2008 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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Species at Risk, Rio Tinto Alcan., and the
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Prepared For The

NECHAKO RIVER WHITE STURGEON

RECOVERY INITIATIVE

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Executive Summary

The Nechako was sampled using gillnets, cod traps, angling and beach seining from September 3 – October 2, 2008 for the purposes of capturing white sturgeon under 1metre total length (TL). Monitoring for acoustic tags was carried out from June to September. Sampling was focused from slightly upstream of Vanderhoof downstream to the confluence of the Stuart River.

Efforts in 2008 were a continuation of focused juvenile white sturgeon sampling programs conducted annually since 2004. The intent of these sampling programs is to gather information about the status of juvenile white sturgeon recruitment into the Nechako's population, and provide insight into factors affecting their survival. Additionally, these sampling efforts are developing information to inform the format of a standardized, long-term "index type" program that will be required 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 164 panel-hours of gillnetting effort were applied (37.3m^2 panels), 8470 hours of cod trapping effort, 15 hours of angling and 10 sets of beach seining over three days were applied throughout the sampling period. No sturgeon were caught via codtraps, angling or beach seining. A total of 29 hatchery reared juvenile white sturgeon were tagged with acoustic tags in the fall of 2007, just prior to their release in October/November. Their tags were programmed to begin signalling in May of 2008. CSTC staff completed a total of 15 days of acoustic monitoring between June and September 2008. Six of the 29 tags were detected. They were located in the Nechako River at km 110km, 116km, 117km, and 117.4km.

A total of five white sturgeon were captured via gillnetting. All were captured between river km 110.1 and 116.1, in association with deep water habitats and known over-wintering sites at 110km, 114km and 116km. The largest (103cm TL) of the five sturgeon captured was aged at 13 years. The smallest (34.0cm TL) was aged at 2 years. The sturgeon were caught in depths between 3.0 – 10.0m. One capture was a hatchery reared juvenile released in 2006 (PIT tag 4849044462). A total of 1,125 other fish were bi-captured during the sampling program, including 53 sport fish. A total of 1,054 of the bi-captured fish were released successfully, and 71 were recorded as mortalities, including three sport fish.

A "splash cam" underwater camera was used for four days in October for the purposes of documenting any congregations of sturgeon, particularly hatchery juveniles, that may be

observable. The camera was used in the Nechako river from 109km-116km and at the 125km over-wintering hole. Sturgeon were observed, but the larger congregations of fish that had been previously recorded could not be found.

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 a limited number of 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 conclusion of assessment activities in 1999, the Ministry of Water, Land and Air Protection (now MoE) 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 Associates Ltd 2003). This involved the creation of a Recovery Team (RT) in 2000 (now termed the Technical Working Group – TWG), comprised of government and non-government technical personnel assembled to recommend technical directions for recovery actions. The Nechako White Sturgeon Recovery Team, through the development of a Recovery Plan, indicated that a focused juvenile sampling program should be carried out on the Nechako River (Golder Associates Ltd 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 annually since 2004 (CSTC 2005, 2006, 2008), was to continue to gather information about the status of juvenile white sturgeon recruitment into the Nechako's 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 is required to monitor the success or failure of recovery actions towards 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 types and 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. Monitor hatchery-reared juveniles tagged with acoustic tags prior to their release in fall of 2007, to assess their distribution etc.

Methodology

Sampling methodologies utilized in 2008 reflected those used from 2004 to 2007. It was determined that sampling for juveniles (defined as TL<1m) would take place between the months of August and October, to sample as wide a range of feasible habitats as possible in the Nechako River from Vanderhoof to the Stuart River confluence. Sampling in September (3-30) and October (3-21) took place over a 33 day period. One crew operated to sample portions of the approximately 50km river length within the study area (Appendix 1).

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 1-2 standardized panels of 2.4m x 15.2m (37.2m^2) with the following mesh sizes: 2.54cm, 3.81cm, 5.08cm, 6.35cm, 7.62cm, and 8.89cm. For specifics on gillnetting methodologies, see CSTC 2005.

Set times for gillnets were variable. The standard approach upon selecting a site consisted of setting for approximately 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 2 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 1.5 hours) or the gear was pulled all together for re-deployment in a new sample site location.

Additional sampling techniques utilized in 2008 (as in 2007) included cod traps and angling. The deployment and sampling protocol for codtraps in 2008 (as in 2007), was to set a total of 10 cod traps 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). Baits utilized in 2008 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 traps' catch. Codtraps had variable set times, usually ~24 hours.

Angling was conducted intermittently between sample sets for gillnets and cod traps. The set time varied from 13 minutes to over 2 hours with an average of 0.755 hr (45 min). Bait types utilized included sockeye (SOX), kokanee and Northern Pikeminnow (NSC).

Beach seining was utilized on a trial basis in 2008. A seine net of 69.87m^2 (height 2.736m x 25.536 length x 0.304m depth – mesh size of 3.81cm) was utilized to attempt several seines in shallower areas on the margins of deeper pools and runs. Three to five people aided in deploying the net in combination with a vessel. A total of 10 sets were completed over three days in October.

Acoustic tags were implanted in 29 sturgeon of suitable size (> 30grams) prior to their release, in the fall of 2007. Monitoring began in June 2008 congruent with other field

sampling and continued at intervals until September 23. A handheld receiver was utilized from a vessel.

For the specifics of:

- How sampling effort and catch were recorded and managed, and example data forms
- The fish capture and handling methods utilized, and morphological measurements and tissue/bone samples collected
- Tagging procedures and the types of tags applied
- 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 measured utilizing the fish finder, which was 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 the Vanderhoof and Isle Pierre Hydrometric stations 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 personnel.

Results

Physical Conditions of the Nechako River at time of Sampling

Based on the Vanderhoof hydrometric station (Figure 1), discharge declined steadily during the first few weeks of sampling from a high of 165m^3/s on September 3, 2008 to 58 m^3/s by September 24th, after which discharge ranged between 52m^3/s and 60m^3/s until October 21st.

Water temperature ranged between 12-16 C from August 20 to September 20, after which it generally trended downward until the end of the sampling period (Figure 1). Water temperatures recorded by the sampling crews showed a similar trend (Figure 2).

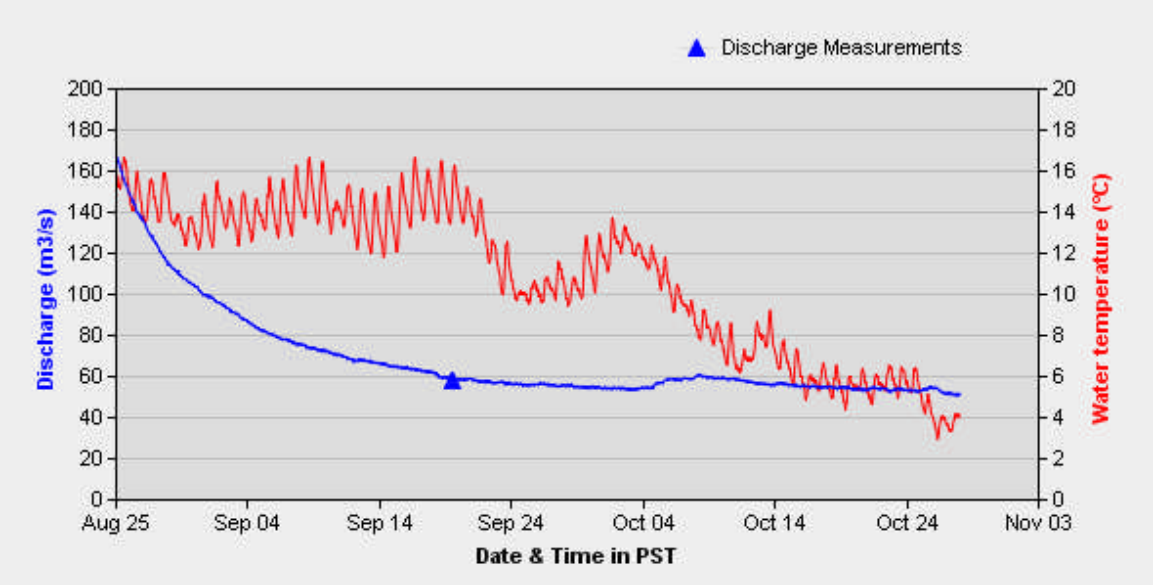

Figure 1. Daily average discharge (m3/s) and temperature (°C) for the Nechako River at Vanderhoof Environment Canada hydrometric station 08JC001 from August 25-October 28.

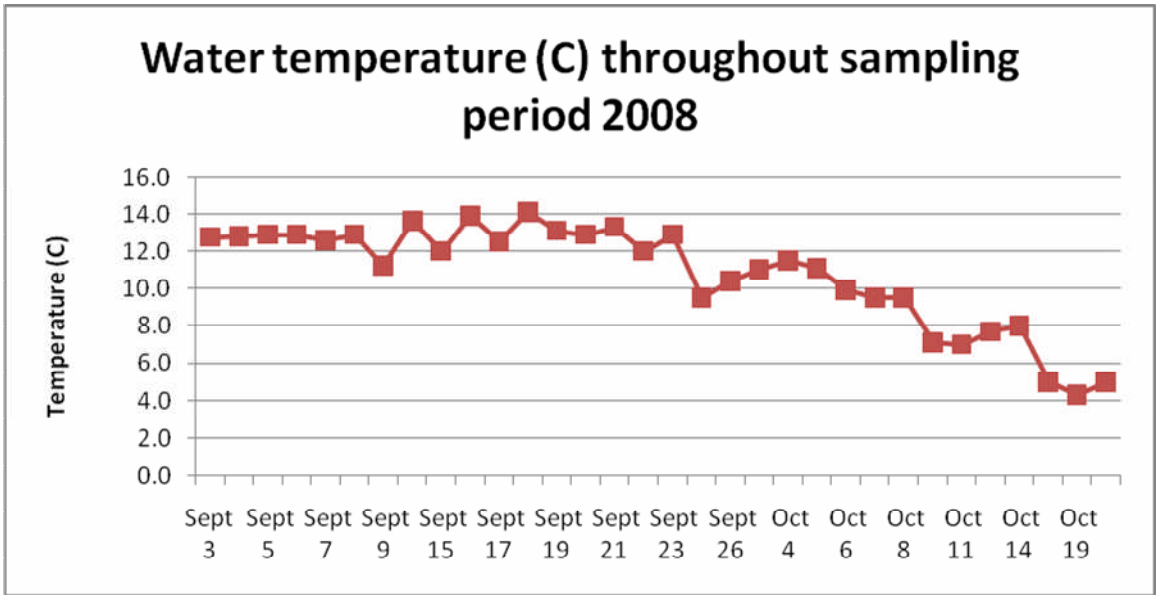

Figure 2. Daily average temperature (^{o}C) recorded by field crews during the sampling period.

Water visibility or clarity measured using a Secchi Disc during the sample period ranged from 2.0 – 4.9 m and an average of 3.0 m. Visibility showed a general increasing trend throughout the sampling period, although measurements were not consistently recorded during much of the sampling period.

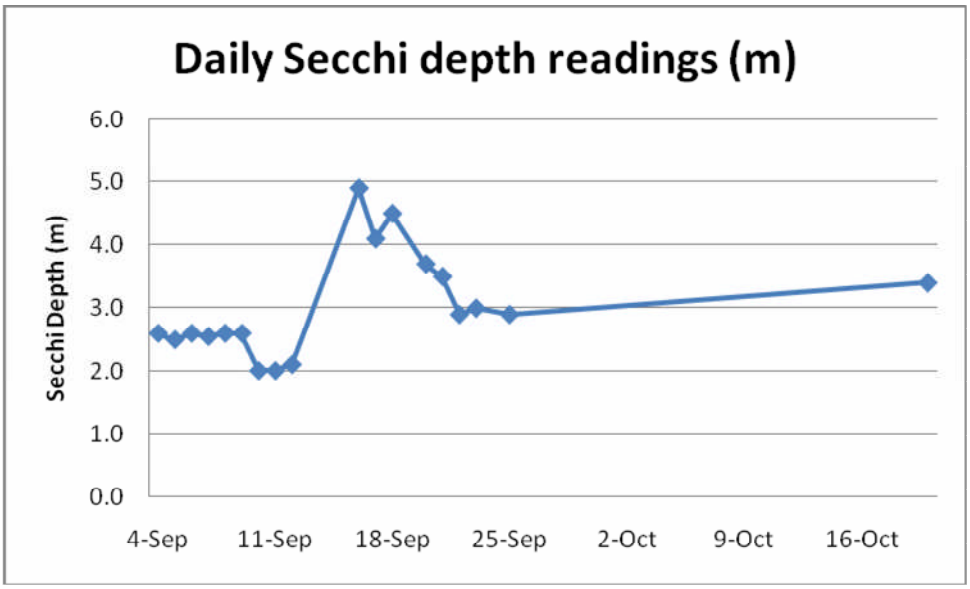

Figure 3. Daily Secchi Depth readings (m) recorded by field crews during the sampling period.

Sampling Summary: September 3 - October 21

Gill net sampling was conducted on 18 days, between Sept 3 and October 20th. The majority of the sampling was completed in September, with October 20th, being the only day of gillnetting in October. Five sturgeon were caught using this method from Sept 7-22 (Table 1). See Table 2 for details of catch by mesh size and overall catch per unit effort (CPUE) for all species.

Angling was conducted for a total of 15hrs 6min throughout the sampling period. No sturgeon were caught via angling but 9 other fish were bi-captured, with a CPUE of 0.60 fish/rod-hour. Sites were angled at 91.6km (downstream from Finmore at a creek), 94.5, 110km (over-wintering hole), 116km (over-wintering hole), 117.4, 124.5 and 125.5km.

Table 1. Summary information relating to sturgeon captured in 2008 (see Appendix 2 for comprehensive data).

Date	River km	Depth (m)	Mesh Size (cm)	Id code	Total Length (cm)	Weight grams	Girth (cm)	Age (yrs)	Tags at capture (ft-pt-rt)	PIT tag
7-Sep-08	115.9	4.20	8.89	2008001	103.0	4082.3	32.0	13	n-pt-n	422E616706
7-Sep-08	116.0	3.50	2.54	2008002	63.5	879.97	19.0	3	n-n-n	486411C11-L 48674C7558-R
8-Sep-08	114.4	4.50	2.54	2008003	75.0	1445.8	22.0	11	n-n-n	4867517C1E
9-Sep-08	110.1	10.0	2.54	2008004	34.0	121.00	11.0	2	n-n-n	486464335C
22-Sep-08	116.1	3.00	5.08	2008005	49.0	392.00	16.0	2	n-pt-n	4849044462

Table 2. Gillnet CPUE by mesh size for white sturgeon (WSG) and bi-catch species.

Mesh size (cm)	Total Panel Hours effort	Hours Fished for Net Area/m^2	No. WSG	Total No. Fish	Total No. By-Catch Caught	Bi-catch CPUE (per 100m2 net/hour)	WSG CPUE (per 100m2 net/hour)	Total CPUE (per 100m2 net/hour)
2.54	54.65	2032.98	3	61	58	2.852955	0.147567	3.000521
3.81	27.5833	1026.1	0	72	72	7.01686	0	7.01686
5.08	27.4167	1019.9	1	105	104	10.19708	0.098049	10.29513
6.35	27.2333	1013.08	0	26	26	2.566431	0	2.566431
7.62	0	0	0	0	0	0	0	0
8.89	27.5833	1026.1	1	51	50	4.872819	0.097456	4.970276
Total	**164.4667**	**6118.16**	**5**	**315**	**310**	**27.50614**	**0.343072**	**27.84922**

Sampling with cod traps occurred from September 3 - October 21, 2008. A total of 19 cod trap sets were completed in September and 13 sets were completed in October. Each set consisted of 10 traps being deployed. No sturgeon were caught using this method, although substantial numbers of other species (bi-catch) were captured. Total effort and CPUE is provided in Table 3.

Table 3. Cod trap CPUE for white sturgeon (WSG) and bi-catch species.

Total trap hours	Amount Bi-catch	# WSG	Total # Fish	Bi-catch CPUE (per trap/hr)	WSG CPUE (per Trap/hr)	Total CPUE (per trap /hr)
8470.0167	759	0	759	0.08961	0	0.08961

Beach Seining was completed at various locations (113.3km, 116.0km and 125.6km) on October 6, 7, and 23, with10 sets in total being completed. The seine net was 2.74m (height) by 25.36m (length), for a total net area of 69.87m^2. Mesh size was 3.81cm. No sturgeon were caught using this method, but 8 fish were bi-captured (Table 4).

Table 4. Beach seine CPUE for 7 sampling events.

Set Date	River km	Easting	Northing	Total No. Bi-Catch	Total No. WSG
10/6/2008 13:17	125.6	439371	5985348	0	0
10/6/2008 13:35	125.5	439370	5985346	0	0
10/6/2008 13:48	125.5	439346	5985413	6	0
10/6/2008 14:00	125.6	439394	5985454	0	0
10/6/2008 14:16	125.6	439410	5985475	1	0
10/7/2008 13:54	113.3	445926	5983021	0	0
10/23/2008 14:08	116.0	445853	5982380	1	0
Total				8	0

Acoustic Monitoring was conducted for 15 days (June 24, 25, Aug 7,8,9,11,30, Sept 3, 6, 8, 12, 17, 21, 22, 23) with 6 of the deployed tags being detected (Table 5). Three tags were heard at 116km (8942, 8964, and 8965) and four at 117.4km (8946, 8963, 8964, and 8965). Only tag 8965 was detected at 116.8km, while two tags were heard at 117.0km (8946 and 8963). One tag was detected at 110km (8952) and it was only detected on August 30th (Table 5).

Table 5. Summary of acoustic tag monitoring completed in 2008 (occasions when tags were detected).

Date	River Km	Tag number	Location description
25-Jun-08	117.0	8963	mouth of Chilco Creek
25-Jun-08	116.0	8965	at 116km ow hole
25-Jun-08	116.0	8942	at 116km ow hole
7-Aug-08	117.4	8946	just d/s creek (Chilco)
7-Aug-08	117.4	8963	just d/s creek (Chilco)
7-Aug-08	116.0	8965	at 116km ow hole
7-Aug-08	116.0	8942	at 116km ow hole
30-Aug-08	110.0	8952	110 ow hole
5-Sep-08	117.4	8965	just d/s creek (Chilco)
5-Sep-08	117.4	8964	just d/s creek (Chilco)
7-Sep-08	116.8	8965	just u/s creek - Legge's house
7-Sep-08	116.0	8964	at 116km ow hole
21-Sep-08	117.0	8963	mouth of Chilco Creek
21-Sep-08	117.0	8946	mouth of Chilco Creek
21-Sep-08	117.0	8963	mouth of Chilco Creek
22-Sep-08	116.0	8965	at 116km ow hole
23-Sep-08	116.0	8965	at 116km ow hole

Success with acoustic tag detection varied with discharge. Two tags (8942 and 8965) were detected at the start of monitoring in late June and detected again in August. Tag 8965 was detected six times throughout the monitoring period, with the last detection being on September 23, 2008. The tag was located at 116.0km with each detection (Table 6).

The largest number of tags was detected on August 7, with a total of four tags (8942, 8946, 8963, and 8965) being found. Tag 8964 was only heard on September 5 and 7. During the last three days of sampling (September 21-23) only three tags were detected (8946,8963 and 8965) (Table 6).

Table 6. Individual tag numbers and amount of repeat detections.

Individual tags	Tag number	River Km	Date
1	8942	116.0	25-Jun-08
1	8942	116.0	7-Aug-08
2	8946	117.0	21-Sep-08
2	8946	117.4	7-Aug-08
3	8952	110.0	30-Aug-08
4	8963	117.0	25-Jun-08
4	8963	117.0	21-Sep-08
4	8963	117.0	21-Sep-08
4	8963	117.4	7-Aug-08
5	8964	116.0	7-Sep-08
5	8964	117.4	5-Sep-08
6	8965	116.0	25-Jun-08
6	8965	116.0	7-Aug-08
6	8965	116.0	22-Sep-08
6	8965	116.0	23-Sep-08
6	8965	116.8	7-Sep-08
6	8965	117.4	5-Sep-08

Sturgeon Captures and CPUE

Five white sturgeon were captured during the sampling program in 2008. Of the five, one was a wild recruited fish previously captured in 2006, and one was a hatchery fish originally released in 2006. This was the first recapture of a hatchery reared Nechako white sturgeon. See Table 1 for details of all sturgeon caught. For comprehensive data for each of the sturgeon captured, refer to Appendix 2. See Table 7 for comparison of the recaptured sturgeons' biophysical data.

Age structure Analysis

Aging structures were collected from three of the sturgeon captured. Age estimates were 2 years, 3 years and 11 years old. The ages of the recaptured fish were extrapolated from known information as 13 years and 2 years old (Table 1 and Appendix 2).

A comparison between previously collected measurements and 2008 biophysical measurements for recaptured fish is provided in Table 7. Fish 2008001 (a wild recapture) grew 13.5cm in length, increased its girth by 3.0cm and gained 1002g (or just over 1kg). Fish 2008005 (a 2006 hatchery release) grew 34cm in length and gained 372 grams in weight.

Table 7. Comparison of measurements collected in 2006 and 2008 for the hatchery reared white sturgeon released in 2006 and recaptured in 2008, and the wild-recruited fish initially captured in 2006 and recaptured in 2008.

Date	River km	Capt. Depth (m)	Capt. Mesh Size (cm)	Sex Mat. Code	Total Length (cm)	Weight (g)	Girth (cm)	Age (yrs)	Tags at capture (ft-pt-rt)	PIT tag
31-Aug-06	116.5	6.6	n/a	98	89.5	3060	29.0	11	n-n-n	422E616706
7-Sep-08	115.9	4.20	8.89	98	103.0	4082.33	32.0	13	n-pt-n	422E616706
12-Oct-06	116.0	n/a	n/a	98	15.0	16.00	n/a	0+	n-pt-n	4849044462
22-Sep-08	116.1	3.00	5.08	98	49.0	392.00	16.0	2	n-pt-n	4849044462

Capture Location –Habitat Types

Sturgeon captures occurred at minimum depth of 3 metres to a maximum depth of 10 metres. All were captured between river km 110.1 and 116.1, in association with deep water habitats and known over-wintering sites at 110km, 114km and 116km. Three of the captures occurred near 116.0km (116.1, 115.9 and 116.0km), a known over-wintering site. One sturgeon was captured at 110.1km, also a known sturgeon over wintering site (110km). The fifth sturgeon was caught at 114.5km, between the two known over-wintering sites (Table 1).

Bi-Catch Data

A total of 1125 fish (by all catch methods) were bi-captured (i.e. non-target species) during the sampling period, including 1054 fish that were released alive and 71 (6.7%) mortalities which succumbed to capture stress or trauma (Table 8). Of the 1125 bi-captured fish, 1072 were non sport fish. Northern Pikeminnow (NSC) suffered 37 mortalities or 4.6% of the total number of NSC caught. Brassy Minnow (BMC) experienced the highest mortality rate at 66.6%, or 8 of 12 BMC caught.

Table 8. Summary of bi-catch data by species. Shaded rows denote sport fish.

Bi-catch Species	Min fork length (cm)	Max fork length (cm)	No. caught	No. released	No. mortalities	Species name
BB	16.0	57.5	30	30	0	Burbot
BMC	9.5	17.5	12	4	8	Brassy Minnow
BT	30.0	55.0	9	7	2	Bull Trout
CAS	10.0	15.0	5	5	0	Prickly Sculpin
CC	n/a	14.5	1	1	0	Slimy Sculpin
CSU	10.5	47.5	56	52	4	Large scale Sucker
LSU	10.0	21.0	9	9	0	Longnose sucker
MW	15.0	31.0	9	9	0	Whitefish
NSC	1.0	69.3	808	771	37	Northern Pikeminnow
PCC	15.0	33.5	172	155	17	Peamouth Chub

RB	28.0	33.0	3	3	0	Rainbow Trout
RSC	4.0	11.0	8	6	2	Redside Shiner
SOX	61.5	63.5	2	1	1	Sockeye
WSC	n/a	12.2	1	1	0	White sucker
		Total	**1125**	**1054**	**71**	

Gillnetting resulted in 94.4% (67 fish) of bi-catch mortalities. Cod trapping, which resulted in 67.5% of bi-catch, resulted in 4 mortalities or 5.6% of the overall number of mortalities observed. No mortalities were observed with angling or beach seining.

The total bi-catch from beach seining was 8 fish. The average catch per set was 1.14 fish per seine.

All sampling methods employed in 2008 resulted in fish being bi-captured (i.e non-target species). Cod trapping resulted in the most bi-catch (759 fish), followed by gill netting (349 fish), angling (9 fish) and beach seine (8 fish). Gill netting was the only method used that was successful at catching juvenile (<1m long) white sturgeon.

Gillnet bi-catch suffered the highest rate (23.8%) of mortality, followed by codtraps (0.53%). No bi-catch mortalities were observed via angling or beach seining. Gillnet catch-per–unit-effort (CPUE) was the highest in 5.06cm (2.0inch) mesh at 11.96 fish per 100m^2/hr (Table 8).

Table 9. Summary of species specific bi-catch for all sampling methods.

Method	Total # of fish	BB	BMC	BT	CAS	CC	CSU	LSU	MW	NSC	PCC	RB	RSC	SK	WSC
GN	349	0	12	7	1	0	54	5	2	169	92	1	3	2	1
CT	759	30	0	1	4	1	2	4	0	630	80	2	5	0	0
AG	9	0	0	0	0	0	0	0	0	9	0	0	0	0	0
BS	8	0	0	1	0	0	0	0	7	0	0	0	0	0	0
Total	***1125***	***30***	***12***	***9***	***5***	***1***	***56***	***9***	***9***	***808***	***172***	***3***	***8***	***2***	***1***

Table 10. Summary of bi-catch mortalities by sampling method.

Method	Live	Dead
GN	282	67
CT	755	4
AG	9	0
BS	8	0
Total	**1054**	**71**

Sport Fish Bi-Catch

A total of 53 sport fish species were caught using Gillnet (GN) Codtrap (CT), Angling (AG) and Beach Seine (BS). Of these 3 fish died. Two sockeye were captured, of which one died, and 2 of 9 bull trout captured died. Cod traps captured 56.6% of the total sport fish catch. The most commonly captured sport fish in 2008 were Burbot (30 fish) followed by Whitefish (9 fish) and Bull trout (9 fish) (Tables 10 and 11).

Table 11. Sport fish bi-catch min. and max. forklength (cm).

Bi-catch Species	Min fork length (cm)	Max fork length (cm)	No. Caught	No. Released	No. Mortalities	Species
BB	16.0	57.5	30	30	0	Burbot
BT	30.0	55.0	9	7	2	Bull Trout
MW	15.0	31.0	9	9	0	Whitefish
RB	28.0	33.0	3	3	0	Rainbow Trout
SK	61.5	63.5	2	1	1	Sockeye
		Total	53	50	3	

Table 12. Summary of sport fish bi-catch by all catch methods.

Method	BB	BT	MW	RB	SK	Total
GN	0	7	2	1	2	12
CT	30	1	0	2	0	33
AG	0	0	0	0	0	0
BS	0	1	7	0	0	8
Total	***30***	***9***	***9***	***3***	***2***	**53**

Overall, the gillnet CPUE was very low for sport fish (1.175 fish per 100m^2/hr) and high for non-sport fish bi-catch (33.62 fish per 100m^2/hr) (Table 12). The overall cod trap CPUE for bi-catch species was 0.0896 fish/trap-hour, with a sportfish CPUE of 0.0039 fish/trap-hour (Table 14).

Table 13. Summary of gillnet bi-catch and CPUE.

Mesh size (cm)	Total Panel Hours	Hours Fished for Net Area/m^2	Sport fish within bi-catch	Total number of Bi-Catch	Bi-catch CPUE (per 100m2 net/hour)	Sport fish bi-catch CPUE (per 100m^2/hr)	Total CPUE (per 100m^2 net/hour)
2.54	54.65	2032.98	0	60	2.951	0.000	2.951
3.81	27.58	1026.1	1	102	9.941	0.097	10.038
5.08	27.42	1019.9	3	119	11.668	0.294	11.962
6.35	27.23	1013.08	2	55	5.429	0.197	5.626
7.62	0.00	0	0	0	0.000	0.000	0.000

8.89	27.58	1026.1	6	47	4.580	0.585	5.165
Total	**164.47**	**6118.16**	**12**	**383**	**34.569**	**1.174**	**35.743**

Table 14. Gillnetting; species-specific numbers of bi-catch by mesh size. Sportfish are shaded grey.

Mesh size (cm)	Hours fished for net area/m^2	Total # fish	BMC	BT	CAS	CSU	LSU	MW	NSC	PCC	RB	RSC	SK	WSU
2.54	2032.98	59	12	0	1	3	1	0	24	14	0	3	0	1
3.81	1026.10	102	0		0	8	1	1	43	48	1	0	0	0
5.08	1019.90	119	0	2	0	8	1	1	84	23	0	0	0	0
6.35	1013.08	23	0	2	0	13	0	1	5	2	0	0	0	0
7.62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.89	1026.10	47	0	4	0	22	1	0	13	5	0	0	2	0
Total	***6118.16***	***350***	***12***	***8***	***1***	***54***	***4***	***3***	***169***	***92***	***1***	***3***	***2***	***1***

Table 15. Gillnetting; species-specific CPUE by mesh size. Sport fish are shaded grey.

Mesh size (cm)	Hours fished for net area/m^2	Total CPUE	BMC/ CPUE	BT/ CPUE	CAS/ CPUE	CSU/ CPUE	LSU/ CPUE	MW/ CPUE	NSC/ CPUE	PCC/ CPUE	RB/ CPUE	RSC/ CPUE	SK/ CPUE	WSU/ CPUE
2.54	2033.0	2.902	0.590	0	0.049	0.148	0.049	0	1.181	0.689	0	0.148	0	0.049
3.81	1026.1	9.941	0	0	0	0.780	0.097	0.097	4.191	4.678	0.097	0	0	0
5.08	1019.9	7.648	0	0.196	0	0.784	0.098	0.098	4.216	2.255	0	0	0	0
6.35	1013.1	10.068	0	0.197	0	1.283	0	0.099	8.292	0.197	0	0	0	0
7.62	0.0	0.000	0	0.000	0	0	0	0	0	0.000	0	0	0	0
8.89	1026.1	4.386	0	0.195	0	2.144	0.097	0	1.267	0.487	0	0	0.195	0
Total	***6118.2***	***34.94***	***0.590***	***0.588***	***0.049***	***5.139***	***0.342***	***0.294***	***19.15***	***8.306***	***0.097***	***0.148***	***0.195***	***0.049***

Table 16. Gillnetting; total effort bi-catch and sport fish CPUE.

Total Panel Hours	Panel Area	Hours fished for net area/m^2	# of bi-catch species caught	# of sport fish within bi catch	Bi-catch CPUE (per 100m^2/hr)	Sport fish bi catch CPUE (per 100m^2/hr)
164.47	37.2	6118.160	350	12	33.62	1.175

Table 17. Summary; Cod trap bi-CPUE.

Total trap hours	Total number of bi-catch	Amount of sport fish within bi-catch	Bi-catch CPUE (per trap/hr)	Sport fish bi-catch CPUE (per Trap/hr)
8470.02	759	33	0.0896	0.0039

Summary Discussion

During the 2008 field season five white sturgeon were captured using gill nets. One was a wild recruited recapture from the 2006 sampling program, and one was a hatchery fish originally released in 2006. All five sturgeon were caught between river km 110.1 and 116.1, in association with the deep water habitats in close conjunction with the known

over-wintering sites at 110km, 114km and 116km, where conditions are ideal for rearing, as seen by white sturgeon capture records from previous years.

Gillnetting effort deployed in the 2008 program was similar to those of previous sampling years with effort hours totaling approximately 164.5 panel-hours for the entire sample period. Cod trapping was utilized daily along with the gillnetting in this program with effort totaling 8470 trap-hours for the entire period. Angling took place for 15 hours, as time allowed between sample sets throughout the sampling period. Beach seining was conducted on three separate days, to assess the method for its potential use for capturing juvenile sturgeon (<1m).

It is evident that gillnetting is the more efficient white sturgeon capture method, while cod trapping is effective at targeting certain species, and induces less direct mortality.

Acoustic tag monitoring took place over 15 days from June to September. Of a total of 29 acoustic tags implanted in juvenile sturgeon in 2007, six (6) tags were detected in 2008.

As annual surveys progress, there will likely be an increase in captures of hatchery reared individuals, as the first cohorts or year-classes grow to sizes recruitable to gillnets.

The juvenile surveys were started slightly later in the year, relative to previous years. Data was amalgamated into one set vs. splitting it into two temporal sets. Some data has been categorized by month, to enable some comparison with earlier results/reports.

Recommendations

1) There are now five years of juvenile-focused sampling data (2004-2008), encompassing years in which record high and record low flows were contended with. The five years of data should be summarized into a single report with recommendations for the format of an ongoing juvenile indexing program.

2) 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:
   a) 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.
   b) Use of hoop-type traps with differing funnel configurations should be attempted.

3) Additional experimentation with sampling via angling should be completed. As hatchery juveniles obtain larger sizes, they will become increasingly recruitable to angling gear.

4) Additional experimentation with beach seining should be attempted.

5) Additional acoustic tags should be implanted in suitably sized sturgeon that are overwintered in Vanderhoof. These fish may then be monitored post release in 2009.

6) The use of underwater videography should be explored for its potential uses with respect to monitoring juvenile white sturgeon in the Nechako.

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