	3.5	Released Good
KR4.2	CH	60	2.8	Released Good
KR4.2	CH	50	2.6	Released Good
KR4.2	CH	65	3	Released Good
KR4.2	CH	53	2.1	Released Good
KR4.2	CH	62	3.8	Released Good
KR4.2	CH	61	2.9	Released Good
KR4.2	CCG	60	-	Released Good
KR4.3	CH	58	2.1	Released Good
KR4.3	CH	60	2.4	Released Good
KR4.3	CH	62	2.8	Released Good
KR4.3	CH	55	2.2	Released Good
KR4.3	CH	54	2	Released Good
KR5.1	CH	62	2.6	Released Good
KR5.1	CH	59	2.6	Released Good
KR5.1	CH	51	2	Released Good
KR5.1	CH	57	2.5	Released Good
KR5.1	CH	58	2.8	Released Good
KR5.1	CH	63	3.2	Released Good
KR5.1	CH	64	3.2	Released Good
KR5.1	CH	62	3	Released Good
KR5.1	CH	61	3	Released Good
KR5.1	CH	63	3.3	Released Good
KR5.1	CCG	85	-	Released Good
KR5.1	CCG	77	-	Released Good



Site ID	Species	Fork Length (mm)	Weight (g)	Release condition
KR5.1	CCG	69	-	Released Good
KR5.1	CCG	80	-	Released Good
KR5.1	CCG	70	-	Released Good
KR5.1	CCG	60	-	Released Good
KR5.1	CCG	66	-	Released Good
KR5.1	CH	-	-	Released Good
KR5.2	CCG	76	-	Released Good
KR5.2	CH	49	1.4	Released Good
KR5.2	CH	55	1.8	Released Good
KR5.2	CH	58	2.4	Released Good
KR5.2	CH	57	1.5	Released Good
KR5.2	CH	62	31	Released Good
KR5.2	CH	54	2.3	Released Good
KR5.2	CH	50	1.5	Released Good
KR5.2	CH	49	1.7	Released Good
KR5.2	CH	50	1.5	Released Good
KR5.2	CH	54	2.5	Released Good
KR5.2	CH	-	-	Released Good
KR5.3	CH	55	2.2	Released Good
KR5.3	CH	57	2.8	Released Good
KR5.3	CH	59	2.5	Released Good
KR5.3	CH	58	2	Released Good
KR5.3	CH	59	2.6	Released Good
KR5.3	CH	58	2.2	Released Good
KR5.3	CH	62	2.4	Released Good
KR5.3	CH	59	1.9	Released Good
KR5.3	CH	56	2.2	Released Good
KR5.3	CH	67	2.9	Released Good
KR5.3	CH	-	-	Released Good