December 8, 2015

CANADIAN COLUMBIA RIVER

Larval Survey For Invasive Northern Pike *(Esox* lucius) in the Robson Reach, Columbia River

Submitted to:
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Castlegar and District Wildlife Association
Castlegar, BC

REPORT

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Cover Photo: Crew inspecting light traps and plankton net tows for Northern Pike larvae.

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1.0 INTRODUCTION

Northern Pike (NP) are non-native to the watersheds that drain the Pacific side of the Rocky Mountains within British Columbia (Harvey 2009). Originally introduced upstream of Couer d'Alene Lake in Idaho four decades ago (McMahon and Bennett 1996), this highly invasive predator has also established a significant breeding population in Box Canyon Reservoir on the Pend Oreille River in northeast Washington.

The Kalispell Tribe and Washington Department of Fish and Wildlife have focused on suppressing the Northern Pike population in Box Canyon Reservoir of the Pend Oreille River, which is the outlet river of Lake Pend Oreille located in North Idaho. Northern pike are not managed as a game species in Washington and are classified by the State of Washington as a "prohibited species" listed under the State's "Aquatic Invasive Species" section (WDFW 2015).

Fisheries managers in Idaho have been less vigilant about NP removal in other areas. In the Coeur d'Alene Lake system, government staff have recently requested that suppression efforts by the Coeur d'Alene Tribe require trophy size Northern Pike be returned to the upper end of the lake to maintain a trophy fishery in the area, which seems counter-productive to the fisheries managers downstream trying to protect salmon stocks (CBB 2015).

Northern Pike are suspected to have survived entrainment through multiple dams on the Pend d'Oreille River (versus further assistance by humans) and were first captured by boat electrofishing in the Canadian Columbia River near Hugh L. Keenleyside Dam in the fall of 2010 (Ford and Thorley 2011). The presence of NP has increased dramatically in this reach of river each year (Baxter and Neufeld 2014; Ford et. al. 2014). NP are considered a serious threat to native fish species and to the preferred sportfishing opportunities. These include the local rainbow trout fishery in the Columbia River that likely contributes $1-2 million dollars in direct expenditures to the local economy annually.

Within the Province of BC, MFLNRO has recognized the significance of this emerging fisheries management issue for the Columbia River sports fishery and has conducted pilot netting and removal programs which may become permanent pike removal program. The Province has also developed fisheries management regulations for unlimited retention quota of NP for recreational fishers. The Spring Pike Index Netting (SPIN) in 2014 (Baxter and Neufeld 2014) observed spawning from mid to late May. Based on these activities, the Columbia River by Castlegar has an estimated total population size of ~700 adults. In addition, TECK Metals Ltd., Columbia Basin Trust and the Central Kootenay Invasive Species Committee are also providing support for identifying the local activities this invasive species.

2.0 OBJECTIVES

As Columbia River fisheries management work proceeds that concentrates on adult NP removal techniques, in the Robson Reach (upstream of the Norn's Creek confluence), additional data is required for the assessment of NP recruitment. One key question to support the design of a future control program is whether NP are recruiting locally in the Robson Reach of the Columbia River (Figures 1 and 2), or are juvenile and adult NP present as a result of downstream migrants from the Pend D'Oreille system continuing to restock the Robson Reach area. By looking for larval NP, we will confirm the establishment of a breeding NP population, which may have fisheries management implications. No larval NP have been captured to date in the Canadian Columbia River, so more directed sampling was necessary to fully evaluate the potential for successful recruitment which would indicate successful establishment of a population of breeding NP in the Robson Reach.

Additionally, another objective of this study is to confirm the most effective NP larvae sample techniques for a larger river system like the Columbia River. A variety of methods have been used to collect NP larvae, depending on the habitat being sampled. Traditional freshwater techniques such as backpack electroshocking, dip netting, beach seining, minnow traps and box traps have been employed (Cott 2004; Lewis 2014; Morrow et. al. 1995). NP larval research has also used the phototaxic characteristic of NP larval fish. Light traps (i.e., quatrefoil traps) used in marine icthyoplankton sampling have shown some success in attracting larval NP in hard to sample vegetated habitat (Pierce et.al 2007). A variety of methods will be deployed during this study to ascertain their potential to use in future abundance and distribution studies in this area.

3.0 STUDY AREA AND HABITAT DESCRIPTION

The study area included both banks of the Columbia River between Zellstoff Celgar Ltd. pulp mill and the confluence of Norn's Creek (Figures 1 and 2), otherwise called the Robson Reach. The locally used nomenclature for specific sites and embayments within the study area was taken from Baxter and Neufeld (2014) to provide consistency between researchers working in the area.

This section of river is regulated by the BC Hydro Hugh L. Keenleyside Dam (HLK) and by Arrow Lakes Generation Station and follows protocols for discharge operations from both environmental issues and the Columbia River Treaty. During the spring of 2015 BC Hydro reduces discharge from HLK to support Rainbow Trout protection flows near April 1. These reduced water levels kept Rainbow Trout spawners to spawning beds below the summer operational water level fluctuation zone and eliminates concerns associated with redd dewatering.

While water levels are low, shallow areas along the shoreline around Robson Reach are exposed and submerged vegetation like water milfoil is dried out. Typically after June 1 the water level rises in response to freshet, at the end of the Rainbow Trout Protection time period, and remains high until late July. On June 1st 2015 water levels in the Robson reach were raised to the point that terrestrial vegetation was submerged in many locations. This change in water level leaves a shallow zone next to the shoreline that is unvegetated until July. The initial survey of both banks of the Columbia River revealed that the submerged vegetation that had the potential to be used by NP was located mostly on the right downstream bank. Golder and the local volunteers weighted their efforts to sample the shoreline downstream of the riprap bank at Zellstoff Celgar Ltd.

4.0 METHODS

As methods appropriate for abundance and distribution surveys of larval NP in large river habitat could not be located, we elected to conduct this survey with many fish sampling methods (described below) to obtain information on efficiencies of each method to capture larval fish.

4.1 Timing of Survey

Timing of NP spawning activity that occurs in the Canadian Columbia River is thought to peak during May (Baxter and Neufeld 2014) but spawning may occur in the period from April to June (Machniak 1975). Generally NP eggs are released onto the substrate and hatch in 12-14 days (Machniak 1975). After the first day, larvae rise to attach themselves to aquatic vegetation using a head sucker for approximately 9-14 days.

To capture a longer time period and wider range of larval fish sizes, shoreline surveys in 2015 were scheduled for June 13 (multiple survey methods), June 24 (light traps only), July 01 (light traps only), and July 11 (multiple survey methods); (Figures 1 and 2). This schedule allowed a time series for sampling sites known from the adult removal gill net program to have higher densities of potentially breeding NP where eggs may be deposited and hatch.

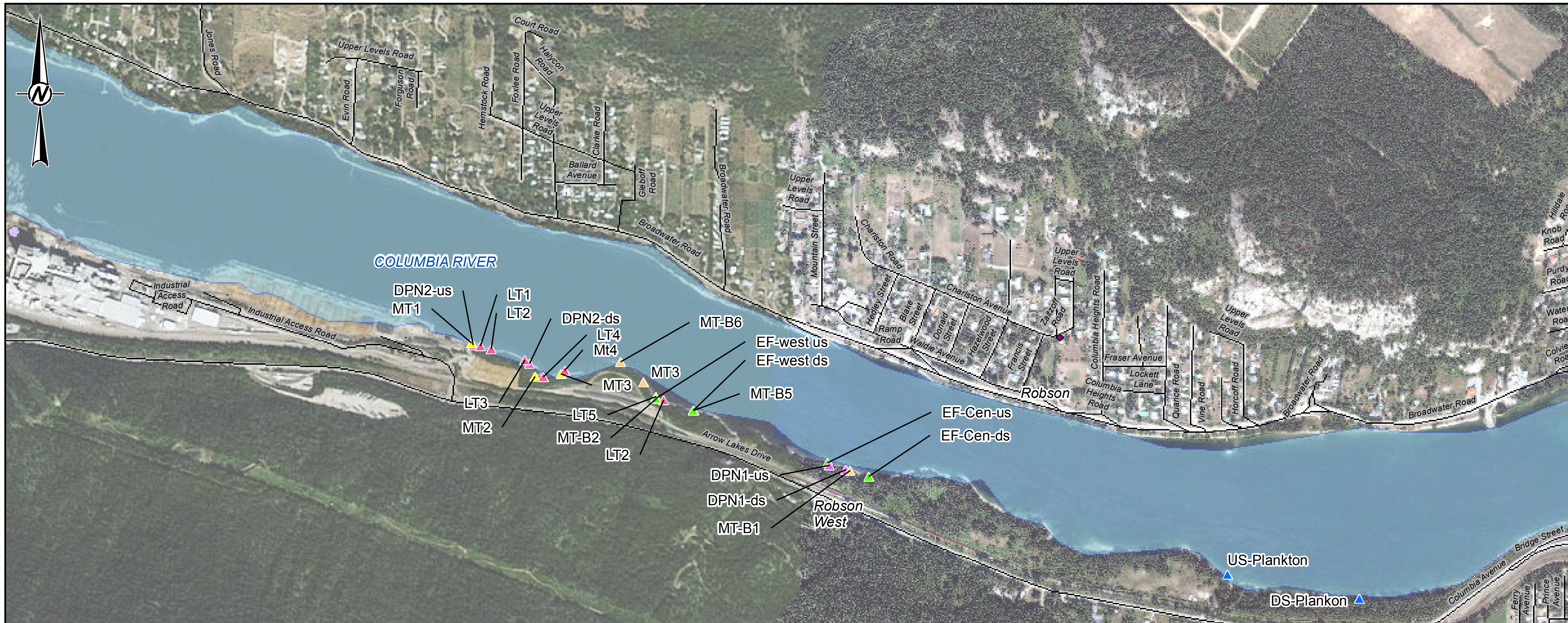
4.2 Backpack Electrofishing

Backpack electroshocking was used along the shoreline between the overhanging vegetation where wadeable. The sites were split with one sampled during the evening daylight hours and another sampled during nighttime hours. One crew member would electroshock (Smith-Root LR-24) along the shoreline accompanied by an additional crew member with a dip net. Captured fish were collected in a bucket, then identified and released at the site.

4.3 Dip Net / Beach Seine/ Plankton Tow

Dip nets and beach seines were taken into the field, but only Hand dip netting was conducted along the shoreline among the overhanging vegetation due to water level and a lack of wadeable habitat. Dip netting typically occurred after backpack electroshocking was completed through the same site length. The sites were split with one sampled during the evening daylight hours and another sampled during nighttime hours. For some less wadeable sample sites, one or two dip netters were positioned in the front of the boat and the boat was nosed along the site length. Captured fish were identified while still in the net, or if ID was not confirmed, then collected in a bucket until confirmation of species ID, and released at the site.

The plankton tow was conducted using a 60 cm long plankton net (see cover photo) with a 30 cm collection cup and a 50 cm opening. The net tow rope was attached to a side planer and the tow conducted on the shoreline side of the boat. The tow was conducted moving upstream at above idle speed for a period of 14 minutes.



SURVEY DATE: JUNE 13, 2015

SURVEY DATE: JUNE 25, 2015

Legend

SAMPLE LOCATION / GEAR TYPE

- DIP NET
- ELECTRO FISH
- LIGHT TRAP
- MINNOW TRAP (BATED)
- MINNOW TRAP (LIGHT STICK)
- PLANKTON

BASEMAP FEATURES

- ROAD
- WATERBODY

DRAFT

0 300 600
1:13,000 METERS

REFERENCE

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, TOMTOM, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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ROADS, PLACENAMES, DAM: CANVEC
WATERCOURSE, WATERBODY: IHS

CLIENT
COLUMBIA BASIN TRUST
COLUMBIA RIVER, CASTLEGAR, BC

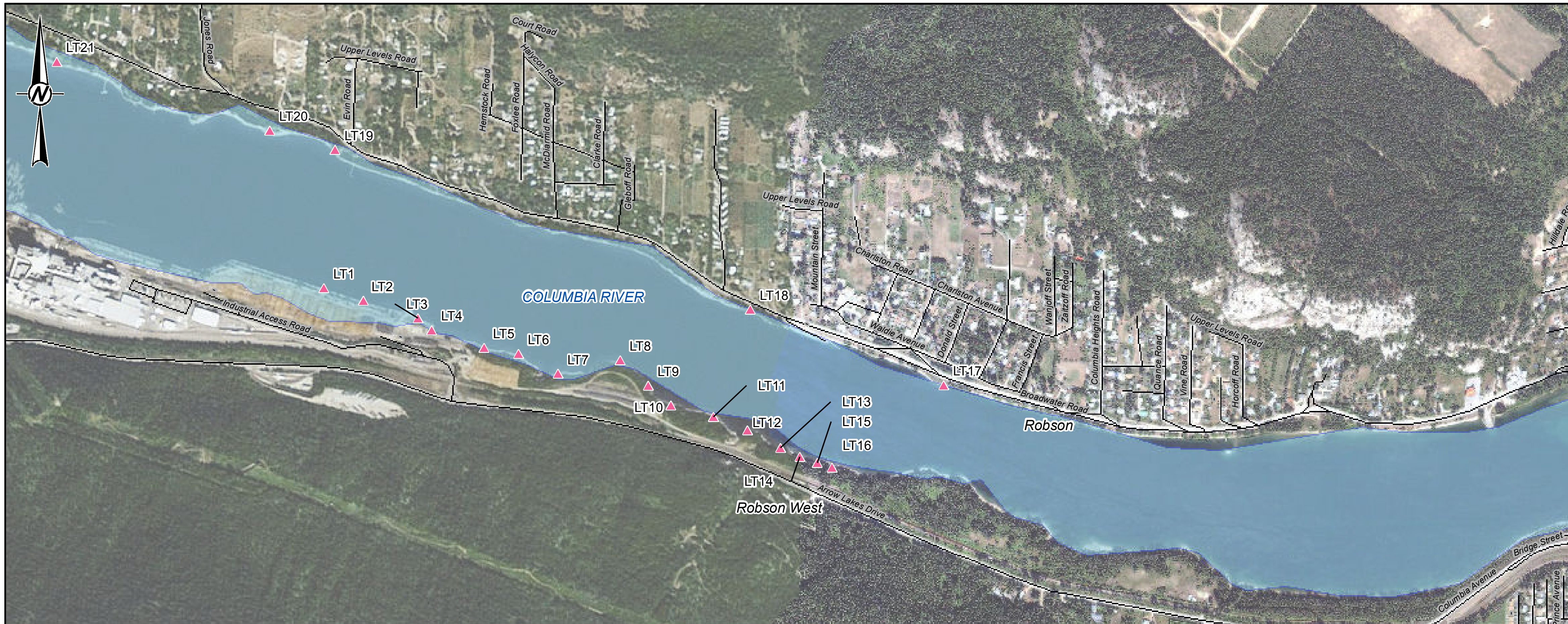
PROJECT
NORTHERN PIKE LARVAL SURVEYS

TITLE
NORTHERN PIKE LARVAL SURVEYS

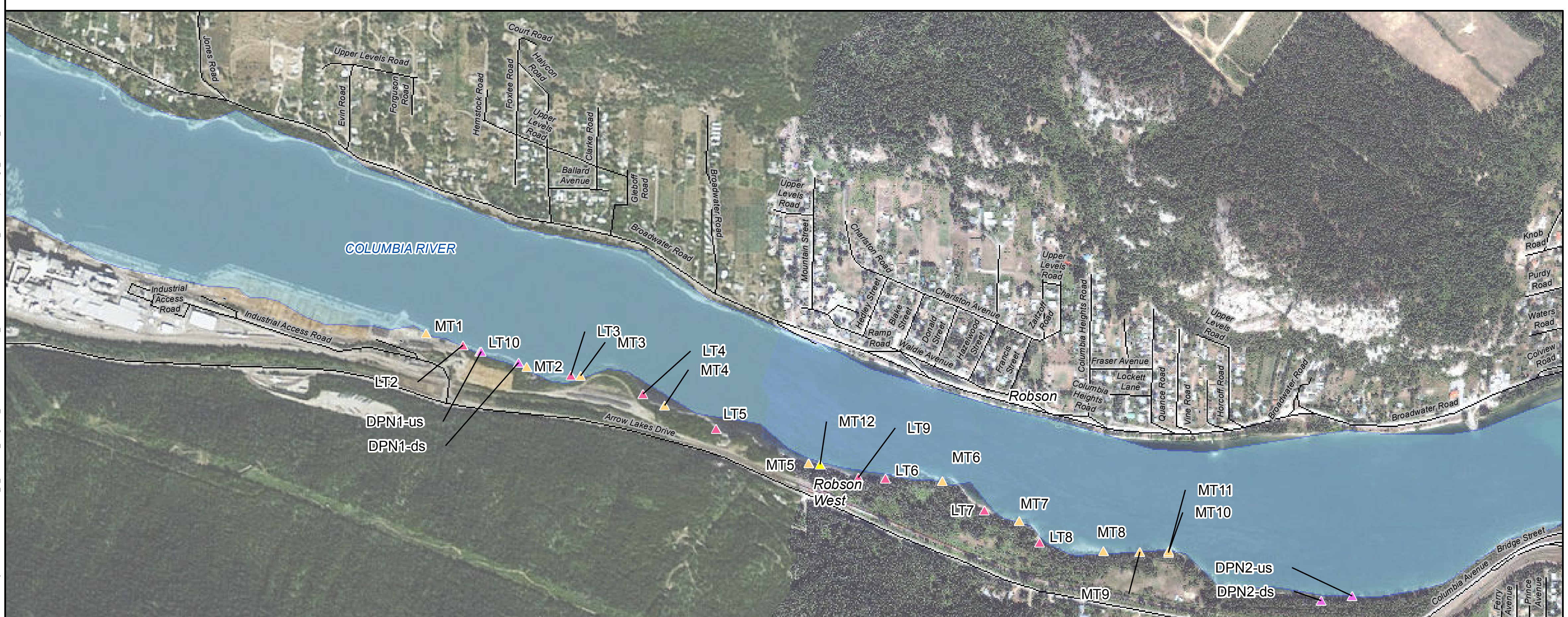
CONSULTANT
Golder Associates

YYYY-MM-DD	2015-10-08
PREPARED	JG
DESIGN	DS
REVIEW	-
APPROVED	-

PROJECT No.	CONTROL	Rev.	FIGURE
1532378	1000	A	1



SURVEY DATE: JULY 1, 2015



SURVEY DATE: JULY 11, 2015

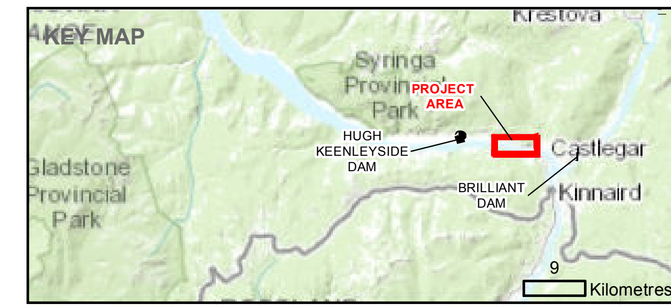
LEGEND

SAMPLE LOCATION / GEAR TYPE

- DIP NET
- ELECTRO FISH
- LIGHT TRAP
- MINNOW TRAP (BATED)
- MINNOW TRAP (LIGHT STICK)

BASEMAP FEATURE

- ROAD
- WATERBODY



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REFERENCE

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, TOMTOM, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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ROADS, PLACENAMES, DAM: CANVEC
WATERCOURSE, WATERBODY: IHS

CLIENT
COLUMBIA BASIN TRUST
COLUMBIA RIVER, CASTLEGAR, BC

PROJECT
NORTHERN PIKE LARVAL SURVEYS

TITLE
NORTHERN PIKE LARVAL SURVEYS

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-10-08
PREPARED	JG
DESIGN	DS
REVIEW	-
APPROVED	-

PROJECT No.	CONTROL	Rev.	FIGURE
1532378	1000	A	2

4.4 Light Traps / Minnow Traps

Due to the presumed relative rarity of NP larvae within the Columbia River, a large number of traps were deployed to increase the odds of trapping larval NP. Up to 20 Quatrefoil light traps, which have shown some previous success (Pierce et. al 2007), were set at undisturbed portions of each site to sample for at least 2 hours at night. A 6-hour light stick (Cyalume Technologies Ltd.) was inserted into the traps and traps were set in habitat with no visible water velocity and amongst submerged or overhanging vegetation if available. Traps were set as close to dusk as possible and then collected after mid-night.

Collapsible minnow traps (up to 12) were set in shallow with traps being baited with preserved salmon roe or a 6 hour glow stick to attract larvae during nighttime hours. Traps were set in habitat with no visible water velocity and amongst submerged or overhanging vegetation if available.

5.0 RESULTS

5.1 Survey Sample Results

During the 2015 survey over four sample sessions, 8+ species of fish were captured using five sample methods during day and night periods (Table 1). No juvenile Northern Pike were captured although one adult was captured using a dipnet (not included in the data summary).

Table 1: Summary of sample effort and young-of-year fish species captured by date and method in the Robson Reach from June 13 to July 11, 2015.

Date	Method	Effort			Young of Year Fish caught	
		Number of traps	Minutes	Meters of shore	Northern Pike	Other Species[1]
June 13	Day backpack electroshock	N/A	6.6	100	N	RSC, NPC
	Night backpack electroshock	N/A	6.2	100	N	RSC, NPC,
	Day dip net	N/A	N/A	50	N	RSC, SU, NPC,
	Night dip net	N/A	N/A	150	N	RSC, SU, NPC, UNID larvae
	Light trap	6	1200	N/A	N	RSC, NPC, MWH, UNID larvae
	Minnow trap	9	1240	N/A	N	RSC, PMC, NPC, CRH
	Night plankton tow	N/A	14	300	N	Zooplankton, UNID larvae
June 24	Light trap	17	1935	N/A	N	RSC, SU, NPC, UNID larvae
July 1	Light trap	21	2760	N/A	N	RSC, SU, NPC, UNID larvae

[1] RSC –Redside Shiner, PMC- Peamouth, NPC-Northern Pikeminnow, CRH-Torrent Sculpin, MWH- Mountain Whitefish, SU –sucker spp., UDC- Umatilla Dace, UNID – unidentified, CAS – Prickly Sculpin

Date	Method	Effort			Young of Year Fish caught	
July 11	Day backpack electroshock	N/A	7.4	60	N	UDC, RSC
	Night backpack electroshock	N/A	8.7	80	N	RSC, SU, NPC, CAS
	Day dip net	N/A	N/A	60	N	RSC, SU, NPC, UNID larvae
	Night dip net	N/A	N/A	200	N	RSC, SU, NPC, UNID larvae
	Light trap	10	2275	N/A	N	RSC, SU, NPC, UNID larvae
	Minnow trap	12	3225	N/A	N	RSC, SU, NPC, CAS

6.0 DISCUSSION

Though we were not successful in capturing NP larvae, we were able to capture other fish larvae and zooplankton with the methods we used, indicating that the methods employed were valid for the shoreline habitat encountered in the Robson reach. Backpack electrofishing tended to capture larger YOY fish, whereas dip netting, light traps and minnow traps were able to capture much smaller fish larvae (under 15 mm). Light traps and minnow traps captured the highest number of species of the methods conducted during the 2015 survey.

As the adult gill net removal program captured a spent female NP in the last week of May 2015, we know that spawning activity does occur. We have not confirmed whether the eggs have hatched or if the larvae did not locate appropriate vegetation to attach to during the higher water levels in June and July. Discharge levels remained high during the presumed hatching period, combined with the lack of very shallow shoreline vegetation may have been obstacles to larvae recruitment (Machniak 1975). The study has been unable to confirm any successful reproduction of NP within the study area, the reach of the Columbia River that has the appropriate habitat for larval recruitment. Either recruitment did not occur, or it was very small or occurred at areas not sampled. The study does provide information suggesting that adult control programs, may still be able to limit the NP population before it becomes reproductively established.

Much of the available NP literature concentrates on confirming the impacts of anthropogenic activities that suppress NP populations in location where they are native. By using this information, it may be possible to suppress NP population in locations where they are non-native if these activities do not present a threat to native or desirable introduced species.

7.0 REFERENCES

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8.0 CLOSURE

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APPENDIX A

Photographs

Photo A1: Downstream view of typical right downstream bank submerged vegetation habitat in the Robson Reach on June 7, 2015.

Photo A2: Cross-stream photo of submerged terrestrial vegetation that would likely attract larval northern pike. Note the sandy bottom at the bottom of the picture where area was dried out during low flow has no vegetation.

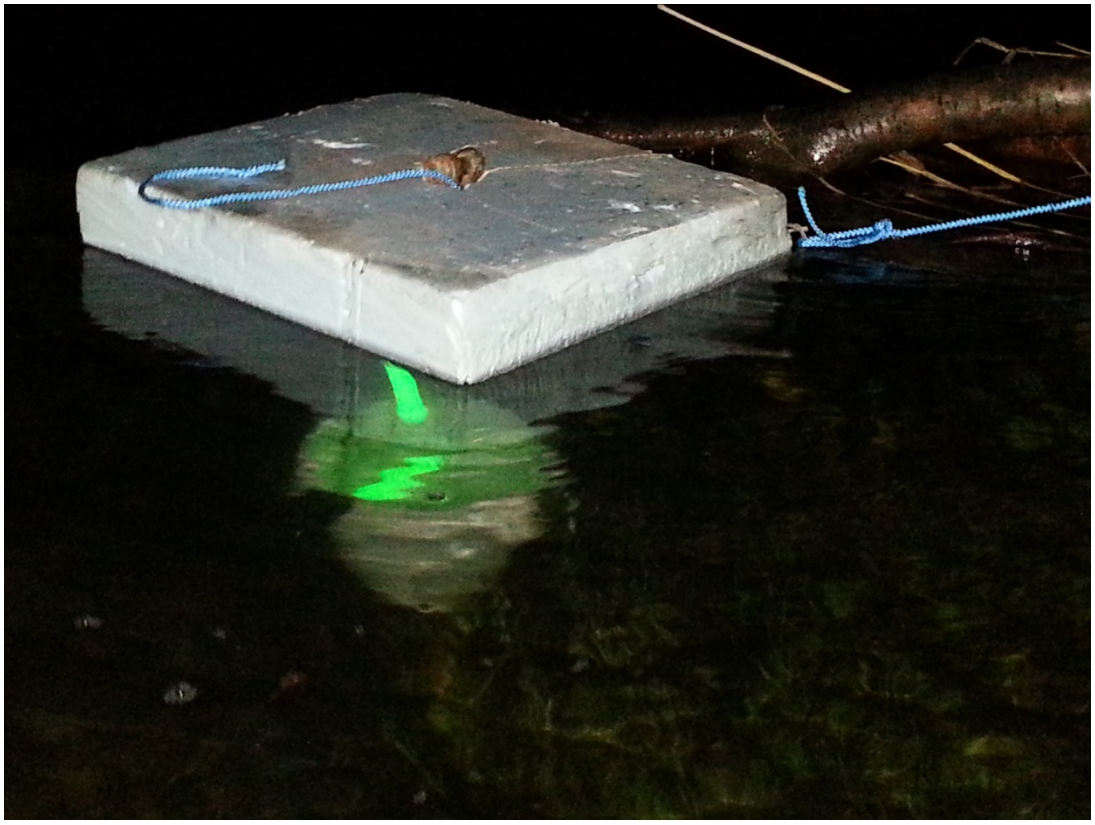

Photo A3: Close-up of light trap fishing in near-shore habitat in the Robson Reach.

Photo A4: Fish captured during the larval survey of the Robson Reach during June 13 to July 11, 2015. Upper photo – sucker spp larva; lower left photo- Mountain whitefish, Northern Pikeminnow, and Redside Shiner; lower right photo – Umatilla Dace (not previously been observed in this section of the Columbia River).

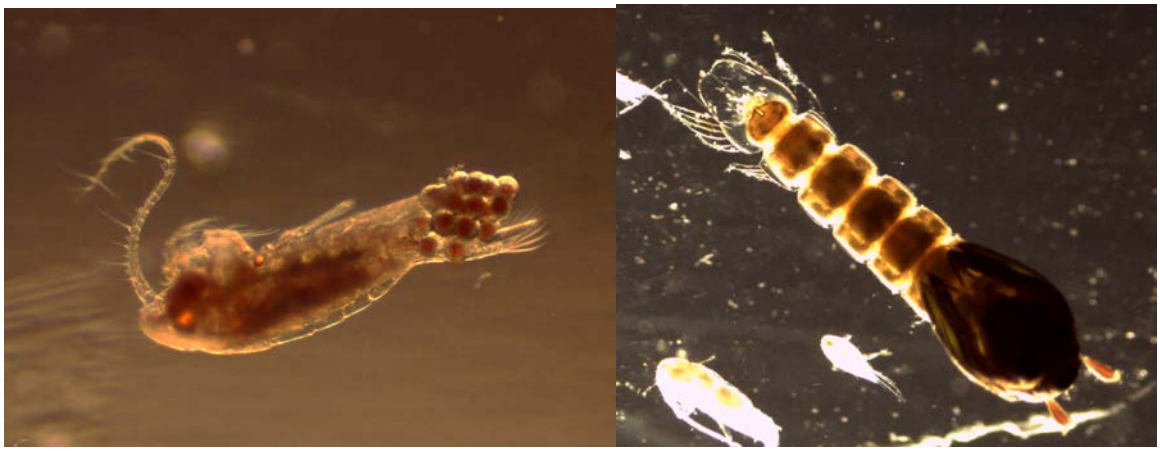

Photo A5: Species captured during nightitme plankton tow on June 13, 2015 include Copepod spp. (left) and chironmid spp. (right)

Photo A6: This program was supported with the assistance of volunteers from the Castlegar and District Wildlife Association (led by John Walton), the West Kootenay Fly Fishing Association (led by Rod Zavaduk), and the 10th Avenue volunteers (led by Joanne and Doug Sperling).

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