2007 Assessment of Juvenile White Sturgeon (*Acipenser transmontanus*) Abundance and Distribution in the Nechako River; Development of an Index of Juvenile Recruitment

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NECHAKO RIVER WHITE STURGEON RECOVERY INITIATIVE

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Executive Summary

The Nechako River was sampled with gillnets, cod traps and angling during two periods from September 8-27 and from October 18 – November 1 for the purposes of capturing white sturgeon under 1 metre total length. Sampling was focused from slightly upstream of Vanderhoof downstream to the confluence of the Stuart River.

Efforts in 2007 were a continuation of focused juvenile white sturgeon sampling programs conducted in 2004, 2005 and 2006. The intent of these sampling programs was to gather information about the status of juvenile white sturgeon recruitment into the Nechako population, and provide insight into factors affecting their survival and recruitment. Additionally, these sampling efforts are determining information to inform the format of a standardized "index type" program to monitor juvenile sturgeon recruitment into the Nechako's population on an ongoing basis. Monitoring the success or failure of recovery actions, relative to their goal of improving the rate of juvenile recruitment into the population, including monitoring the survival, health and distribution of hatchery-reared juveniles, is a key component of the Recovery Strategy for the Nechako's white sturgeon population.

A total of 450 panel-hours of gillnetting effort, 5823 hours of cod trapping effort and 33 rod-hours of angling were applied during the sampling program in 2007. A total of two white sturgeon were captured, both via gillnetting. The larger (127cm TL) of the two sturgeon captured was not successfully aged. The 2nd white sturgeon captured (89cm TL) was aged 15years. Both sturgeon were captured at rkm 114.5, slightly downstream of the Sinkut River confluence. A total of 926 other fish were captured during the sampling program, including 82 sportfish. CPUE was hampered in 2007, relative to previous years, by the record high water levels experienced during the sampling program.

Introduction

The status of white sturgeon within the Nechako River has been examined in several investigations over the past two decades (Dixon 1986; RL&L 1996, 1997, 1998, 1999 & 2000a). Work by Dixon (1986) and subsequent investigations into the Nechako white sturgeon populations by RL&L Environmental Services (*now* Golder Associates Ltd.) between 1995 and 1999 identified a number of issues with regards to this population, the most notable of which was the negligible level of juvenile recruitment that appeared to be occurring (RL&L 2000b).

White sturgeon stock assessment work conducted throughout the Fraser River watershed resulted in the identification of at least four genetically distinct stock groupings within specific geographically bounded portions of the watershed, including the lower, middle, and upper Fraser, and Nechako (Nelson et al. 1999; Pollard 2000; Smith et al. 2002). The population of white sturgeon within the Nechako are presently "red listed" or "critically imperiled" by the BC CDC (2002), inferring that this unique stock is facing imminent extirpation without intervention. More recently, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the North American White Sturgeon as Endangered, including populations within all portions of the known range of the species in the Fraser and Columbia/Kootenay watersheds north of the US/Canada border. In August 2006, two of the four Fraser watershed populations, the Nechako and Upper Fraser stock groups, were added to Schedule 1 of Canada's *Species at Risk Act*.

The capture of very few juvenile sturgeon in the Nechako River during studies undertaken over the last 25 years has been a critical piece of evidence for the conclusion that there is a continuing recruitment failure. Following the assessment activities completed from 1995-99, the Ministry of Water, Land and Air Protection (MoWLAP) initiated a recovery planning process for the Nechako River white sturgeon stock. This *Nechako White Sturgeon Recovery Initiative* (NWSRI) parallels recovery planning processes implemented on the Columbia and Kootenay rivers, where sturgeon populations within those regulated systems have also experienced recruitment failures (Golder 2003). This involved the creation of a Technical Working Group (TWG) comprised of government and non-government technical personnel assembled to recommend technical directions for recovery actions. The Nechako White Sturgeon Technical Working Group, through the development of a Recovery Plan, indicated that a focused juvenile sampling program should be carried out on the Nechako River (Golder 2003). The intent of the recommended research is to increase the existing level of knowledge regarding recruitment, factors controlling recruitment, and juvenile sturgeon habitat requirements.

Purpose

The intent of this study, which was a continuation of efforts completed in 2004, 2005 and 2006, was to continue to gather information about the status of juvenile white sturgeon recruitment into the Nechako population. As well, the development of information about juvenile sturgeon distribution and habitat usage is intended to provide insight into factors affecting their survival and recruitment. Further, information from a program of this nature will contribute to the development of a

standardized "index type" program to monitor juvenile sturgeon recruitment into the Nechako's population on an ongoing basis. A program of this nature will be required to monitor the success or failure of recovery actions, relative to their goal of improving the rate of juvenile recruitment into the population, including monitoring the survival, health and distribution of hatchery-reared juveniles.

Objectives

The primary objectives of this project were stated as follows:

1. Assess the abundance, distribution, and life history characteristics of juvenile white sturgeon within the study area.
2. Based on capture locations, determine characteristics of juvenile sturgeon habitat use.
3. Collect detailed biological and morphological information from any sturgeon captured, including tissue samples for DNA analysis.
4. Apply identifying tags (PIT) to sturgeon captured that have not been previously captured.
5. Qualitatively assess the abundance and distribution of other species within the Nechako River.

Secondary objectives of this sampling program, and subsequent uses of the data generated are summarized in (CSTC 2005).

Methodology

Sampling methodologies utilized in 2007 reflected those used in 2004, 2005 and 2006. It was determined that sampling for juveniles (defined as TL<1m) would take place in the months of September and October, and sample as wide a range of feasible habitats as possible in the Nechako River from Vanderhoof to the Stuart River confluence. Sampling took place over two 10-14 day periods. Two crews operated in a coordinated fashion to sample portions of the approximately 50km river length of identified study area.

The protocol for a standardized index approach to juvenile sampling utilized small-mesh monofilament sinking gillnets, deployed in a "set" or stationary fashion in selected sampling locations. Nets consisted of 1-3 standardized panels of 2.4m depth x 15.2m length (37.2m^2) of the following mesh sizes: 2.54cm, 3.81cm, 5.08cm, 6.35cm, 7.6cm, 8.9cm, and 9.53cm. Nets were typically set using an anchor with a line and buoy attached at one end, and were deployed while backing through the site in the direction of the set, and completed with a second anchor and float upon release from the boat. Sets were made either parallel or perpendicular to the current or eddy. The gillnets were attached using

a “bridal system” to both the anchor and the buoy rope, to ensure the net’s led-line was in contact with the substrate and reduce the likelihood of the net collapsing due to water velocity. Typically, sets consisted of two panels, however, depending upon the sampling site, anywhere from one to three panels were deployed. On several occasions, nets were attached to shore using a shore rope.

Set times for gillnets were variable. The standard approach upon selecting a site consisted of setting for approximately 0.5-1 hour, the net was then checked, and fish encountered were removed and processed. A field-based decision regarding reset time was then made based on the level of bi-catch and net fouling. Typically, the second sample at the selected site was approximately 1.0 hours. However, if high rates of bi-catch, net fouling, or fish stress were observed, sample times were either adjusted accordingly (reduced to anywhere from 0.5 hours to 1.0 hours) or the gear was pulled all together for re-deployment in a new sample site location.

Two additional sampling techniques utilized in 2007 included “cod traps” and angling. A total of 8 cod traps were utilized daily. Cods traps are a conical type trap with a single entry funnel meant to facilitate fish entry but hamper their exit from the trap (see photo below). They are fished with bait fastened inside them to attract fish into entering the trap. Baits utilized on 2007 included sockeye flesh. Traps are fished on the bottom with an attached rope and buoy. Their outer mesh is a stiff 1” braided nylon, which causes smaller fish to be underrepresented within the trap’s catch. Angling was utilized sparsely in 2007.

For the specifics of:

- How sampling effort and catch were recorded and managed, and example data forms
- Fish capture and handling methods utilized, and morphological measurements and tissue/bone samples collected
- Tagging procedures and the types of tags applied
- Internal examination and radio tagging application procedures
- Bi-catch management and documentation procedures

See CSTC 2005.

Physical Conditions

Water temperatures were obtained daily during sampling using either a digital thermometer or the sampling vessel's fish finder. Water depth at the site of gear deployment was also measured utilizing the fish finders. Both were tested for accuracy using a known length of rope with weight attached. Water clarity was estimated utilizing a standard size Secchi Disc deployed and interpreted in a standardized manner.

Nechako River temperature and discharge information collected at Vanderhoof were retrieved from Environment Canada's Water Survey of Canada website for the duration of sampling activities.

Aging Analysis

The ages of individual white sturgeon captured were determined through an examination of the annuli patterns visible on the fin ray section that was removed from the leading ray of either the left or right pectoral fin. Age structure preparation and analyses were completed by CSTC staff and staff from Environmental Dynamics Inc.

Results

Sampling efforts were conducted within two distinct time periods from September 8-27 and from October 18 – November 1. Sampling during both sessions was focussed between rkm 138.8 (slightly upstream of the bridge crossing at Vanderhoof) downstream to rkm 90.2 (near the Stuart River confluence). Based on capture success rates in the past sampling years, this area was identified to contain the majority of suitable white sturgeon habitats. Sampling methods utilized in 2007 were diversified slightly from pervious years with the addition of angling and an increased number of cod traps. Areas extending upstream of the

Vanderhoof bridge (> rkm 134.0) were sampled due to the higher than usual river discharge during shift 2.

Physical Conditions of the Nechako River at time of Sampling

Values for daily average discharge and water temperature were obtained from Environment Canada's hydrometric website. As indicated in Figure 1, discharge declined steadily during the first sampling shift. Discharge increased abruptly partway through the second sampling shift. River temperature was on a declining trend during both shifts (Figure 1 and 2). Temperature readings collected by field crews during sampling indicate similar information (Figure 3).

Water clarity was measured daily by field crews using a Secchi Disc. Visibility during shift 1 (September 8 – September 27) ranged from 1.5 – 3.0 m with an overall average of 2.05 m. Visibility during shift 2 (October 18 – November 1) ranged from 1.0 - 2.0 m and averaged 1.68 m. Visibility during shift 1 generally increased during the sampling session with decreasing discharge, whereas visibility during shift 2 decreased mid-shift with increasing discharge (Figure 4). Variability in water clarity between shifts is attributable to the discharge conditions during sampling periods. Shift 1 sampling efforts were conducted during lower water discharges (~95m^3/s to ~125m^3/s) (Figure 1), whereas shift 2 experienced a range of higher discharges (~95m^3/s to ~225m^3/s) (Figure 2).

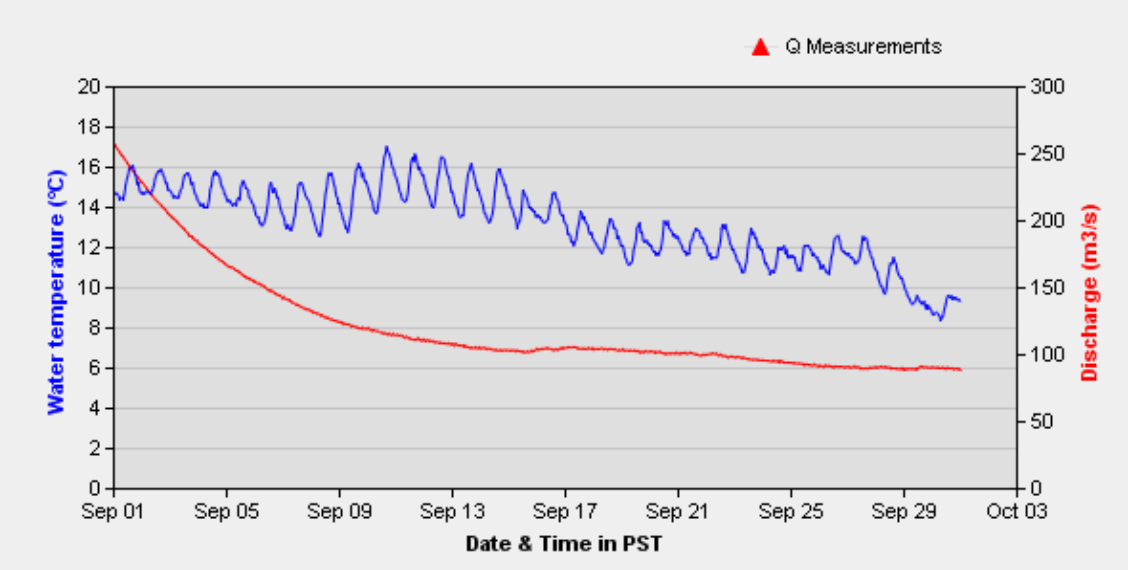


Figure 1. Daily average discharge (m^3/s) and temperature (°C), for the Nechako River at Vanderhoof, as recorded by Environment Canada hydrometric station 08JC001 (2007) during sampling shift 1.

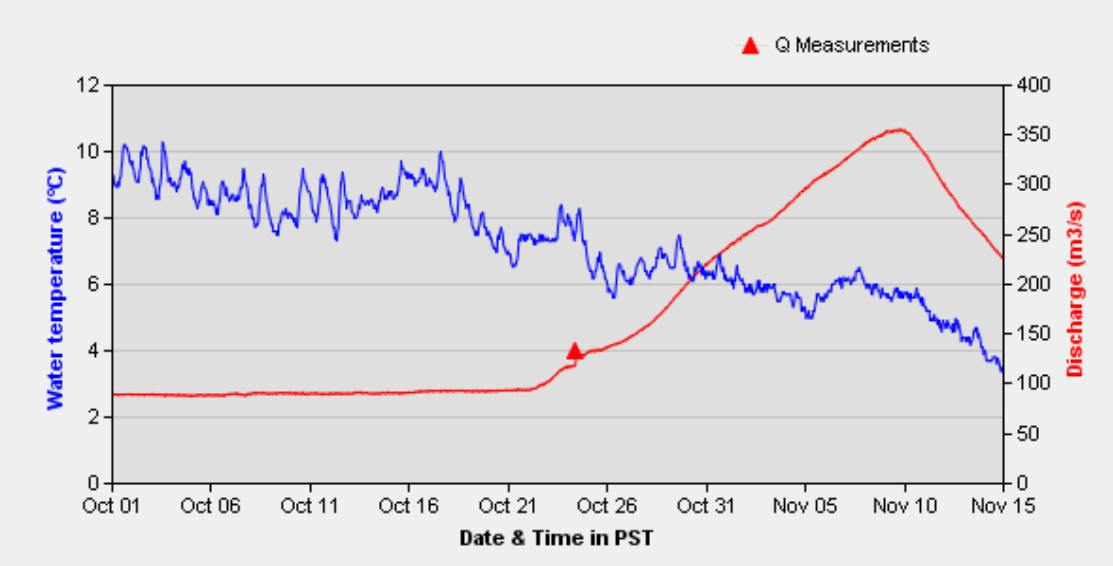


Figure 2. Daily average discharge (m^3/s) and temperature (°C), for the Nechako River at Vanderhoof, as recorded by Environment Canada hydrometric station 08JC001 (2007) during sampling shift 2.

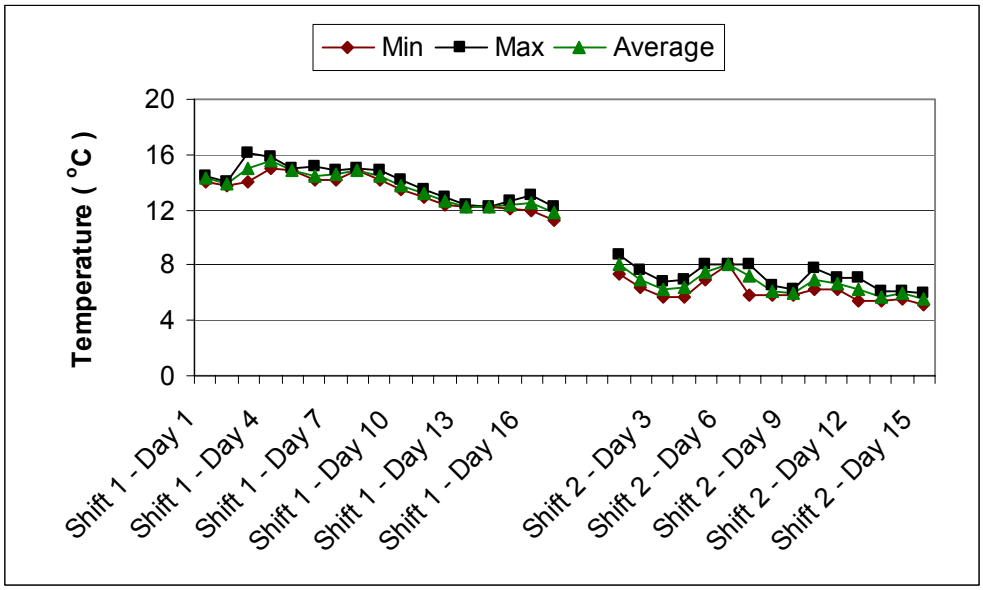


Figure 3. Daily minimum, maximum and average temperatures (°C) recorded by field crews during sampling shifts 1 and 2.

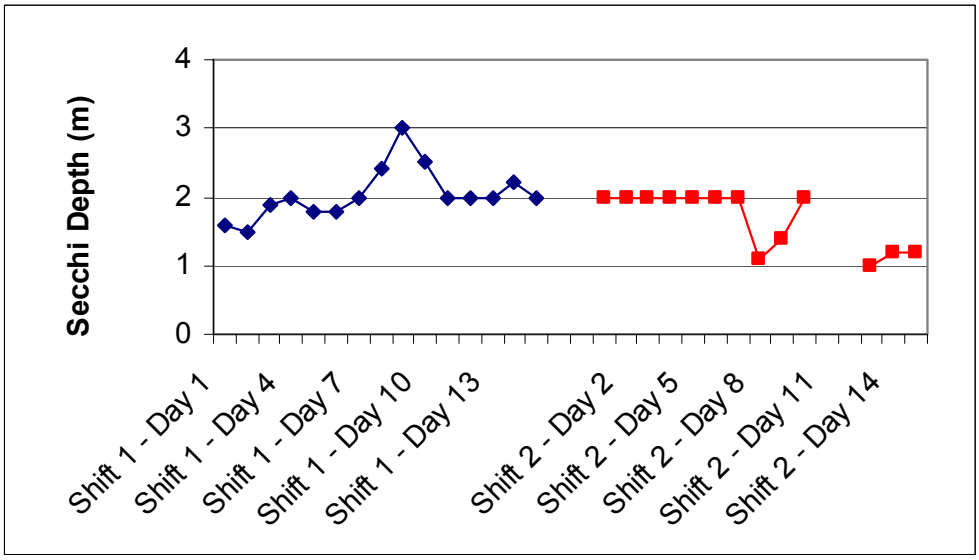


Figure 4. Daily Secchi Depth readings (m) recorded by field crews for sampling shifts 1 (blue) and 2 (red).

Shift 1 Sampling Session; September 7 – September 27

Gillnet and cod trap sampling during shift 1 was conducted between rkm 92.2 and rkm 130. Cod trap sampling was equally prioritized relative to gillnet sampling in 2007, with both methods being utilized daily. Differences between sites sampled in 2007 and previous years are attributable to the record high flows the Nechako experienced in 2007, which created a greater array of deeper habitats.

Table 1 provides a summary of the gillnet effort deployed and resulting catch per unit effort (CPUE) for shift 1. Table 2 provides a summary of the cod trap effort deployed and resulting CPUE for shift 1. Maps showing the distribution of shift 1 gillnetting and cod trapping efforts are provided in Appendix 1.

Shift 2 Sampling Session; October 18 – November 1

Sampling during shift 2 was conducted between rkm 110.0 and rkm 138.8. Table 3 provides a summary of gillnetting effort deployed and resulting CPUE for shift 2. Table 4 provides a summary of the cod trap effort deployed and resulting catch per unit effort (CPUE) for shift 2. Maps demonstrating the distribution of shift 2 gillnetting and cod trapping efforts are provided in Appendix 1.

An additional 32.9 rod-hours of angling effort was applied during shift 1 (32.5 rod-hours) and shift 2 (0.43 rod-hours). No white sturgeon were captured via angling, but 23 other fish were bi-captured with this method (CPUE 0.70 fish/rod-hour).

The distribution of angling sites for both shifts (combined) is provided in Appendix 1. Angling was only attempted when time permitted in 2007, between activities related to cod trap and gillnet deployment (Tables 7 and 8).

Table 1. Gillnet CPUE and effort for shift 1; 37.2m^2 panel area.

Gillnet Sampling Shift 1 - September 8 - September 27								
Mesh Size (cm)	**Total Panel Hours Effort**	**Hours fished for Net Area/m^2**	**No. WSG**	**No. Bi-catch**	**Total No. Fish**	**Bi-catch CPUE (per 100m^2/hr)**	**WSG CPUE (per 100m^2/hr)**	**Total CPUE (per 100m^2/hr) all fish**
2.54	3.07	114.08	0	3	3	2.63	0	2.63
3.81	165.67	6162.80	0	329	329	5.34	0	5.34
5.08	0.00	0.00	0	0	0	0	0	0
6.35	45.13	1678.96	1	65	66	3.87	0.06	3.93
7.62	24.37	906.44	0	70	70	7.72	0	7.72
8.89	98.23	3654.28	1	60	61	1.64	0.03	1.67
Total	336.5	12516.6	2	527	529	4.21	0.02	4.23

Table 2. Cod trap CPUE and effort for shift 1.

Cod Trap Sampling Shift 1 - September 8 - September 27							
Shift	**Total Trap Hours**	**No. WSG**	**No. Bi-catch**	**Total No. Fish**	**Bi-catch CPUE (per Trap/hr)**	**WSG CPUE (per Trap/hr)**	**Total CPUE (per Trap/hr) all fish**
1	3055.83	0	104	104	0.034	0	0.034

Table 3. Gillnet CPUE and effort for shift 2; 37.2m2 panel area.

Gillnet Sampling Shift 2 – October 18 to November 1								
Mesh Size (cm)	**Total Panel Hours Effort**	**Hours fished for Net Area/m^2**	**No. WSG**	**No. Bi-catch**	**Total No. Fish**	**Bi-catch CPUE (per 100m^2/hr)**	**WSG CPUE (per 100m^2/hr)**	**Total CPUE (per 100m^2/hr) all fish**
2.54	20.73	771.28	0	10	10	1.30	0	1.30
3.81	33.13	1232.56	0	67	67	5.44	0	5.44
5.08	1.67	62.00	0	1	1	1.61	0	1.61
6.35	16.93	629.92	0	54	54	8.57	0	8.57
7.62	13.90	517.08	0	74	74	14.31	0	14.31
8.89	26.50	985.80	0	23	23	2.33	0	2.33
Total	112.9	4198.6	0	229	229	5.45	0	5.45

Table 4. Cod trap CPUE and effort for shift 2

Cod Trap Sampling Shift 2 - October 18 - November 1							
Shift	**Total Trap Hours**	**No. WSG**	**No. Bi-catch**	**Total No. Fish**	**Bi-catch CPUE (per Trap/hr)**	**WSG CPUE (per Trap/hr)**	**Total CPUE (per Trap/hr) all fish**
2	2767.17	0	43	43	0.016	0	0.016

Summary of Sturgeon Bio-physical & Tagging Data

During the 2007 sampling project, 2 white sturgeon were captured via gillnet sampling. No white sturgeon were captured in cod traps. Both white sturgeon were captured at rkm 114.5, in association with the deep water habitats near the confluence of the Sinkut River. One of the sturgeon captured was measured however no pit tag was inserted due to an equipment failure. The second fish captured was a previously unsampled fish and was measured, weighed and pit tagged (Table 5).

Table 5. Summary of bio-physical and tagging information for the sturgeon captured during the 2007 juvenile-focussed sampling program.

Capture Location Information			**Physical Characteristics**						**Tagging Information**		
Date	**Station**	**Mesh size (inches)**	**Sex Mat. Code**	**Fork Length (cm)**	**Total Length (cm)**	**Girth (cm)**	**Wt. (lbs.)**	**Age in years**	**Tags at Capt. (ft-pt-rt)**	**Tags at Release (ft-pt-rt)**	**PIT Tag No.**
18-Sep-07	GN-114.5R	3.5	97	113	127	43	24	n/a	n-n/a-n	n-n/a-n	n/a
19-Sep-07	GN-114.5R	2.5	98	74	89	28.5	6.6	15	n-n-n	n-pt-n	424D4B206C

Age Structure Analysis

No age structure was collected from the larger fish that was captured on September 18, which, based on size criteria (>1m), is considered an adult. The second sturgeon captured on September 19 was less than 1m in total length and its age was estimated at 15 years based on the finray collected (Table 5).

Capture Location – Habitat Types

The sturgeon caught in the 2007 project were both captured at the same general location (rkm 114.5) and similar depths (3.0 and 3.2 m) on the outside bend (right bank) downstream of the Sinkut River's confluence. The capture location is between two known sturgeon over wintering sites (at rkms 110 and 116). The capture site is the tail-out of a deeper scour zone connected to slow-moving back

eddies, creating depositional areas that are favoured by white sturgeon as summer and winter rearing habitats.

Bi-Catch Data

A combined total of 926 fish were bi-captured (i.e. non-target species) during the two sampling sessions, including 772 fish that were released alive and 154 mortalities which succumbed to capture stress or trauma (Table 6). During shift 1 the three sampling methods caught a combined total of 653 fish. Gillnetting generated most of the total bi-catch (81%), with cod trapping and angling the least (16% and 3% respectively) (Table 7). A total of 273 fish were captured during Shift 2, with gill netting generating 84% of the catch and cod trapping and angling accounting for smaller proportions (15.7% and 0.3% respectively) (Table 8). The majority of the fish caught in both sampling sessions (all methods) were Northern Pikeminnow (NSC) (59% for both shifts) (Tables 7 and 8). Figure 5 presents a summary of the fish species caught during both sampling shifts. Similar proportions of species can be seen within the catches for both shifts.

Table 6. Summary of bi-catch data for 2007 project, both shifts and all methods; sportfish shaded in grey.

Bi-Catch Species	Min Fork Length (cm)	Max Fork Length (cm)	# Captured	# Released	# Mortalities
BB	14	61	56	56	0
BMC	13.5	14.4	2	2	0
BT	24.7	67	14	8	6
CC	13	13.2	4	4	0
CH	7.1	9	3	3	0
CSU	8.5	49	122	84	38
LSU	6	41	28	26	2
NSC	5.2	46.7	546	452	94
PCC	11	33	118	105	13
RB	34.7	38.2	2	2	0
RSC	6.1	11.5	24	23	1
WF	8	43.8	7	7	0
		Total	926	772	154

Table 7. Shift 1; summary of species specific bi-catch for all sampling methods.

Shift 1 - Bi-Catch Summary													
Method	**Total # Fish**	**Species Caught**											
		BB	**BMC**	**BT**	**CC**	**CH**	**CSU**	**LSU**	**NSC**	**PCC**	**RB**	**RSC**	**WF**
GN	527	0	0	6	0	0	88	14	317	95	1	0	6
CT	104	30	0	0	4	0	2	0	47	0	0	21	0
AG	22	0	0	1	0	0	0	0	20	0	1	0	0
Total	***653***	***30***	***0***	***7***	***4***	***0***	***90***	***14***	***384***	***95***	***2***	***21***	***6***

Table 8. Shift 2; summary of species specific bi-catch for all sampling methods.

Shift 2 - Bi-Catch Summary													
Method	**Total # Fish**	**Species Caught**											
		BB	**BMC**	**BT**	**CC**	**CH**	**CSU**	**LSU**	**NSC**	**PCC**	**RB**	**RSC**	**WF**
GN	229	0	2	6	0	0	30	12	154	23	0	2	0
CT	43	26	0	1	0	3	2	2	7	0	0	1	1
AG	1	0	0	0	0	0	0	0	1	0	0	0	0
Total	***273***	***26***	***2***	***7***	***0***	***3***	***32***	***14***	***162***	***23***	***0***	***3***	***1***

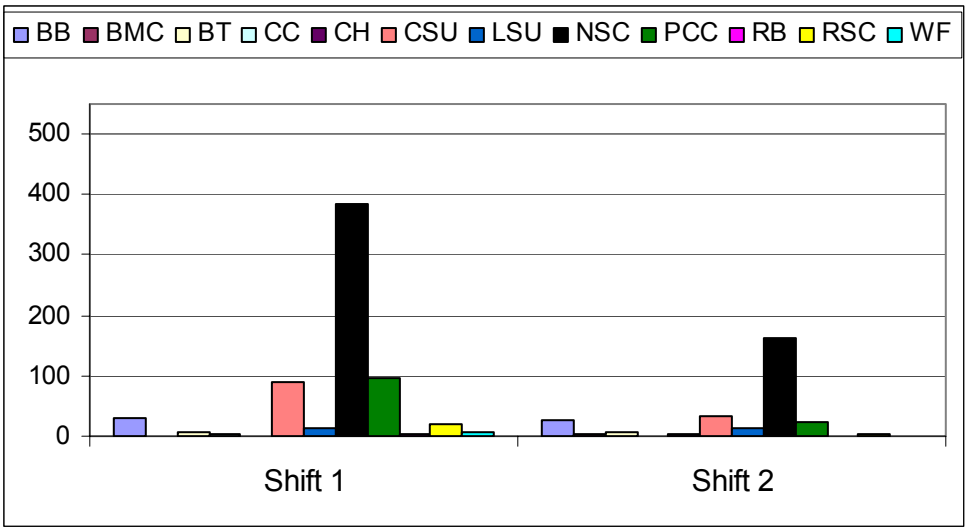


Figure 5. Shift 1 and 2, all methods, bi-catch summary for 2007 sampling sessions.

A total of 82 sportfish are included within the 2007 bi-catch discussed above. A total of 61 (74.4%) of these were caught in cod traps, 19 (23.2%) in gillnets and 2 (2.4%) were caught by angling. The most commonly captured sportfish within the sampling sessions were burbot (BB - 56 fish) (Table 9). Six of the 154 bi-captured mortalities were sportfish (Table 6; sportfish shaded in grey). The CPUE for sportfish caught during the gillnet sampling is 0.11 fish per 100m^2/hr (Table 10). The CPUE for sportfish caught during cod trap sampling is 0.0105 fish/trap hr (Table 11).

Table 9. Summary of sportfish species bi-caught by all methods of sampling.

Sportfish Caught by Method						
Method	**Species Caught**					
	BB	**BT**	**CH**	**RB**	**WF**	***Total***
GN	0	12	0	1	6	***19***
CT	56	1	3	0	1	***61***
AG	0	1	0	1	0	***2***
Total	***56***	***14***	***3***	***2***	***7***	***82***

Table 10. Summary of gillnet bi-catch and CPUE for both gillnet shifts.

Total Panel Hours	Panel Area	Hours fished for net Area/m^2	# of Bi-Catch Species Caught	# Sportfish Bi-Catch	Bi-catch CPUE (per $100m^2$/hr)	Sportfish Bi-Catch CPUE (per $100m^2$/hr)
449.33	37.20	16715.20	756	19	4.52	0.11

Table 11. Summary cod trap bi-catch and CPUE for both shifts.

Total Trap Hours	# Bi-Captured Species Caught	# Sportfish within Bi-Catch	Bi-Catch CPUE (per Trap/Hour)	Sportfish Bi-Catch CPUE
5823.00	147	61	0.0252	0.0105

The majority of fish bi-captured via gillnetting during shift 1 were captured in 3.81cm (1.5") mesh and the least amount was captured in the 2.54cm (1") mesh; 329 (329/527= 62%) and 3 (3/527= 0.57%), respectively (Table 12). During shift 2, the majority of fish were captured in 7.62cm (3") mesh and the least amount captured in the 5.08cm (2.5") mesh; 74 (74/229 = 32%) and 1 (1/229 = 0.44%), respectively (Table 13). The majority of fish captures via cod traps were captured during the first sampling shift of the program, and the method captured a disproportionate amount of burbot (Table 14).

Table 12. Gillnetting species-specific bi-catch summary for shift 1.

Shift 1 - Bi-Catch Summary									
Mesh Size	Hours fished for net Area/m^2	Total # Fish	Species/ CPUE						
			BT/ *CPUE*	CSU/ *CPUE*	LSU/ *CPUE*	NSC/ *CPUE*	PCC/ *CPUE*	RB/ *CPUE*	WF/ *CPUE*
2.54	115.32	3	0/*0*	0/*0*	0/*0*	3/*2.60*	0/*0*	0/*0*	0/*0*
3.81	6175.20	329	0/*0*	44/*0.73*	1/*0.02*	217/*3.48*	65/*1.04*	1/*0.02*	1/ *0.02*
6.35	1685.16	65	1/*0.06*	14/*0.83*	12/*0.71*	22/*1.31*	14/*0.83*	0/*0*	2/*0.11*
7.62	892.80	70	1/*0.11*	9/*1.01*	0/0	46/*5.15*	12/*1.34*	0/*0*	2/*0.22*
8.89	3645.60	60	4/*0.11*	21/*0.58*	1/*0.03*	29/*0.80*	4/*0.11*	0/*0*	1/*0.027*

Table 13. Gillnetting species-specific bi-catch summary for shift 2.

Shift 2 - Bi-Catch Summary									
Mesh Size (cm)	Hours fished for net Area/m^2	Total # Fish	Species/ *CPUE*						
			BMC/ *CPUE*	BT/ *CPUE*	CSU/ *CPUE*	LSU/ *CPUE*	NSC/ *CPUE*	PCC/ *CPUE*	RSC/ *CPUE*
2.54	21.00	10	2/*0.26*	0/*0*	0/*0*	0/*0*	6/*0.77*	0/*0*	2/*0.26*
3.81	33.00	67	0/*0*	0/*0*	4/*0.33*	0/*0*	61/*4.97*	2/*0.16*	0/*0*
5.08	1.70	1	0/*0*	0/*0*	0/*0*	0/*0*	1/*1.58*		0/*0*
6.35	16.93	54	0/*0*	0/*0*	14/*2.22*	7/*1.11*	29/*4.60*	4/*0.64*	0/*0*

7.62	**14.00**	**74**	**0/*0***	***4/0.77***	***7/1.34***	***3/0.58***	***43/8.26***	***17/3.26***	**0/*0***
8.89	**26.00**	**23**	**0/*0***	***2/0.21***	***5/0.52***	***2/0.21***	***14/ 1.45***	**0/*0***	**0/*0***

Table 14. Species-specific bi-catch summary for cod trapping during shifts 1 and 2.

Bi-Catch Summary											
Shift	**Total trap Hours**	**Total # Fish/ *CPUE***	**Species/ CPUE**								
			BB/ *CPUE*	**BT/ *CPUE***	**CC/ *CPUE***	**CH/ *CPUE***	**CSU/ *CPUE***	**LSU/ *CPUE***	**NSC/ *CPUE***	**RSC/ *CPUE***	**WF/ *CPUE***
1	3055.83	104/ *0.17*	30/ *0.0098*	0/*0*	4/ *0.0013*	0/*0*	2/ *0.0007*	0/*0*	47/ *0.15*	21/ *0.0069*	0/*0*
2	2767.17	43/ *0.022*	26/ *0.0094*	1/ *0.0004*	0/*0*	3/ *0.0011*	2/ *0.0007*	2/ *0.0007*	7/ *0.0025*	1/ 0.004	1/ 0.004

Cod Trapping – Assessment of Effectiveness vs. Gillnet

A total of 3055.8 hours of cod trap effort were deployed during shift 1 (Table 14), which can be summarized as 127.3 cod trap-days of effort (3055.83/24hours) or ~ 8 traps fished ~24 hours per day for the duration of the 15 days within the shift (i.e. 1 trap for 24hours = 1 trap-day). The CPUE for shift 1 was determined to be 0.817 fish/trap-day. The cod trapping catch results from 2007 were expanded to estimate the potential catch if 30 cod traps per day were deployed (i.e. the number of traps it would appear a crew could reasonably fish effectively on a daily basis, if gillnetting was not pursued – this season 8 traps were fished, in combination with gillnetting). Expanding the observed CPUE from shift 1 in 2007, it was determined that a total of 25 fish would be caught per day, with an expected species specific breakdown as follows; BB = 7, CC = 1, CSU = 1, NSC = 11, RSC = 5. The same expansion was done for shift 2 (Table 12) and it was estimated that 11 fish per day would be captured for 30 traps deployed, with a species specific breakdown as follows; BB = 7, BT = 0, CH = 1, CSU = 0.5, LSU = 0.5, NSC = 2, RSC = 0, WF = 0.

Gillnetting in shift 1 included a total of 336.5 panel hours of effort resulting in a total of 527 fish being captured, or approximately 1.6 fish/panel-hour. Crews averaged 22.4 panel-hours of effort per day, yielding an average catch of 36 fish of the following averaged species breakdown; BT = 0.5, CSU = 6, LSU = 1, NSC = 21, PCC = 6, RB = 0, WF = 0.5. Gillnetting in shift 2 included 112.9 panel-hours of effort with an overall average of 16.1 hours panel-hours per day, resulting in an average daily catch of 33 fish; BMC = 0, BT = 1, CSU = 4, LSU = 2, NSC = 22, PCC = 3, RSC = 0.

Assuming that gillnetting effort was being maximized during these shifts, the figures above are utilized to compare the results of a sampling strategy focussed on gillnet sampling, as has been the focus of this program, versus a sampling program focussing on cod trapping (Table 15).

Table 15. Comparative results for gillnet (observed) and cod trap (expanded) methods based on results in 2007.

	[1]Shift 1 – Gillnetting	[2]Shift 1 – Cod Trapping	[1]Shift 2 - Gillnetting	[2]Shift 2 – Cod Trapping
Daily Effort	22.4 panel-hours	30 trap-days	16.1 panel hours	30 trap-days
Daily Catch	36	25	33	11
Per 10day sampling shift	360	250	330	110
Sportfish/Non-sportfish	9/251	72/178	9/321	79/31
No. mortalities predicted	96 (26.8%)	0	6 (1.8%)	0

[1]Based on actual results observed during 2007, assuming effort was near maximum for sampling crews

[2]Expanded based on results observed during 2007 with 8 cod traps, assuming maximum effort for a sampling crew would involve fishing 30 traps/day

It is evident that while cod trapping is overall slightly less effective for catching fish, it is far more effective for capturing certain species, and in particular sportfish species. The mesh size of the cod traps was noted to not retain smaller fish (such as peamouth chub and reside shiner), thus the method is likely self selective for fish >10cm.

Cod trapping imparted far less direct mortality relative to gillnetting. However, the cod trap method also poses risk to fish caught, including young sturgeon, for inducing in-trap predation. Larger fish caught by this method in 2007 were scanned for PIT tags to ensure they have not preyed upon a tagged juvenile sturgeon while in the trap.

It should be noted that no white sturgeon were captured utilizing cod traps.

Discussion

During the 2007 sampling program two white sturgeon were captured via gillnetting. Only one of the two fish was within the target size range (<1m), and an age structure analysis confirmed it was a 15 year old fish. Both fish were caught at rkm 114.5 which is between two known over wintering sites (rkms 110 and 116). This site is within a meander of the Nechako River where conditions are ideal for rearing, as seen by white sturgeon capture records from previous years. Record high water flows in 2007 constrained the capture efficiency of

sampling methods but allowed gear deployment in "new" habitats normally not suitable in lower water conditions.

Gillnetting effort deployed in the 2007 program was similar to those of previous sampling years with effort hours totalling approximately 450 panel-hours for both shifts combined. Cod trapping was utilized daily along with the gillnetting in this program with effort totalling 5823 trap-hours for both shifts. Angling was used as a secondary technique during the 2007 program, and was only attempted when time allowed during both shifts.

A comparison between results observed via gillnetting and cod trapping was completed. It is evident that gillnetting is the more efficient fish capture method, but cod trapping appears to more effectively capture some species, and induces less direct mortality. There may be benefits achieved through increasing the amount of cod trapping effort, although 2 white sturgeon were captured via gillnetting in 2007, while cod trapping has yet to capture a single white sturgeon (2006 or 2007).

Recommendations

a. There are now four years of juvenile-focussed sampling data (2004-2007), encompassing years in which record high and record low flows were contended with. The four years of data should be summarized into a single report with recommendations for the format of an ongoing juvenile monitoring program.

b. Cod traps appear to offer some promise as an alternative method to gillnet sampling. There are a number of issues that need to be investigated further before increasing their use for the purposes of this program:
    i. They should be deployed in an environment with juvenile sturgeon present (either a rearing facility circular or a stream habitat) where fish behaviour can be observed, and traps could be modified in any manners that may be conducive to attracting and capturing juvenile sturgeon.
    ii. Smaller mesh sizes should be applied to the cod traps to determine the effect of mesh size on overall and species-specific CPUE.

c. Data forms utilized should be modified and updated to reflect both the needs of this program and to facilitate the entry of data into access databases.

i. Program staff should receive updated training related to sampling and data recording procedures.

d. All sampling related to this project should be completed by mid-October, depending on annual temperature and discharge variations in the Nechako River.

References

B.C. Conservation Data Centre, (BC CDC). 2002. http://srmwww.gov.bc.ca/cdc/tracking.htm

Carrier Sekani Tribal Council (CSTC). 2005. 2004 Assessment of Juvenile White Sturgeon (*Acipenser transmontanus*) Abundance and Distribution in the Nechako River; Development of an Index of Juvenile Recruitment. Prepared for the Nechako White Sturgeon Recovery Team. 35pp. + 5app.

Dixon, B.M. 1986. Ministry of Environment, Fisheries Branch. Age, growth and migration of white sturgeon in the Nechako and Upper Fraser rivers of British Columbia. Fisheries Technical Circular No. 70. Fish and Wildlife Branch, Prince George, B.C. 27p.

Environment Canada Website. 2008. http://scitech.pyr.ec.gc.ca/waterweb/fullgraph.asp

Golder Associates Ltd. 2003. Recovery Plan for Nechako White Sturgeon. Prepared for Nechako White Sturgeon Recovery Team, 73 pp.

Nelson, J., C. Smith, E. Rubidge, and B. Koop. 1999. Genetic Analysis of D-Loop Region and Microsatellite DNA of White Sturgeon from British Columbia – Population Structure and Genetic Diversity. Unpublished Report Prepared for B.C. Fisheries, Conservation Section, Victoria, BC.

Pollard, S. 2000. Fraser River White Sturgeon Genetic Results – Implications to Stock Structure. Unpublished Report Prepared for BC Fisheries, Conservation Section, Victoria, BC. 4p.

RL&L Environmental Services Ltd. 1996. Fraser River White Sturgeon Monitoring Program. 1995 Data Report. Prepared for BC Ministry of Environment, Lands and Parks, Fisheries Branch. Victoria, BC. RL&L Report No. 465F: 54 p. + 7 app.

RL&L Environmental Services Ltd. 1997. Fraser River White Sturgeon Monitoring Program. Region 7 (Omineca-Peace) – 1996 investigations. Prepared for BC Ministry of Environment, Lands and Parks, Fish and Wildlife Section, Prince George, BC. RL&L Report No. 520F: 78 p. + 7 app.

RL&L Environmental Services Ltd. 1998. Fraser River White Sturgeon Monitoring Program. Region 7 (Omineca-Peace) – 1997 Data Report. Prepared for BC Ministry of Environment, Lands and Parks, Fish and Wildlife Section, Prince George, BC. RL&L Report No. 565D: 36 p. + 6 app.

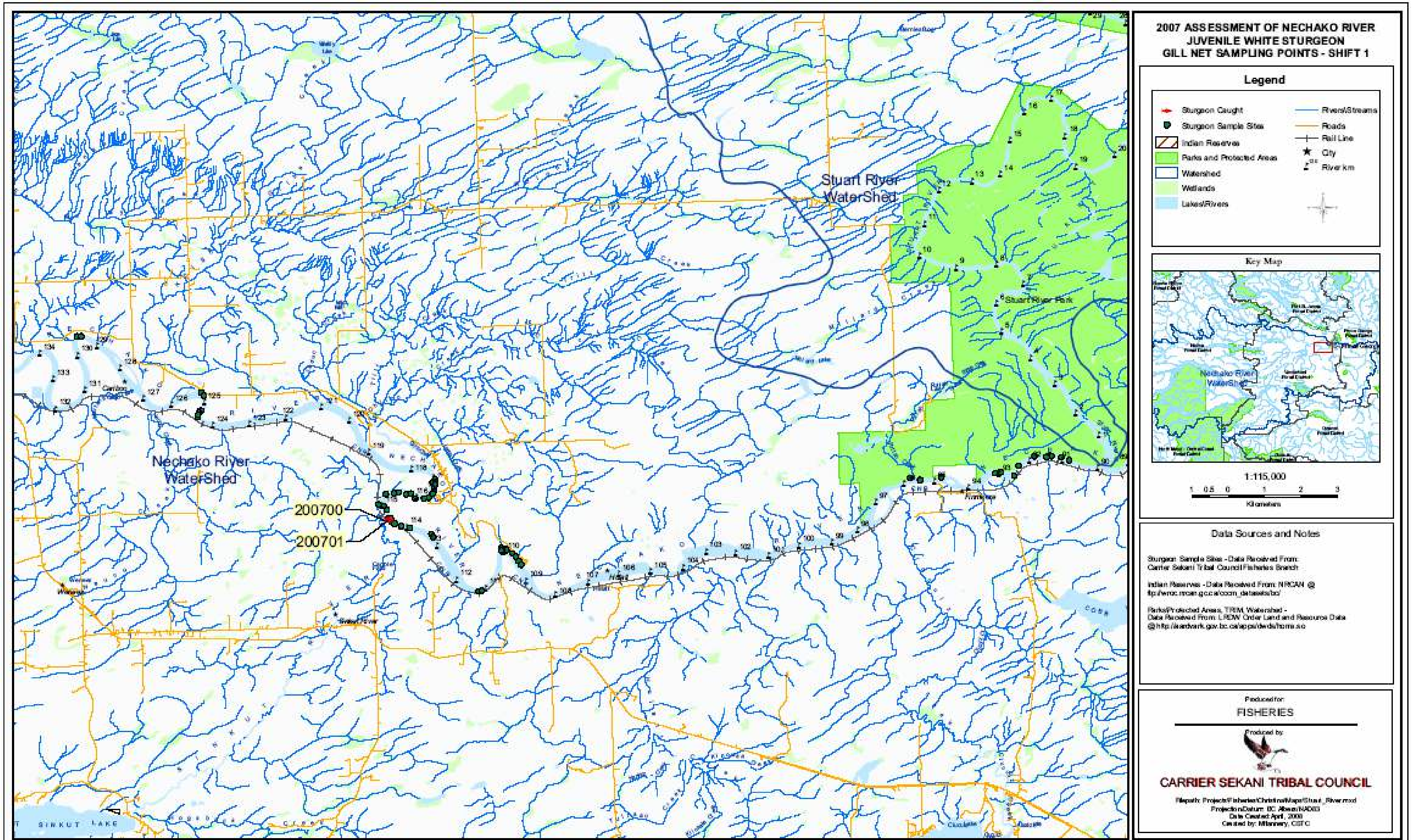
RL&L Environmental Services Ltd. 1999. Fraser River White Sturgeon Monitoring Program. Region 7 (Omineca-Peace) – 1998 Data Report. Prepared for BC Ministry of Environment, Lands and Parks, Fish and Wildlife Section, Prince George, BC. RL&L Report No. 646F: 26 p.

RL&L Environmental Services Ltd. 2000a. Fraser River White Sturgeon Monitoring Program. Region 7 (Omineca-Peace) – 1999 Data Report. Prepared for BC Ministry of Environment, Lands and Parks, Fish and Wildlife Section, Prince George, BC. 742F: 32 p.

RL&L Environmental Services Ltd. 2000b. Fraser River White Sturgeon Monitoring Program – Comprehensive Report (1995 to 1999). Final Report Prepared for BC Fisheries. RL&L Report No. 815F: 92 p. + app.

Smith, C.T., R.J. Nelson, S. Pollard, E. Rubidge, S.J. McKay, J. Rodzen, B. May and B. Koop. 2002. Population genetic analysis of white sturgeon (*Acipenser transmontanus*) in the Fraser River. Journal of Ichthyology 18 (2002): 307-312.

Appendix 1. Maps showing the distribution Sampling Efforts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JUVENILE WHITE STURGEON
GILL NET SAMPLING POINTS - SHIFT 1
Legend
Sturgeon Caught
Sturgeon Sample Sites
Indian Reserves
Parks and Protected Areas
Watershed
Wetlands
Lakes/Rivers
Rivers/Streams
Roads
Rail Line
City
River km
Key Map
1:115,000
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Kilometers
Data Sources and Notes
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Carrier Sekani Tribal Council Fisheries Branch
Produced for:
FISHERIES
Produced by:
CARRIER SEKANI TRIBAL COUNCIL
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Nechako River WaterShed
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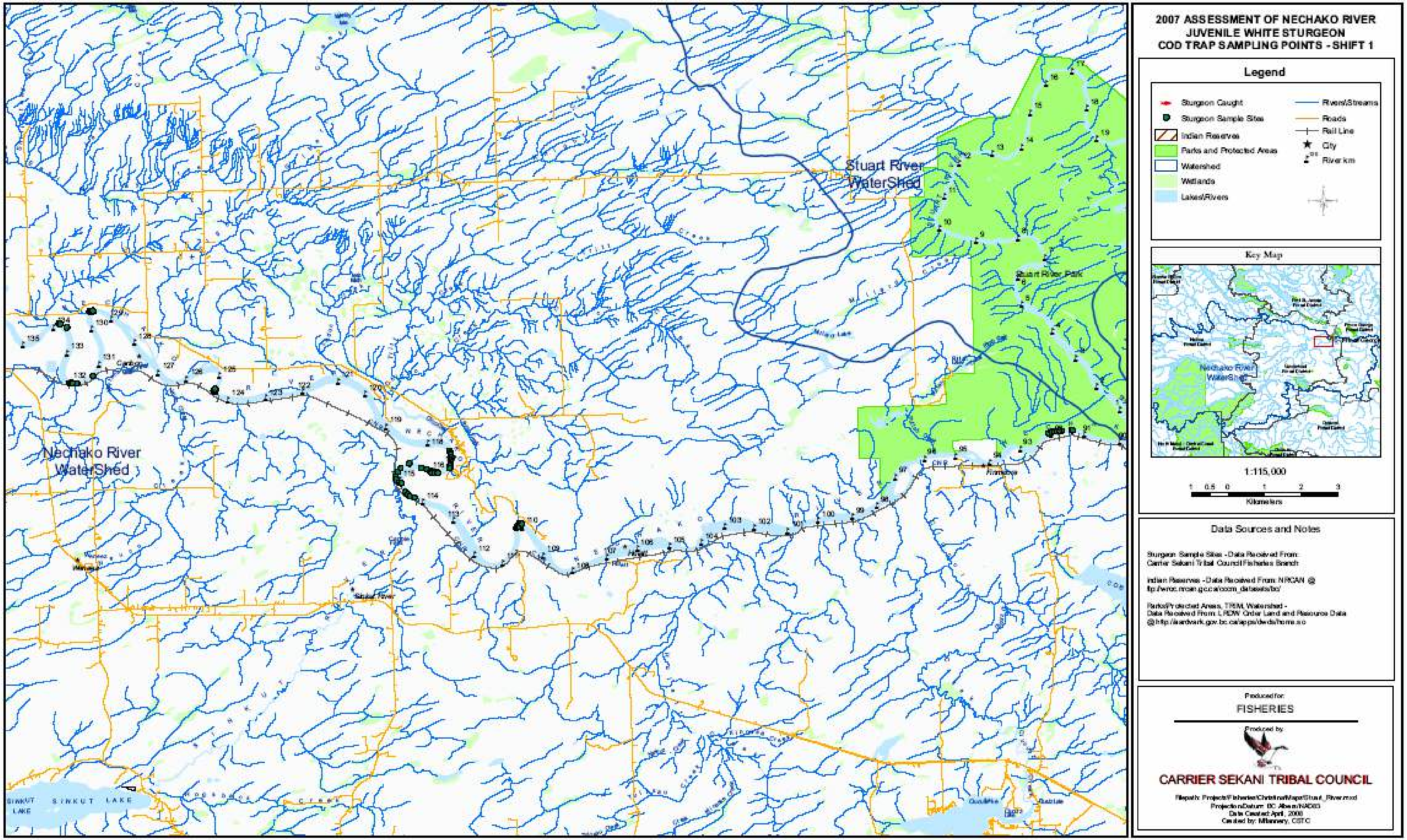
200701
Stuart River Park
SINKUT LAKE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JUVENILE WHITE STURGEON
COD TRAP SAMPLING POINTS - SHIFT 1
Legend
Sturgeon Caught
Sturgeon Sample Sites
Indian Reserves
Parks and Protected Areas
Watershed
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Rail Line
City
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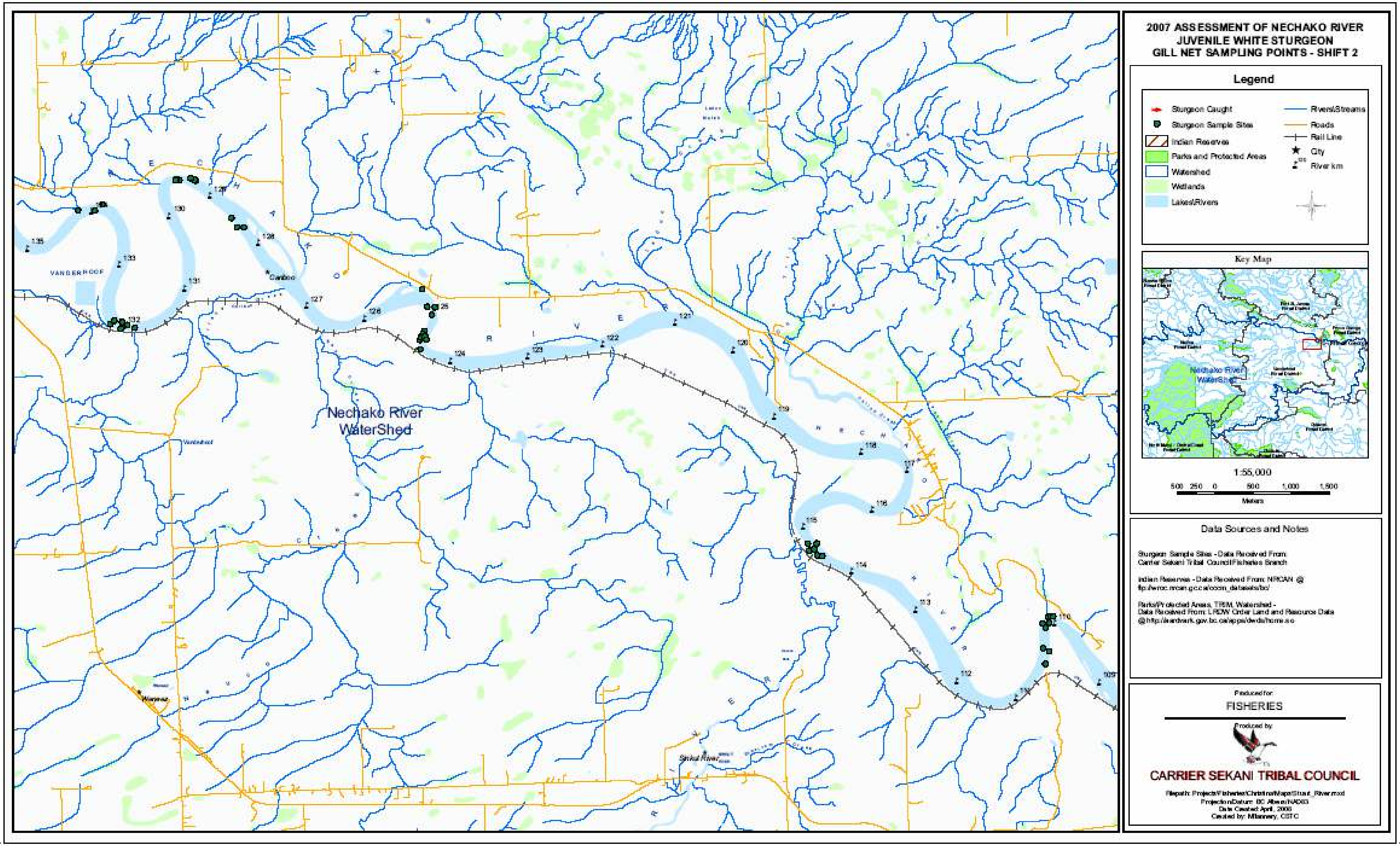
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Sturgeon Caught
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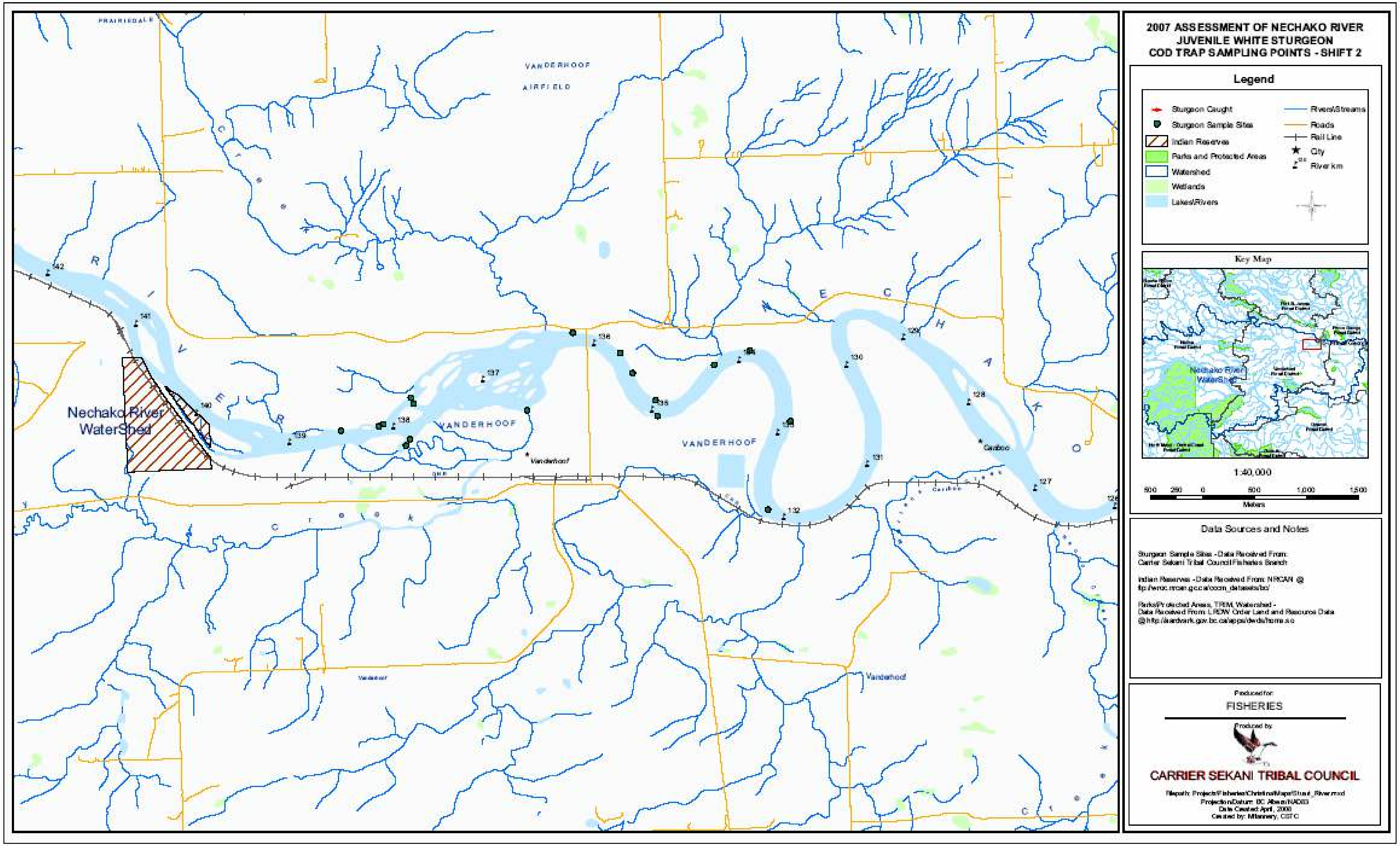
Nechako River
WaterShed
VANDERHOOF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River km
Key Map
Nechako River WaterShed
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Meters
Data Sources and Notes
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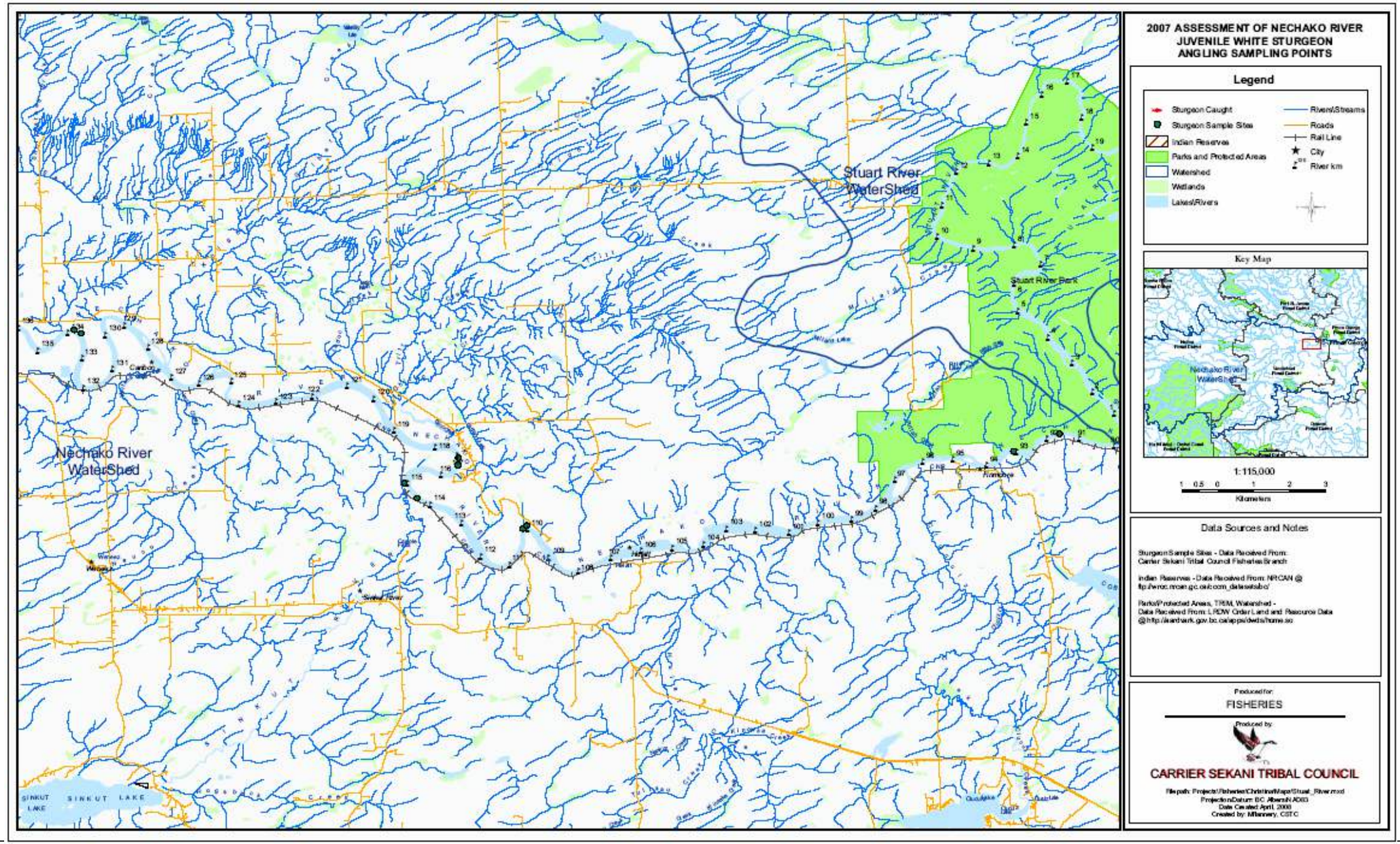
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