2005 Assessment of Juvenile White Sturgeon (*Acipenser transmontanus*) Abundance and Distribution in the Nechako River; Development of an Index of Juvenile Recruitment

Prepared for:

NECHAKO RIVER WHITE STURGEON RECOVERY INITIATIVE

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EXECUTIVE SUMMARY

Two sampling sessions were undertaken in the Nechako River in 2005; the first from August 29 to September 3 and the second from September 26 to 30. Sampling took place from rkm 134 (east of Vanderhoof) downstream to rkm 90.2 (at the Stuart River confluence) during each session. Standardized experimental-type small mesh gillnets were deployed throughout a range of habitat types within the study area. Each 37.2m^2 gillnet panel consisted of a (stretched) mesh size of either 3.81cm, 5.08cm, 6.35cm, 7.6cm, or 8.9cm. The majority of panels deployed were comprised of a monofilament mesh, however white cotton gillnet panels were also utilized. Deployed nets were comprised of 1 to 3 panels, subject to conditions at the sampling location and the habitat type observed by field crews.

Sampling effort in the first and second sessions resulted in 276.7 and 288.3 panel-hours respectively. A total of 9 "juvenile" white sturgeon between 70.5 cm and 126.5 cm total length were captured, three of which were re-captures. In addition, 1 adult sturgeon of 184 cm total length was captured. All basic morphological information was collected. All "new" fish received Floy and PIT tags, and three "new" juvenile sturgeon received internal radio tags. All sturgeon appeared to be healthy both at the time of capture and release. The 6 "new" juvenile sturgeon were aged at between 10 and 18 years. The "new" adult sturgeon captured was aged at 41 years. Juvenile sturgeon were captured throughout 33 km of the 43.8 km study area length, and capture depths of juvenile sturgeon varied from 3.2 m to 6.5 m.

1.0 INTRODUCTION

Sturgeon research activity within the Nechako watershed was initiated in 1986 by the Province of BC and continued throughout the late 1990's. The combined works indicated that recruitment failure within the Nechako white sturgeon sub-population was a critical issue and posed a significant risk to the long term maintenance of this stock group. The Nechako White Sturgeon Recovery Process was subsequently initiated in 2000.

Environmental Dynamics Inc. (EDI) was contracted by the Carrier Sekani Tribal Council (CSTC) to provide professional expertise for the purposes of completing a survey of juvenile white sturgeon abundance and distribution in the Nechako River. This ongoing work, initiated in 2004 by Alcan Primary Metals – B.C. and the CSTC, is critical for monitoring juvenile white sturgeon recruitment, creating a baseline of recruitment trends, assessing recruitment responses to recovery measures, and documenting habitat preferences (CSTC 2005).

1.1 Project Objectives

The objectives of this project were as follows:

1. Assess the abundance and distribution of juvenile[1] white sturgeon within the study area.
2. Based on capture locations, determine characteristics of juvenile sturgeon habitat.
3. Collect detailed biological and morphological information from all sturgeon captured, including tissue samples for DNA analysis.
4. Apply identifying tags (PIT and FLOY) to any "new" sturgeon captured.
5. Apply uniquely coded radio tags to "new" juvenile sturgeon captured to assist the recovery initiative with tracking migratory behavior and to better understand the critical juvenile habitats.
6. Determine if mesh size and/or composition creates bias in the catchability of juvenile sturgeon to specified gear types.

2.0 METHODOLOGY

2.1 Sampling Procedure

Sampling was conducted over two time periods; August 29 to September 3, 2005 and September 26 to September 30, 2005. Sampling occurred within the Nechako River mainstem between the town of Vanderhoof and the confluence of the Stuart River with the Nechako (Figure 1). Sampling efforts were synoptically distributed over a wide array of habitat types, with additional effort directed towards areas of known juvenile and adult white sturgeon use. Single or multiple panel small mesh gillnets were deployed in stretched mesh sizes of 3.81cm, 5.08cm, 6.35cm, 7.6cm and 8.89cm. Each gillnet panel was standardized at 2.4m x 15.2m (37.2m^2) and nets deployed consisted of 1-3 panels. Two mesh types were utilized; the predominant mesh type consisted of monofilament strand, the other was a white, multi-fibre cotton herring net. Both net types were sinking nets, however the herring net had a notably heavier lead line than that of the monofilament nets.

[1] Juvenile white sturgeon are considered any sturgeon less than 1 meter total length for research purposes (RL&L 1999).

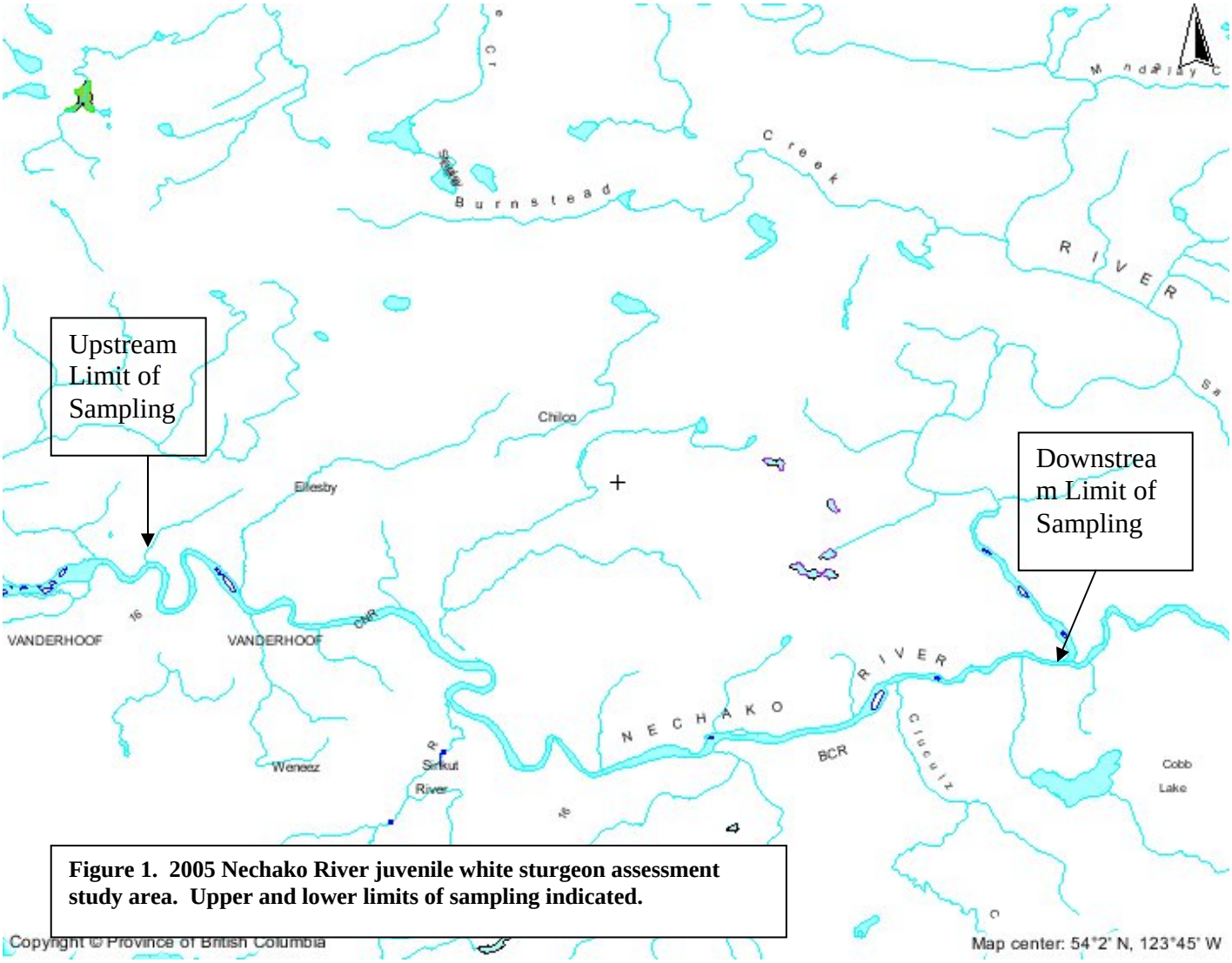


Figure 1. 2005 Nechako River juvenile white sturgeon assessment study area. Upper and lower limits of sampling indicated.

Gillnets were deployed either parallel or perpendicular to the flow, depending upon habitat characteristics and hydrologic conditions observed at the site. In areas where relatively low water velocities were observed, sets were made either parallel or perpendicular to the direction of flow; the orientation of the nets at these locations would be varied throughout the project. Nets were set parallel to the direction of flow in areas of higher water velocity, when large quantities of suspended organic materials were observed (to reduce net fouling), or along eddy lines (a location where the opposing directions of flow would likely render the net ineffective). Nets were 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. The gillnets were attached using a "bridal system" to both the anchor and the buoy rope, to ensure the net's lead-line was in contact with the substrate and to reduce the likelihood of the net collapsing due to water velocity (CSTC, 2005).

To maintain consistency with the 2004 program and to reduce the risk of harm to both sturgeon and other possible incidental species, nets were typically set for 1 hour, checked, all fish captured removed/released and reset for an additional 2 hours. If levels of by-catch were considered high (based on field crew professional judgement) sampling times were either reduced or nets removed altogether and reset at a different location. In areas where the likelihood of encountering adult sturgeon was high, set times were reduced to as short as 15 minutes. In all areas of sampling, nets were attended by the field crews in order to monitor net position and ensure that if an adult sturgeon was encountered (based on float movement) that the net would be pulled immediately and any sturgeon present sampled and released in a timely manner.

The use of standardized data forms, previously designed for an array of sturgeon sampling projects in the upper Fraser/Nechako watersheds, were again used for this project. Refer to Appendix 1 to view the data form template. These forms document site specific parameters and are also used for the collection of information pertaining to all fish captured.

2.2 Sturgeon and By-Catch Handling and Tagging Procedures

Sturgeon captured were immediately removed from gillnets and placed in a container filled with fresh water. If required, the nets were cut to assist in removing sturgeon. Additional water was added every 5 to 10 minutes if the sturgeon required holding for more than this amount of time. Sturgeon were placed in a water filled stretcher and externally examined for any unique physical attributes or evidence of previous tagging. This examination included scanning the entire animal for a PIT tag with an Avid Power Tracker II multi mode reader. Post-orbital, snout, fork, and total lengths along girth were obtained using a soft metric measuring tape. Weights of sturgeon were determined using either a calibrated Ohaus Scout 6000 gram capacity digital scale or a Berkley digital fishing scale. All “new” sturgeon received uniquely coded PIT (TX 1400L Destron 11.5mm x 2.1mm) and Floy tags, and if of appropriate size, fish were radio tagged. Radio tagged sturgeon received a uniquely coded Lotek MCFT-3A internal transmitter; some of which utilize the 1999 code-set. Sturgeon were not internally examined to determine sex or sexual maturity.

An age structure was removed from the leading fin ray of the left pectoral fin for all “new” sturgeon captured. A small sterile hack saw blade was used to make two cuts through the fin ray; the first approximately 1 cm from the articulation with the body wall and the second approximately 1 cm to 1.2 cm towards the terminal end of the fin ray. In addition, a small soft tissue sample was collected from the tip of the left pectoral fin for possible DNA analysis.

For the purpose of radio tag insertion, an incision was made offset of the ventral midline, adjacent to the fourth ventral scute. Prior to making the incision, the area was swabbed with betadine surgical scrub and all instruments (including the radio tag) were sterilized using a diluted isopropanol bath. All instruments were removed from the isopropanol and air dried to avoid damage to tissues exposed during the radio tag insertion procedure. All internal work associated with the implantation of radio tags was conducted wearing sterilized latex gloves. An incision of between 2 cm and 3 cm was sufficient to accommodate the radio tag. The antenna was threaded through the body wall posterior to the incision

with the aid of a 14 gauge cannula. The antenna was threaded through the cannula and the cannula was removed. The antenna remained trailing to the posterior of the sturgeon along the ventral surface of the animal. Absorbable sutures (2/0 PDS II – CP 2) were used to close the incision with a combination of mattress and simple stitches.

Total handling time for sturgeon not fitted with an internal radio tag averaged 15 minutes. Processing time averaged 25 to 30 minutes if a radio tag was deployed. A more comprehensive description of sturgeon sampling and tagging methodologies is available in CSTC (2005).

Species other than sturgeon captured (by-catch) were also removed to water-filled containers, and sorted according to the mesh size and type in which they were captured. By-catch were processed in a timely fashion by field crews, specifically documenting species, fork length (sub-sample), mesh size and mesh type with which they were captured and individual fate recorded.

2.3 Habitat / Site Characteristics

Upon setting gillnets at any location, the site was described briefly utilizing the header information provided on the data form (Appendix I). Information recorded included the range of depths covered by the set, water temperature (^{o}C), visibility (m), and a basic description of the site and weather conditions.

In addition, a sketch of the site was prepared, and notable site attributes at the landscape level were noted. Included with the diagram was the location and direction of the set relative to the flow.

At every site, maximum and minimum set depths and water temperature were documented. To obtain these values, either a Garmin or Cuda fish finder (through the transducer) was used. A UTM coordinate was also recorded for each set, to assist future sampling efforts. Secchi depths were obtained daily and measurements were taken on the shaded side of the boat, with the observer not wearing any sunglasses.

2.4 Age Structure Mounting and Analysis

Fin rays (aging) structures were submitted to Ministry of Environment staff who contracted sectioning and mounting services from Sheldon Reddekop of SKG consulting; whom conducted the initial read of the aging structures. EDI staff provided a secondary read of the structures. Structures were read with the aid of a dissecting microscope with light table capability. A description of aging structure preparation and analysis is available in CSTC (2005).

3.0 RESULTS

During both sampling sessions, sampling efforts were conducted between rkm 134.0 (east of Vanderhoof) downstream to rkm 90.2 (near Stuart River confluence). Based on capture success rates in 2004, this area was identified as containing the majority of suitable white sturgeon habitats. In addition, given the limited number of days available for sampling and the Recovery Initiative's interest in identifying index sites for future work (i.e. for the purpose of tracking recovery efforts), this 43.8 km length of river was a suitable focus for the 2005 program

3.1 Physical Conditions of the Nechako River at time of Sampling

Values for daily average water temperature and discharge were obtained from the Environment Canada's hydrometric website. As indicated in Figure 2, discharge had rapidly declined due to the completion of the Summer Temperature Management Plan (STMP) flows. Temperatures were also collected by each field crew at the time of every gillnet set and reset. As these values varied slightly between crews and throughout the day with varying weather conditions, values were averaged for each session and crew; the results of which are presented in Figure 3. The general temperature trends observed in the field closely resemble the thermograph-based averages presented in Figure 2.

Secchi depths were obtained once daily by field crews. These values did not change significantly on a daily basis, though some variation between readings did occur due to conditions such as cloud cover, individual reader abilities, etc. Despite daily variation, there was a notable trend towards higher levels of visibility during the sampling session in late September (Figure 4).

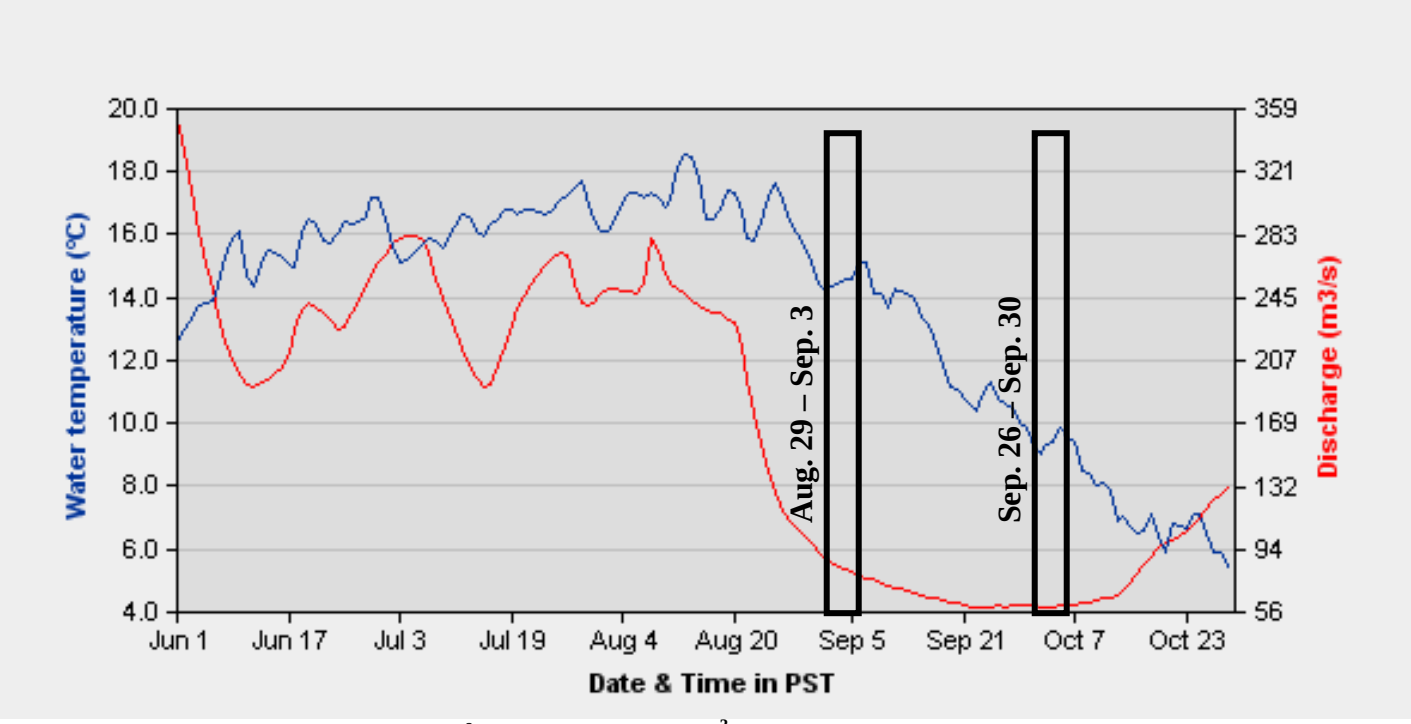


Figure 2. Daily average temperature (°C) and discharge (m^3/s) for the Nechako River at Vanderhoof recorded by Environment Canada hydrometric station 08JC001 (2006) and approximate conditions under which sampling occurred.

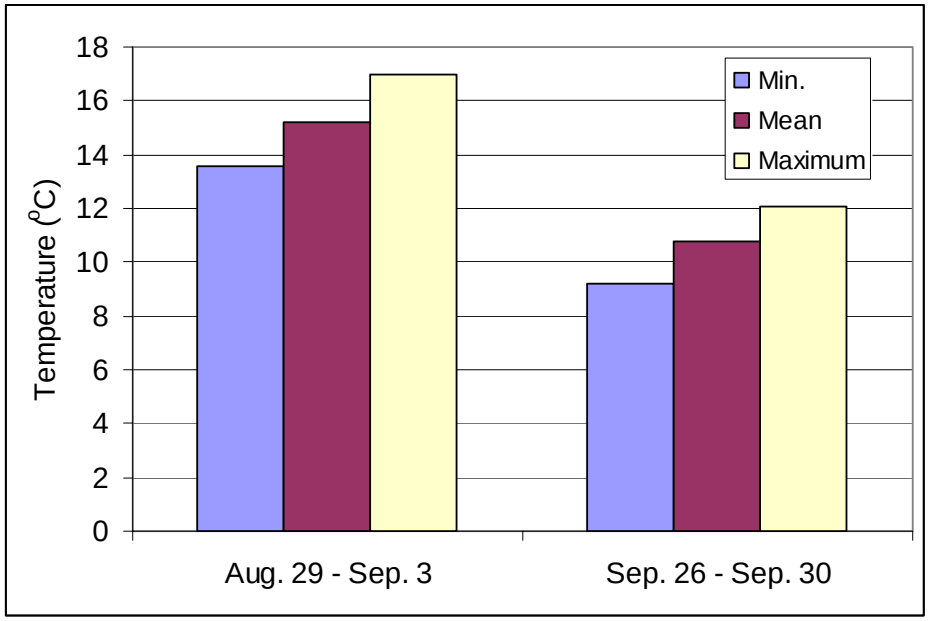


Figure 3. Temperature averages (°C) for the two boat crews for each sampling session. Presented are the weekly averages for minimum, mean and maximum values obtained.

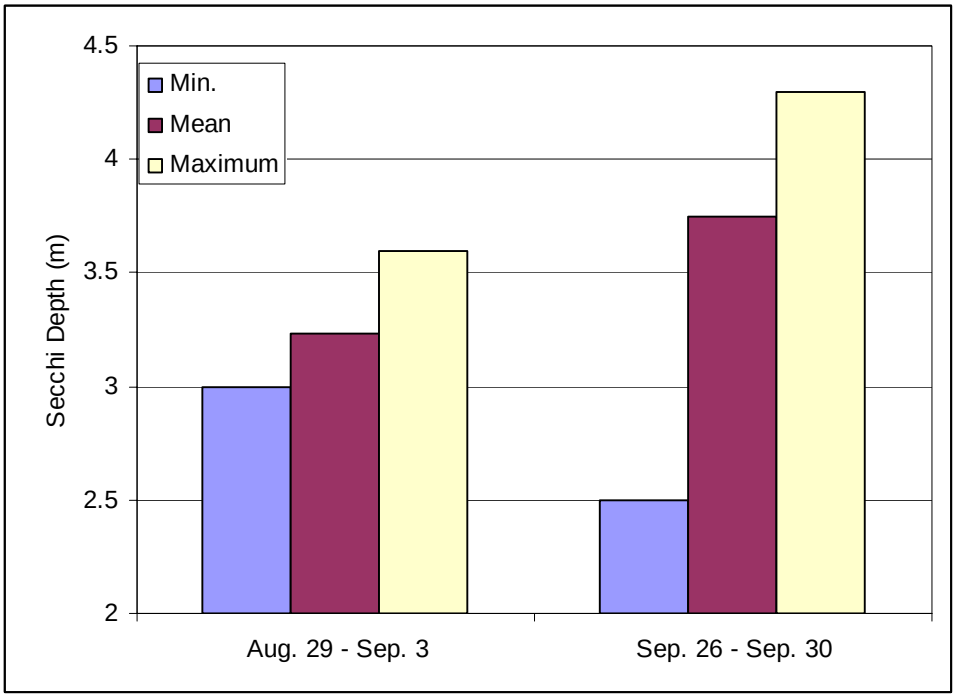


Figure 4. Secchi depth averages (m) for the two sampling sessions presenting average session minimum, mean and maximum values obtained.

3.2 August 29 – September 3 Sampling Session

Sampling efforts during the first sampling session were conducted between rkm 134.0 (east of Vanderhoof townsite) downstream to rkm 90.2 (Stuart River confluence). Sample site locations were typically the same as those of the 2004 project year, with some additional effort directed towards "new" sites. New sites were sampled as a result of varying water levels and/or based observations made by field crews. These efforts towards new sites ensure critical habitats are not overlooked, or may provide the opportunity to identify areas for future sampling.

Table 1 summarizes the effort deployed during the first sampling session and provides information pertaining to sturgeon captured, by-catch and Catch per Unit Effort (CPUE), related to mesh size and type.

3.3 September 26 – September 30 Sampling Session

Sampling efforts during the second sampling session were also conducted between rkm 133.9 (east of Vanderhoof townsite) downstream to rkm 90.2 (Stuart River confluence). As with the first session, sample site locations were typically the same as those of the 2004 project year, with some additional effort directed towards new sites. Table 2 summarizes the efforts deployed during the second sampling session and provides information pertaining to sturgeon captured, by-catch, and CPUE, related to mesh size and type.

Table 1. First sampling session effort and CPUE (August 29 to September 3).

August 29 – September 3															
Mesh Size (cm)	Total Panel Hours Effort **mono**	Total Panel Hours Effort **herring**	Panel Area (m^2)	Hours fished for Net Area/m^2 **mono**	Hours fished for Net Area/m^2 **herring**	No. WSG **mono**	No. WSG **herring**	No. By-Catch **mono**	No. By-Catch **herring**	Total No. Fish	By-Catch CPUE (per 100m^2/hr) **mono**	By-Catch CPUE (per 100m^2/hr) **herring**	WSG CPUE (per 100m^2/hr) **mono**	WSG CPUE (per 100m^2/hr) **herring**	Total CPUE (per 100m^2/hr) all fish and both net types
3.81	9.61		37.2	357.5				6		6	1.68				1.68
5.08	22.9		37.2	851.9				10		10	1.17				1.17
6.35	115		37.2	4278		1		75		76	1.75		0.023		1.78
7.62	49.9	15.3	37.2	1856.28	569.96			14	3	17	0.75	0.53			0.7
8.9	57	6.95	37.2	2120.4	258.54		2	25		27	1.05			0.77	1.14

Table 2. Second sampling session effort and CPUE (September 26 to 30).

September 26 – September 30															
Mesh Size (cm)	Total Panel Hours **mono**	Total Panel Hours **herring**	Panel Area (m^2)	Hours fished for Net Area/m^2 **mono**	Hours fished for Net Area/m^2 **herring**	No. WSG **mono**	No. WSG **herring**	No. By-Catch **mono**	No. By-Catch **herring**	Total No. Fish	By-Catch CPUE (per 100m^2/hr) **mono**	By-Catch CPUE (per 100m^2/hr) **herring**	WSG CPUE (per 100m^2/hr) **mono**	WSG CPUE (per 100m^2/hr) **herring**	Total CPUE (per 100m^2/hr) all fish and both net types
3.81	13.8		37.2	513.4				1		1	0.19				0.19
5.08	33.5		37.2	1246.2				28		28	2.25				2.39
6.35	129		37.2	4798.8		2		95		97	1.98		0.042		2.02
7.62	68.5	7	37.2	2548.2	260.4	2	2	30	3	37	1.18	1.15	0.08	0.77	1.32
8.9	36.5		37.2	1357.8		1		37		38	2.72		0.074		2.8

3.4 Summary of Sturgeon Bio-physical and Tagging Data

A total of 10 sturgeon were captured as a result of efforts in the summer/fall program of 2005. Nine of these sturgeon are referred to as "juveniles" throughout this report (despite total lengths greater than 1 meter in some cases), and one was an adult. Refer to Table 3 below for a summary of bio-physical and tagging parameters. Individual sturgeon data are presented in Appendix II.

Table 3. Summary of bio-physical and tagging information for sturgeon captured in the 2005 program.

Date	Station	Capt. Mesh Size (cm)	Fork Length (cm)	Total Length (cm)	Girth (cm)	Wt. (kg)	Age in years (EDI Est., Consultant)	Tags at Capt.	Tags at Release	FLOY Tag Colour and No.	PIT Tag No.	Radio Tag Freq.	Radio Tag Code
31-Aug-05	GN116.0L	7.62hn	109.5	126.5	38.5	7.6	18/18	N-N-N	ft-pt-rt	R2049	42360E1A0F	149.770	18
1-Sep-05	GN116.0M	7.62hn	91	104.5	32	4.4	11/11	N-N-N	ft-pt-rt	R2047	422E40300F	149.770	26
3-Sep-05	GN91.3R	6.35	62.5	70.5	23.5	1.51	11/10	N-N-N	ft-pt	G00096	422E44015D		
26-Sep-05	GN124.6L	7.62						ft-pt-rt		R2047	422E40300F	149.770	26
27-Sep-05	GN116.1R	7.62hn	92.5	107.5	33.5	4.9	10/10	N-N-N	ft-pt-rt	R2046	4240131D34	149.440	9
27-Sep-05	GN116.1R	7.62hn	165	184	61	31.3	41/38	N-N-N	ft-pt	R2045	501F651016		
28-Sep-05	GN116.0M	8.9	94	107.5	35	5.1	15	n-n-rt	ft-pt-rt	R2044	5020145C2D	148.380	2
28-Sep-05	GN116.0M	6.35	70	78.5	25	1.91	10	ft-pt		R2007	424E087403		
28-Sep-05	GN116.0M	6.35	95.5	110	33	4.7	11/11	N-N-N	ft-pt	R2043	5O27275953		
28-Sep-05	GN116.0M	7.62	102	118	37.5	6.3	15/16	N-N-N	ft-pt	R2042	422E42571F		

3.5 Summary of Juvenile Sturgeon Recapture Data

Three of the juvenile sturgeon captured in 2005 had been tagged previously. One recapture (Floy Tag No. R2047) (Table 3) was initially tagged during this project on September 1 at rkm 116.0, the over-wintering site. It was recaptured three weeks later at rkm 124.6 at the secondary over-wintering site. The incision scar associated with the deployment of the radio tag was in the process of healing, all sutures were still intact and the incision was clean and free of any signs of irritation. The Floy and PIT tags deployed were still secure and the age structure removal site on the left pectoral fin appeared to be healing well.

Two recaptures were collected in a single set on September 28, 2005 at rkm 116.0. One fish had a surgery scar indicating it had been previously captured and tagged. Though it was thoroughly scanned for a PIT tag, none was detected. In addition, a Floy tag was absent. The internal radio tag was still active, with a Frequency of 148.380, Code 2. This fish had been previously captured and tagged on September 23, 2004 at rkm 114.7 adjacent to the Sinkut River. New Floy and PIT Tags were deployed (refer to Table 3). Physical changes noted from 2004-2005 for this individual included:

- Fork Length had increased from 83 cm to 94 cm
- Total Length had increased from 101 cm to 107.5 cm

- Weight had increased from 4173 g to 5100 g

The second juvenile recaptured on September 28, 2005 had been previously captured and tagged during the 2004 project on July 27 at rkm 110.1. Both Floy (Tag No. R2007) and PIT tags were in place, and the age structure removal site on the left pectoral fin had healed well. This particular fish did not receive a radio tag in 2004. Physical changes noted from 2004-2005 included:

- Fork Length had increased from 66 cm to 70 cm
- Total Length had increased from 74 cm to 78.5 cm
- Weight had increased from 1882 g to 1910 g

3.6 Age Structure Analysis

The results of the age structure analysis conducted by both readers are included in Table 3. One age structure obtained (Floy Tag No. R2042) was difficult to read and the estimated age should be considered approximate. Ages for two juveniles sturgeon recaptured from the 2004 project are included based on aging completed in 2004.

3.7 Recruitment Patterns

It is interesting that 4 of the 7 fish captured and aged in 2005 were within the 10-11 year old range, (Table 3). Figure 5 presents the number of fish captured during the 2004-2005 project years and displays these results relative to their year of recruitment. There appears to be a period of time in the mid 1990's where cohorts are appearing more frequently in the catch than in other years. However, due to the relatively small sample size it is difficult to place any confidence in this trend.

In order to further investigate potential reasons for the absence of recruits from certain years, we compared the mean monthly discharge at Vanderhoof for May from 1985 to 2004 with the number of juvenile sturgeon captured in the 2004-2005 project years, relative to the year of recruitment (Table 4). There appears to be a correlation between higher levels of discharge during the early part of the spawning period and successful long-term recruitment of juvenile sturgeon. An analysis was conducted of the daily discharge curves at Vanderhoof recorded by Environment Canada for the period in question. These data indicate that during years in which sturgeon have been shown to have successfully recruited into the population, there is a sharp spike in and around the 180 m^3/s range during the early part of May. These abrupt increases in discharge are absent from the hydrograph in years that are missing cohorts from the 2004/2005 catch data.

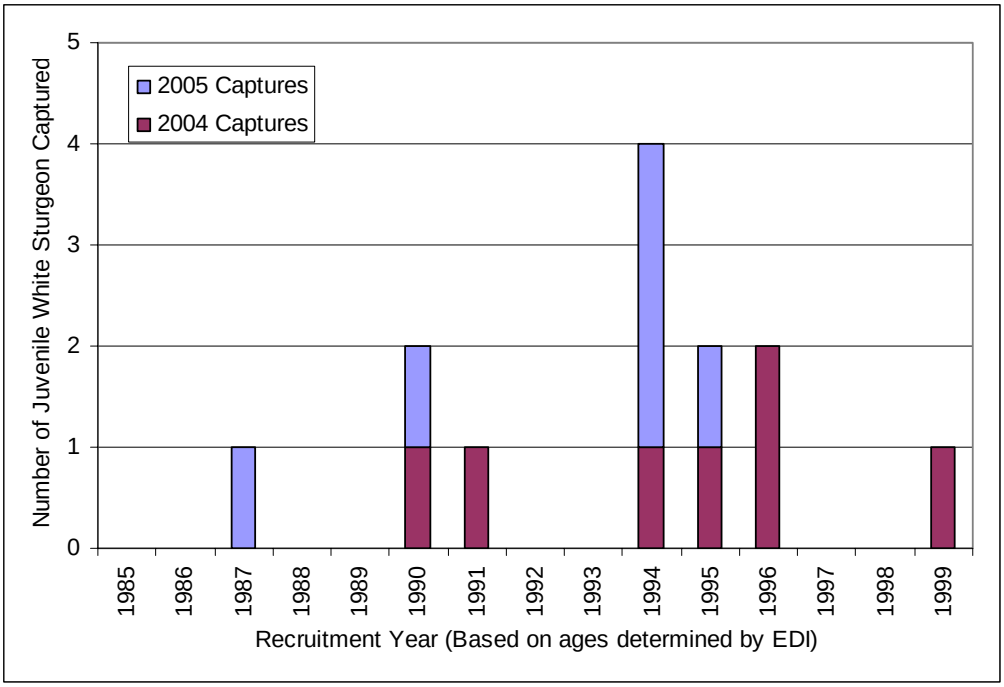


Figure 5. Number of fish captured during the 2004 and 2005 project years relative to their recruitment year.

Table 4. Mean discharge (m^3/s) for the month of May, sorted by ascending discharge rates, and number of recruits produced (based on 2004 and 2005 captures).

Mean Monthly Discharge for May (cms)	Year	Number of WSG Recruits	Comments
104	1988		
105	2003		
107	2001		
112	2000		
112	1986		
123	2004		
133	1985		
135	1993		
139	1989		
144	1992		
147	1998		
155	1987	1	
160	1995	2	
161	1991	1	
173	1999	1	
192	1994	4	
196	1990	2	
216	2002		Late spike (end of May) skews the monthly mean.
223	1996	2	
464	1997		Extremely high water from May 1 to August 20 (over 400 cms)

3.8 Capture Locations – Habitat Types

Despite the variability of capture depths, juvenile white sturgeon were typically captured within the deepest habitats available at the sample site. Seven juveniles were captured at or within close proximity to rkm 116; the other 2 were captured at rkm 124.6 and rkm 91.3. All capture sites were relatively deep (as compared with the surrounding habitats). All three locations were hydraulically influenced by a natural feature such as a bend or point. Streamflow dynamics at these locations were characterized by a defined thalweg that acted to maintain deep scour zones, associated with slow-moving back eddies that created depositional areas. These habitat types are often selected for summer and winter rearing by white sturgeon throughout the Fraser and Columbia watersheds.

3.9 By-Catch

A detailed analysis of by-catch was not considered within the scope of EDI's work with the 2005 project. The following Tables 5 and 6 summarize by-catch statistics resulting from the 2005 project.

Table 5. Summary of by-catch data for the 2005 project; both sessions combined.

By-Catch Species	Min Fork Length (mm)	Max Fork length (mm)	No. Captured	No. Released	No. Mortalities
BT	390	700	12	6	6
CC	140	140	1	1	0
CSU	165	445	32	32	0
LSU	269	412	8	8	0
MW	232	363	19	18	1
NSC	155	460	186	184	2
PCC	170	333	42	39	3
RB	334	334	1	1	0
SK	537	650	10	7	3

Table 6. Total by-catch CPUE and sport fish CPUE by mesh type for all species and effort combined in 2005.

Total Panel hours **mono**	Total panel Hours **herring**	Panel Area (m^2)	Hours fished for Net Area/m^2 **mono**	Hours fished for Net Area/m^2 **herring**	Total Number By-catch **mono**	Total Number By-catch **herring**	By-Catch CPUE (per $100m^2$/hr) **mono**	By-Catch CPUE (per $100m^2$/hr) **herring**	Sport Fish By-Catch CPUE (per $100m^2$/hr) **mono**	Sport Fish By-Catch CPUE (per $100m^2$/hr) **herring**
535.71	29.25	37.20	19928.41	1088.10	306.00	6.00	1.54	0.55	0.21	0.00

4.0 DISCUSSION

Despite the dominance of older adult fish observed within the adult white sturgeon population of the Nechako River, which may be indicative of poor levels of recruitment, the capture of 6 "new" juvenile white sturgeon in the 2005 season coupled with the 7 "new" sturgeon of the 2004 project, suggests that recruitment is occurring periodically at very low levels. Determination of the conditions under which recruitment was occurring is beyond the scope of this project, however we believe that a daily average discharge above 180 m^3/s in May during the putative spawning period (Triton 2004), when correlated to the recruitment year of juveniles captured, may warrant further investigation.

Eight of the 10 sturgeon captured in 2005 were found near the overwintering site at rkm 116.0. This appears to demonstrate that there is a high degree of seasonal selection by juvenile sturgeon towards the use of this area. As the majority of adult sturgeon migrate to this location during the fall, and congregate within this area until the spring, it is not surprising that the majority of juveniles also select for this habitat type and location during this time period. The captures of the juveniles at rkm 91.3 and rkm 124.6 indicate that there are other habitats available and occupied by juvenile sturgeon during the time periods under which sampling occurred. Similar to the overwintering site at rkm 116.0, the sturgeon captured at both rkm 91.3 and rkm 124.6 could be described as associated with deeper, eddy-type habitats. Both fish were captured in depths in excess of 5 metres. At both locations, points create deep slow eddies with a measure of reversed flow. Substrates and small amounts of woody debris indicate areas of moderate deposition; again supporting the preference of juvenile sturgeon for deep, low velocity habitats. One potential bias noted is that of site selection by field crews as it relates to successful gear deployment. Areas of higher velocity were typically avoided as the gear would often drift out of place and quickly foul. For this reason, alternative methods of sampling these habitat types should be explored.

No 2.54 cm (1") panels and limited hours of the 3.81 (1.5") mesh sizes were deployed in the 2005 project as a result of higher levels of by-catch CPUE observed with smaller mesh in the 2004 season. It was believed that based on the mesh sizes resulting in the capture of sturgeon in 2004, that this decision would not likely reduce the potential for sturgeon captures in the target size range. The susceptibility of sturgeon to the larger mesh sizes (fish in the 60 cm to 120 cm fork length range) was supported by the captures of the 2005 project. One concern raised during the 2005 project was the absence of fish under 60 cm fork length. Several questions were considered:

1. Do small sturgeon (< 50 cm FL) recruit at higher rates to the smaller mesh sizes?

2. Are there swimming performance or other issues which may prevent or reduce the recruitment rate of smaller sturgeon (<50 cm FL) to our gear types?

3. Are there preferred habitat types that we are overlooking?

To assist in addressing these questions, Mr. V. Paragamian of the Idaho Department of Fish and Game was contacted to provide his perspective on mesh size selectivity and juvenile white sturgeon. This agency annually conducts an extensive recruitment monitoring program. The response to all three of these inquires was no. Based on Mr. Paragamian's experience on the Kootenai River, mesh sizes similar to those deployed on the Nechako River in 2005 do not appear to be heavily selective in any direction; sturgeon as small as 20 cm recruit to the larger mesh sizes. Sturgeon in the 18 cm to 20 cm length range are typically captured in areas where larger sturgeon are known to congregate, supporting the present level of effort which is, to some extent, guided by our understanding of adult habitat preferences in the Nechako. Mr. Paragamian believed that juvenile sturgeon densities in the Nechako are potentially low enough that mere random chance may be a sufficient explanation as to the absence of fish under 60 cm having recruited to gear presently deployed. It was recommended that alternative capture techniques be explored, including the use of trap or hoop nets (Paragamian 2006, Pers. Comm).

Slight differences (between readers) in the ages determined for the sturgeon captured are the result of potentially poor mounts (some structures were quite thick). Older sturgeon or factors such as trauma to the leading fin ray make the reading of annuli more complicated, hence some variation in the age analysis process. Four of the 7 sturgeon aged in the 2005 project were given the same age by both readers, two varied by only 1 year and one sturgeon (the largest/oldest adult captured) was aged with a three year discrepancy between reader estimates.

DNA analysis has not been completed on the 2005 samples.

As indicated in Tables 1 and 2 above, by-catch CPUE did not strongly correlate to any one mesh size, however the CPUE did vary slightly by mesh type. It appears that the herring mesh exhibits a lower by-catch CPUE, based on results compiled in Tables 1, 2, and 6. In addition, there does appears to be a potential trend with a reduced sport fish by-catch CPUE as it relates to the mesh type (mono-filament versus white herring net) as per Table 6. The low levels of mortality observed within the by-catch summary (Table 4) are based on the individual fishes' ability to swim away from the boat. Field crews did observe poor swimming performance based on injury related to capture and the delayed mortality rate is likely to be higher than the documented rate. A detailed analysis of the effects of the project on by-catch were not considered within the scope of this project

5.0 RECOMMENDATIONS

- Continue the experimental gillnetting/index project within the Nechako River. Based on results discussed in Section 3.7, further investigate the relationship between recruitment year and discharge patterns.

- Baited hoop-nets should be experimented with. This technique would greatly increase effort and permit sampling in habitats not feasibly sampled via conventional gillnets.

- Intensive radio tag tracking efforts should be conducted throughout May, June and July, specifically focusing on the tagged juveniles, to document habitat preferences and migratory behaviour.

- As in the 2004 project, test the potential difference in CPUE with day and night sampling sessions in areas where juvenile white sturgeon have been historically documented.

- Expand the use of the white herring nets. It appears that they may reduce the interception rate of both sport and non-sport fish while maintaining or possibly increasing the capture rate of juvenile white sturgeon.

6.0 REFERENCES

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 Initiative, Prince George, BC: 34 p + app.

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. 2006. http://scitech.pyr.ec.gc.ca/waterweb/fullgraph.asp

Paragamian, V.L. 2006. Fisheries Research Biologist, Idaho Department of Fish and Game. Boise, ID, Personal Communication.

Province of British Columbia Website. 2006. http://maps.gov.bc.ca/

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.

APPENDIX I

Gillnet Effort Data Form Template - Front and Back

Front of Gillnet Data Form

WHITE STURGEON DATA FORM - GILLNET (GN)

Project No._____

Page_____of_____

PHYSICAL DATA:

River:_____ Station:_____ River km:_____ UTM:_____E_____N Set Type (circle) Index Synoptic

Personnel:_____ Channel Location:__UB Site Description:_____ Weather:_____

SET: 2005/_____/_____@_____h Water Temp:____ºC Visibility:_____m Depth: _____m (Min) _____m (Max)

PULL: 2005/_____/_____@_____h Water Temp:____ºC Visibility:_____m Total Effort:_____h

Net Type: Gill Tangle Net Length:_____ Panel Length:_____ Panel Height:_____ Overall Net Area:_____

Mesh Sizes:_____,_____,_____,_____,_____ Condition:_____ Set Orientation:_____ Set Location: Bottom Mid Surface

BIOLOGICAL DATA: **Sampling Efficiency (1-4):_____ (1=poor; 4=excellent)**

				Morphological Characteristics											TAG DATA			
No.	Depth (m)	Hook Size	Sex Mat. Code	Fork Length (cm)	Total Length (cm)	Snout Length (cm)	Post-Orbital Length (cm)	Girth (cm)	Weight (lbs)	DNA Sample (location taken)	Fish Disposition	Tags @ Capture	Tags @ Release	Mark @ Capture	Mark @ Release	C.	Floy Tag No.	PIT Tag Size	PIT Tag No.
1											-	- -	-						
1																			
2											-	- -	-						
2																			
3											-	- -	-						
3																			
4											-	- -	-						
4																			
5											-	- -	-						
5																			
6											-	- -	-						
6																			
7											-	- -	-						
7																			
8											-	- -	-						
8																			

Back of Gillnet Data Form

Comments: _____

		Velocities (m/s)					
Station	Depth	Bottom	0.2	0.6	0.8	Surface	Substrate
Nearshore							
Mid							
Offshore							

MAP: (Show shore configuration, flow patterns, set locations, velocity, locations of measurement, substrate types, bank habitat, etc.)

INCIDENTAL SP:

Species	Length	Weight	Sex	Tag	Cap Code	Age Structure	Sample #	Fate	Hook Size	Comments

APPENDIX II

Sturgeon Bio-physical and Tagging Data

Capture Location Information							Physical Characteristics									Tagging Information								
		UTM																						
Date	Station	Zone	Easting	Northing	Capt. Depth (m)	Capt. Mesh Size	Sex Mat. Code	Post Orbit. (cm)	Snout (cm)	Fork Length (cm)	Total Length (cm)	Girth (cm)	Weight (kg)	DNA Taken?	Fish Disp.	Tags at Capt.	Tags at Release	Mark at Capt.	Mark at Release	FLOY Tag Colour and No.	PIT Tag No.	Radio Tag Freq.	Radio Tag Code	Comments
31-Aug	GN116.0L	10	445614	5982218	6.5	3.5hn	97	14	27.5	109.5	126.5	38.5	7.6	Y	S-AO	N-N-N	ft-pt-rt	n	LP	R2049	42360E1A0F	149.770	18	Split nares, four barbles, no evidence of previouse tags, excellent condition.
1-Sep	GN116.0M	10	445605	5982224	5.5	3.5hn	97	11.5	22.5	91	104.5	32	4.4	Y	S-AO	N-N-N	ft-pt-rt	n	LP	R2047	422E40300F	149.770	26	No sign of recap., 4 barbles, split nares, little bit of blood in left eye - not serious. Tear in dorsal fin, both leading pectoral fin ray are warped. 30 min total processing time.
3-Sep	GN91.3R	10	462970	5982699	5.6	2.5	98	8	16	62.5	70.5	23.5	1.51	Y	B-AU	N-N-N	ft-pt	n	LP	G00096	422E44015D			4 barbles, double nares, tear on dorsal fin, left pertoral rin mark, tiny amout of blood trauma (left eye), too small to accommodate radio tag.
26-Sep	GN124.6L	10	439748	5984849	6	3								N		ft-pt-rt	ft-pt-rt	LP	LP	R2047	422E40300F	149.770	26	Re-capture. Fish looks healthy, sutures look good, fin looks in good shape. Tagged three weeks ago.
27-Sep	GN116.1R	10	445622	5982317	4	3hn	97	24	12.5	92.5	107.5	33.5	4.9	Y	S-AO	N-N-N	ft-pt	n	LP	R2046	4240131D34	149.440	9	No distinguishing marks, healthy.
27-Sep	GN116.1R	10	445622	5982317	4	3hn	97	19.5	41	165	184	61	31.3	Y	S-AO	N-N-N	ft-pt	n	LP	R2045	501F651016			No scars or distinguisging marks. Net marks on fins, four barbles, double nares.

Capture Location Information							Physical Characteristics									Tagging Information								
		UTM																						
Date	Station	Zone	Easting	Northing	Capt. Depth (m)	Capt. Mesh Size	Sex Mat. Code	Post Orbit. (cm)	Snout (cm)	Fork Length (cm)	Total Length (cm)	Girth (cm)	Weight (kg)	DNA Taken?	Fish Disp.	Tags at Capt.	Tags at Release	Mark at Capt.	Mark at Release	FLOY Tag Colour and No.	PIT Tag No.	Radio Tag Freq.	Radio Tag Code	Comments
28-Sep	GN116.0M	10	445588	5982284	4.1	3.5	97	24	12	94	107.5	35	5.1	N	B-AO	N-N-rt	ft-pt-rt	LP	LP	R2044	5020145C2D	148.380	2	No pit tag found, scar from old floy tag, surgery scar looks well healed, picture taken, age structure sample healed very well. New PIT and Floy deployed.
28-Sep	GN116.0M	10	445588	5982284	5.3	2.5	98	18	9.5	70	78.5	25	1.91	N	B-AU	ft-pt	ft-pt	LP	LP	R2007	424E0B7403			Small rip in dorsal fin, age structure scar healed well, Pictures taken. Did not deploy radio tag, fish too small. The "B" in the PIT Tag number may be an 8. It was an "8" in the 2004 records.
28-Sep	GN116.0M	10	445549	5982296	3.9	2.5	98	11.5	23	95.5	110	33	4.7	Y	B-AO	N-N-N	ft-pt	n	LP	R2043	5O27275953			Few net marks, split nares, 4 barbles, little blood trauma in left eye, bleeding a bit from age sturcture cut so didn't put a radio tag. Released at the Sinkut confluence.
28-Sep	GN116.0M	10	445549	5982296	3.2	3	98	13	25.5	102	118	37.5	6.3	Y	B-AO	N-N-N	ft-pt	n	LP	R2042	422E42571F			Double nares, 4 barbles, looks healthy, belly wall extremely thick, unable to put a radio tag in.

Appendix III

CD ROM of all Digital Files

Appendix IV

Map of Sampling Site Distribution and Sturgeon Capture Locations

AUGUST SAMPLE SITES

XX — Sample site/Map Reference

XX — Sturgeon capture site

Scale 1:75,000

rkm 130 · rkm 120 · rkm 110 · rkm 100 · rkm 90

NECHAKO RIVER · Carole Falls River · Chilco Creek

SEPTEMBER SAMPLE SITES

XX — Sample site/Map Reference

XX — Sturgeon capture site

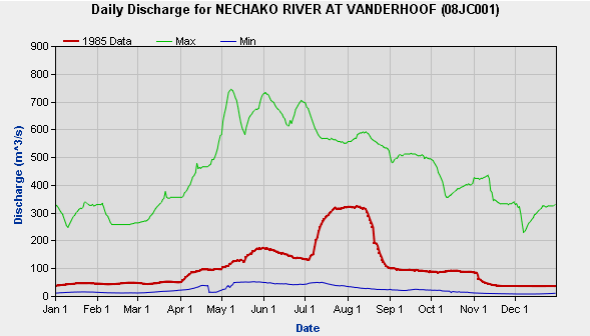
Scale 1:75,000

rkm 130 · rkm 120 · rkm 110 · rkm 100 · rkm 90

NECHAKO RIVER · Carole Falls River · Chilco Creek

Appendix V

Environment Canada Daily Discharge for the Nechako River at Vanderhoof: 1985 to 2005


Daily Discharge for NECHAKO RIVER AT VANDERHOOF (08JC001)
1985 Data
Max
Min
Discharge (m^3/s)
Date
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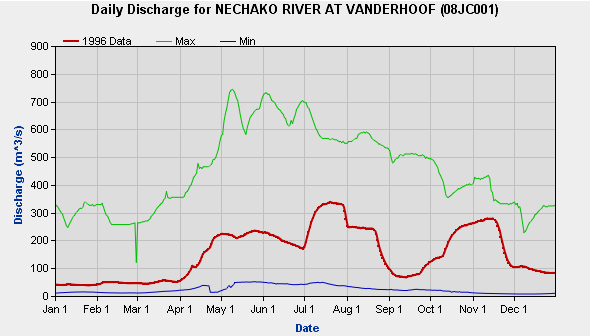
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
Oct 1
Nov 1
Dec 1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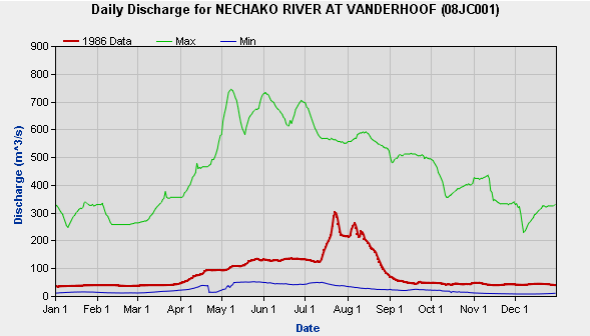
1996 Data
Max
Min
Discharge (m^3/s)
Date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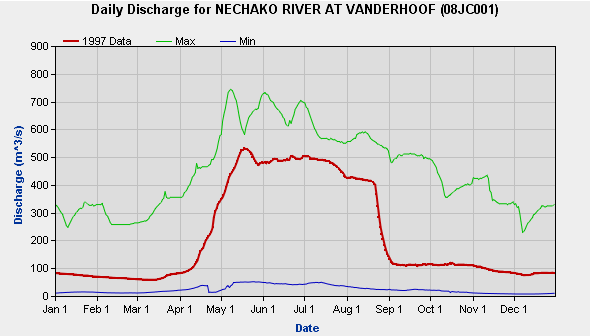
Max
Min
Discharge (m^3/s)
Date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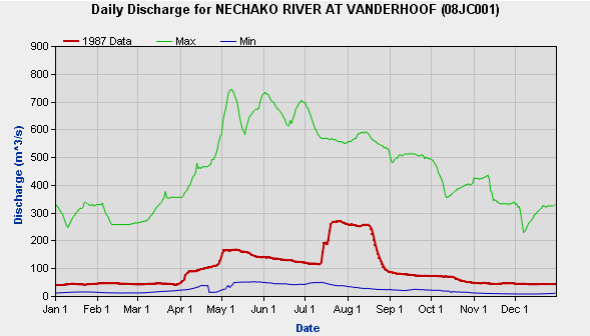
Max
Min
Discharge (m^3/s)
Date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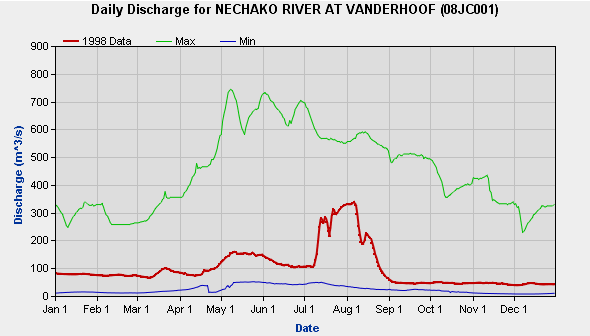
Max
Min
Discharge (m^3/s)
Date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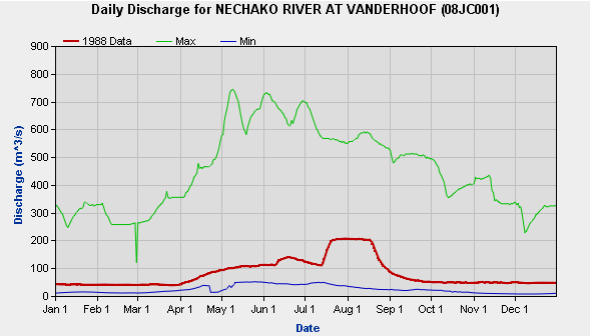
Max
Min
Discharge (m^3/s)
Date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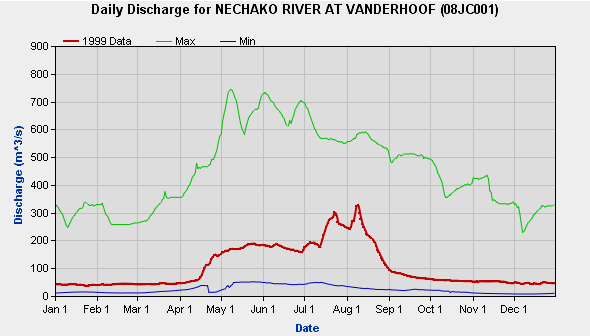
1988 Data
Max
Min
Discharge (m^3/s)
Date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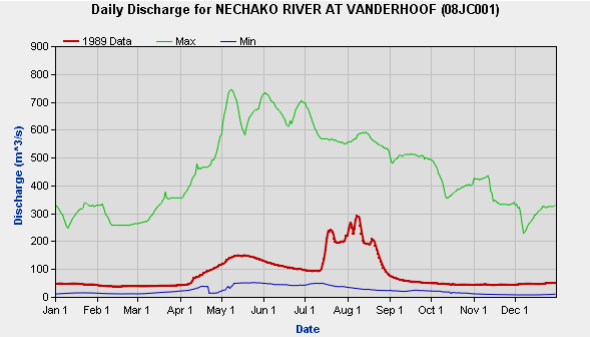
1999 Data
Max
Min
Discharge (m^3/s)
Date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1989 Data
Max
Min
Discharge (m^3/s)
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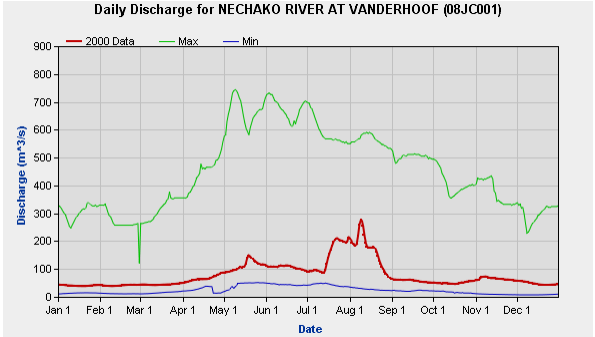
Date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Min
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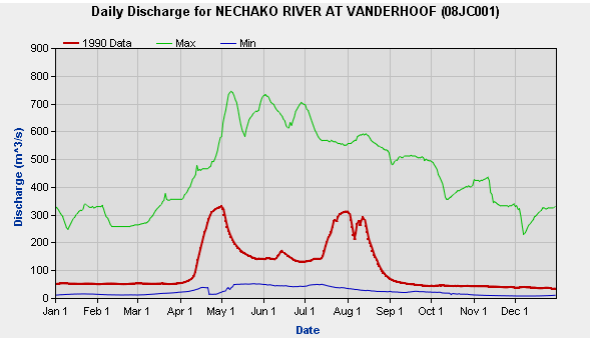
Date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Min
Discharge (m^3/s)
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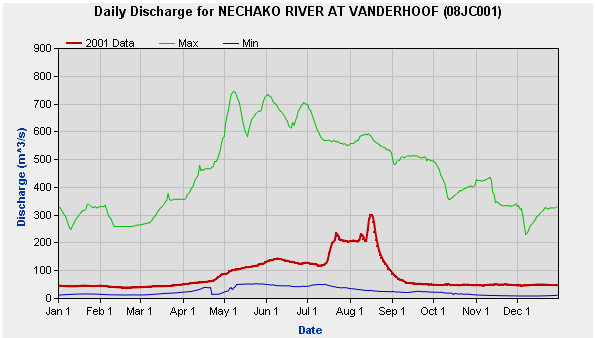
Date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Max
Min
Discharge (m^3/s)
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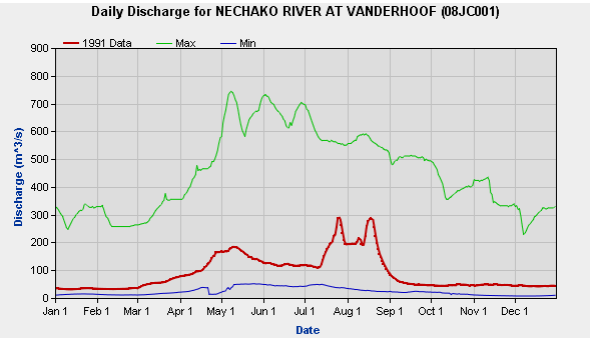
Date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Min
Discharge (m^3/s)
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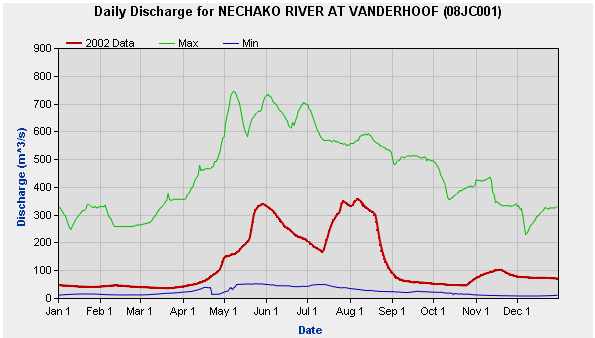
Date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2002 Data
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Min
Discharge (m^3/s)
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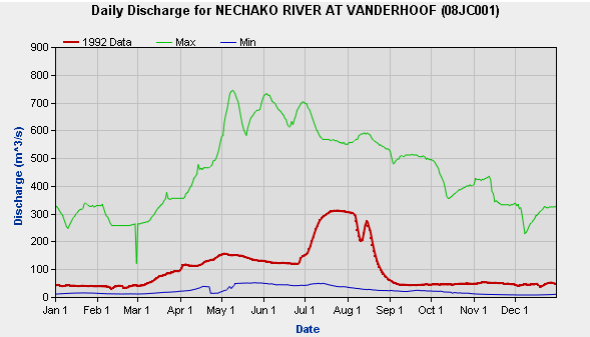
Date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Discharge (m^3/s)
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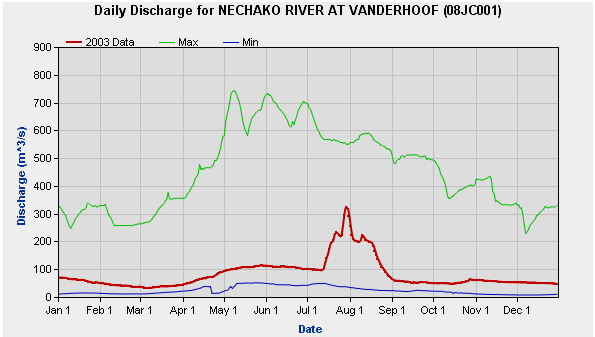
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2003 Data
Max
Min
Discharge (m^3/s)
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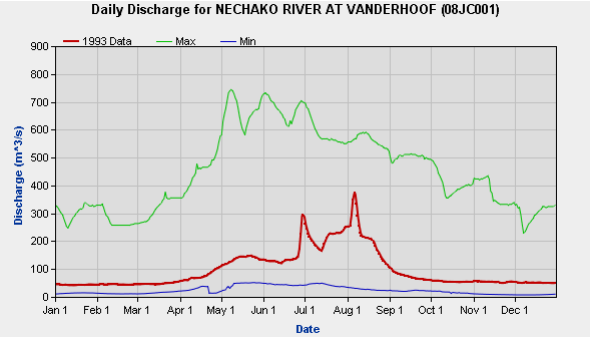
Date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Min
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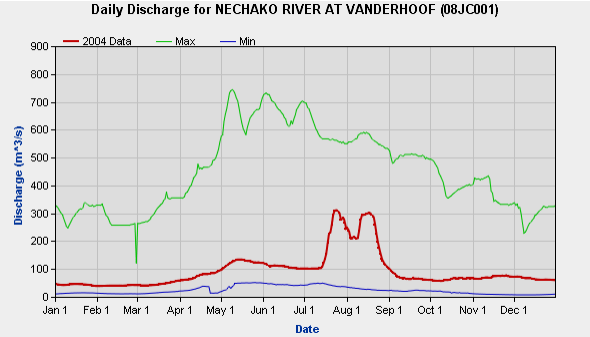
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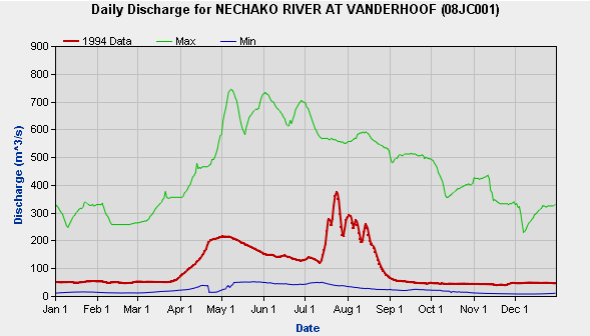
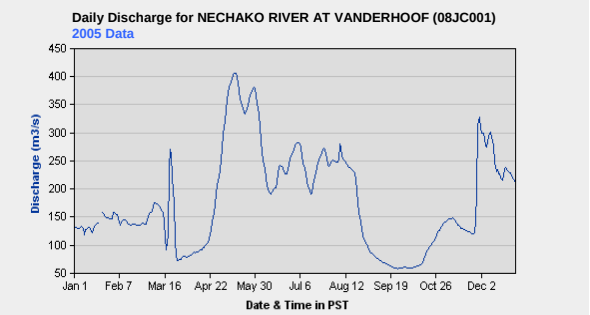
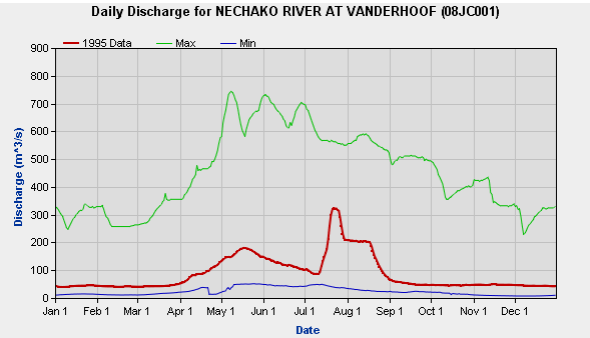
2004 Data
Max
Min
Discharge (m^3/s)
Jan 1 Feb 1 Mar 1 Apr 1 May 1 Jun 1 Jul 1 Aug 1 Sep 1 Oct 1 Nov 1 Dec 1
Date


Daily Discharge for NECHAKO RIVER AT VANDERHOOF (08JC001)
1994 Data
Max
Min
Discharge (m^3/s)
Jan 1 Feb 1 Mar 1 Apr 1 May 1 Jun 1 Jul 1 Aug 1 Sep 1 Oct 1 Nov 1 Dec 1
Date


Daily Discharge for NECHAKO RIVER AT VANDERHOOF (08JC001)
2005 Data
Discharge (m3/s)
Jan 1 Feb 7 Mar 16 Apr 22 May 30 Jul 6 Aug 12 Sep 19 Oct 26 Dec 2
Date & Time in PST


Daily Discharge for NECHAKO RIVER AT VANDERHOOF (08JC001)
1995 Data
Max
Min
Discharge (m^3/s)
Jan 1 Feb 1 Mar 1 Apr 1 May 1 Jun 1 Jul 1 Aug 1 Sep 1 Oct 1 Nov 1 Dec 1
Date