Columbia River Project Water Use Plan

Columbia River White Sturgeon Management Plan

White Sturgeon Conservation Aquaculture – 2017 Annual Report

Reference: **CLBWORKS-25: Mid-Columbia River White Sturgeon Conservation Aquaculture (Implementation Year 5)**
CLBWORKS-34: Lower Columbia River White Sturgeon Conservation Aquaculture (Implementation Year 9)

BC Hydro and Power Authority

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COLUMBIA WHITE STURGEON CONSERVATION FISH CULTURE PROGRAM

KOOTENAY STURGEON HATCHERY

2016 Annual Report

July, 2017

Executive Summary

Juvenile White Sturgeon age classes are lacking in the Upper Columbia River population due to recruitment failure, where insufficient survival in the wild from embryos through the first year of life has threatened persistence of the population. Accordingly, conservation aquaculture has become a critical component of the Upper Columbia White Sturgeon Recovery Initiative (UCWSRI), with hatchery reared juveniles being released over the last decade into both the lower (since 2001) and Mid-Columbia (since 2007) Rivers in Canada.

At the April 2013 UCWSRI Technical Working Group (TWG) meeting, members identified and ranked the primary goals for a sturgeon conservation aquaculture program focused on rearing wild caught eggs and larvae in a streamside white sturgeon conservation aquaculture facility (the Facility). The primary goal of the Facility is to augment the genetic diversity of supplemental progeny given results that have shown reduced diversity of progeny produced using traditional broodstock methods. The Facility was first piloted in the summer of 2014 and is located on the Canadian section of the transboundary reach of the Columbia River near the Waneta spawning area and supports the incubation of wild caught eggs and short-term rearing of larvae. Eggs and larvae are collected from the Columbia River near the three known spawning locations in Canada. In April of 2015, the UCWSRI TWG identified the continued rearing of wild caught eggs and larvae as higher importance than the rearing and release of juveniles from hatchery brood stock programs, and the decision was reached to suspend the brood stock program and rely solely on wild origin progeny. As part of this decision, it was agreed that a portion of 2014 year class juveniles produced from broodstock would be held back and released into the Mid-Columbia as two and three year olds in 2016 and 2017, respectively. Further, in March 2015, there was a surplus of juveniles collected as wild larvae being reared at the Wells facility in Washington, USA. It was decided that these surplus juveniles could be used to satisfy releases into the Mid-Columbia River and Arrow Lakes Reservoir given that broodstock program was suspended. Through the work of individuals associated with the UCWSRI group, necessary steps were taken to transfer 2500 Well fish to the Kootenay Sturgeon Facility. These fish were reared to meet release criteria for age and size (300 grams) for the Mid-Columbia. In 2015 and again in 2016, Juvenile sturgeon produced from wild source eggs and larvae collected in Canada (primarily at the Waneta spawning area) were hatched in the Facility and then transferred and reared at Kootenay Trout Hatchery (KTH) and released into the lower Columbia River. Since the first season of capture, there have been 2,063 wild origin fish released into the Columbia.

The ploidy of wild white sturgeon has previously been determined to be octaploid (8N) in Columbia and Kootenay River populations. Concern was raised when a large number of 12N white sturgeon were discovered in juvenile family groups which were offspring of wild adult Kootenay River White Sturgeon spawned at the Kootenay Tribe of Idaho (KTOI) Sturgeon Hatchery in 2013. The mechanism of this ploidy shift is unknown but it is thought to occur at the fertilization stage. Given that there are potential implications to the UCWSRI program, the Freshwater Fisheries Society, under the direction of the TWG, assessed the ploidy of all wild progeny white sturgeon being reared at KTH. This amounted to 1156 collected as wild eggs and

larvae in the lower Columbia River and 2154 transferred from the Wells hatchery with a portion used for release into the Mid-Columbia River. The remaining wells fish kept on hand in the hatchery were also tested (553).

Juvenile releases occurred in the spring of 2017 on May 9rd in the mid-Columbia River and on May 11th and May 13th in the lower Columbia River. Releases of two year old juveniles from the Wells group into the Mid-Columbia River occurred at Shelter Bay Provincial Park near Revelstoke BC on May 9th, with a total of 1,589 fish released. Average weight of these fish was 313 grams and average fork length was 38 cm. On May 11th, a total of 350 wild progeny juvenile sturgeon were released into the lower Columbia River at Beaver Creek below Trail BC, and a total of 350 wild progeny juvenile sturgeon were released into the lower Columbia River at Millennium Park in Castlegar, BC. The average weight of the wild progeny fish released at Beaver Creek and at Millennium Park was 190.3 grams, and average fork length was 29.7 cm. Also, on May 13th, 100 wild progeny juvenile sturgeon was released into the lower Columbia River at Beaver Creek during the CRITTER DAY'S Celebration. These fish averaged 284.2 grams, and were an average fork length of 33.8 cm. There were school and public events associated with the sturgeon releases at Beaver Creek on both May 11th and May 13th, at Millennium Park on May 11th, and at Shelter Bay near Revelstoke on May 9th.

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Acknowledgements

This Project is funded by the BC Hydro Water Use Plan for the Columbia River and the Fish and Wildlife Compensation Program on behalf of its program partners BC Hydro, the Province of B.C., First Nations and the public, who work together to conserve and enhance fish and wildlife impacted by the construction of BC Hydro dams.

We also acknowledge the Upper Columbia White Sturgeon Recovery Initiative Technical Working Group for their contribution to this program.

1.0 Background

The population of White Sturgeon in the Canadian portion of the Columbia River has been undergoing recruitment failure for several decades (UCWSRI 2012). This was recognized as a critical issue for this population in the early 1990's and resulted in the establishment of the Upper Columbia White Sturgeon Recovery Initiative (UCWSRI) in 2001 and the population being listed as endangered under the Species at Risk Act (SARA) in 2006. Original estimates, based on annual levels of natural recruitment being insufficient for maintaining a self-sustaining population, suggested that the population would become functionally extinct by 2044 (UCWSRI 2002; Hildebrand and Parsley 2014). Accordingly, intervention and monitoring were deemed essential to preclude extinction. An integral part of the original recovery plan was the initiation of a conservation aquaculture program designed to provide artificial recruitment to the population and provide fish for research purposes. The conservation aquaculture program was designed to support the population until such time as stock abundance/age structure and habitat conditions (including spawning, incubation and rearing flows and reservoir levels) can support a self-sustaining population. This program was initiated in 2001 and has stocked sub-yearling juvenile sturgeon annually into the lower Columbia River.

Although construction and operation of dams have been implicated in the decline of white sturgeon in the Columbia River, the mechanisms responsible for recruitment failure have been difficult to ascertain with certainty (Gregory and Long 2008). During development of the Columbia River Water Use Plan (WUP), this uncertainty made it difficult for the WUP Consultative Committee (CC) to develop response measures to address sturgeon declines. The conservation aquaculture program, as delivered under the Columbia River WUP, is divided between two areas of the Columbia River, the lower Columbia River and the Mid-Columbia River. The program goals differ between the two areas. Under operational parameters of the Columbia River Treaty, adequate flow treatments before and during spawning, incubation and drift phases of the life cycle were not seen as feasible in the lower Columbia River downstream of HLK. The CC therefore agreed to a plan which included monitoring to assess trends in population dynamics, research into juvenile habitat use and survival, and an assessment of the feasibility of different management responses. However, it was deemed impossible to deliver this plan without releases of hatchery reared juvenile sturgeon as wild juvenile age classes were lacking and a project (CLBWORKS#34 - Lower Columbia River White Sturgeon conservation aquaculture program) was initiated to provide for dependable financial resources for the maintenance of the aquaculture program for the duration of the Columbia WUP.

In the Mid-Columbia River there were more uncertainties (e.g. biological, operational etc.) during the development of the WUP and the CC report (BC Hydro Columbia White Sturgeon 2012 Annual Report) recognized several possible long term directions for the Mid-Columbia program including:

- Initiate a conservation aquaculture program for development of an Arrow Lakes Reservoir failsafe population.

- Develop a self-sustaining (in the long term) population in a Kinbasket Reservoir/upper Columbia River recovery area.
- Initiate a conservation aquaculture program for development of a Kinbasket Reservoir failsafe (non-reproducing) population.

The CC recommended that the conservation aquaculture strategy for this program be robust enough to allow for the determination of whether or not wild production is possible and where recovery efforts would be best directed in either the Mid-Columbia or Kinbasket. CLBWORKS#24, Mid-Columbia White Sturgeon Experimental Aquaculture, was implemented during the first four years of the program (2008-2011). During this period, the focus was on providing for larval and sub-yearling juvenile releases designed to assist with monitoring habitat selection and use, and early survival. The second phase of the work under project CLBWORKS#25, Mid-Columbia White Sturgeon Conservation Aquaculture, was initiated in 2012 following a technical review of the entire Mid-Columbia White Sturgeon management plan. The results of a review in 2012 were to continue with conservation aquaculture program (2012-2018) in the Mid-Columbia and assess optimal size at release (survival / temperature / growth relationships) by releasing larger sized juveniles compared to those released from 2008-2012. Though the programs for the lower and mid-Columbia Rivers differ in implementation and design, they share several overarching objectives.

The overall objectives of the Columbia River White Sturgeon conservation aquaculture program include:

- The capture, transportation between the Columbia River and KTH, care and breeding of mature adult sturgeon at targeted numbers of 10 females and 10 males to provide for an annual objective of eight genetically distinct families or secondarily subfamilies. Adults are to be returned to the Columbia River upon completion of spawning.
- The successful incubation and rearing of approximately equal numbers of healthy juveniles from each family or subfamily bred in a given year targeting an annual release in the fall of the brood year or subsequent spring of a total of up to 12,000 sub-yearling sturgeon to facilitate stock rebuilding and research needs. Stocking targets are established through the TWG.
- The annual marking and tagging of all fish according to protocols, including scute removal, Passive Integrated Transponder (PIT) tagging, sonic tagging and other tagging as may be required of both broodstock adult and juvenile sturgeon.
- Annual participation in public awareness and educational activities including but not necessarily limited to release events, school events, public events, open houses workshops etc.
- Provision of research, testing and pilot programs exploring techniques for improved efficiencies and an ability to provide for broader genetic diversity of released stock.

In discussions at the UCWSRI TWG meetings in 2015, the alternative to focus all conservation aquaculture efforts on the rearing of wild caught eggs and larvae, with the use of a streamside white sturgeon rearing facility (the Facility) was brought up.

Such programs have been found to result in improved genetic diversity, have more natural rearing conditions, and have allowed for the development of collection and rearing methods that incorporate more aspects of the species reproductive ecology compared to more traditional rearing practices for both white sturgeon and other sturgeon species. In addition, it was decided to hold back approximately half of the 2014 year class white sturgeon from the regular production brood stock program, to be released at a larger size into the mid-Columbia River near Revelstoke BC in the spring of 2015.

The specifics of this alternative were:

- Wild progeny (eggs/larvae) to be imprinted at their respective spawning areas within streamside rearing containers and the surviving progeny transferred to and reared at KTH until a minimum of 9 months of age.
- 2014 year class white sturgeon to be reared to a minimum of 300 grams and released into the mid-Columbia River at 22 months of age.
- Suspend all hatchery brood stock programs from brood year 2015.

This report specifically describes the conservation fish culture activities undertaken from May 2016 through to May 2017 by the Freshwater Fisheries Society of BC at their Kootenay white sturgeon conservation facility to meet the objectives defined by CLBWORKS#25 and CLBWORKS#34.

2.0 Incubation, larval development, and juvenile rearing

2.1 Wild Progeny

In the spring of 2014 a streamside rearing facility was piloted on the banks of the Columbia River near Waneta. The facility was constructed within a 14 by 8 foot cargo trailer for ease of transport. The trailer was parked at a streamside location just upstream of Waneta eddy, supplied with power and plumbed to allow river water to be pumped through a series of MacDonald Jar upwellors set up over small rearing troughs. Each year, wild source eggs are collected in river and taken directly to the container to be placed into flowing MacDonald Jars. There they were incubated to hatch and the larvae retained in a compartmentalized collection trough (equipped with artificial substrate (Bio balls) for cover and hiding) for a maximum of 7 days post-hatch. Larvae need to be in the hatchery for rearing before 10 days post hatch to ensure they are successfully weaned onto feed, so FFSBC staff made regular trips to the facility to retrieve larvae and transport them back to KTH. Larvae are placed into rearing containers once they arrive at the hatchery. Separated by spawning events (usually by weeks), larvae are kept in their own groups (until they are large enough to PIT tag and take DNA from). Food (a mixture of krill, Cyclopeze *(biologically engineered organism of the Copepod family which has a much higher concentrations of essential omega-3 fatty acids, biological pigments and other nutrients than Brine Shrimp or Artemia nauplii)* and fish meal is introduced slowly to each group, with care taken to ensure suffocation does not occur in the excess food accumulation on tank bottoms (See Table 1 *for feeding rates based on fish size and water temperatures*). In the first few weeks, ponds are drawn down four to six times daily, and food is smeared onto the sides of the tank wall. As the pond level slowly

rises, access increases to the food on the tank walls. This process continues until the fish reach the 'first grade' size. At KTH wild larvae were reared in quarantine using the same juvenile rearing techniques described in section 2.2 and the same marking and tagging protocols with the exception of the lateral scute removal, which is now done on the right side of the body to identify wild progeny fish. All mortalities were preserved in ethyl alcohol for DNA samples. All DNA sampling on the released fish was only done when the fish were large enough to have tissue samples taken (dorsal fin clip) without any negative effects. A total pf 30 wild origin fish were selected for Fish Health Samples. Results of the testing proved negative, removing the requirement for quarantine.

2.2 Juvenile Rearing

During the juvenile rearing process, fish are graded based on size to improve growth and survival. At grading, fish were hand-picked into either large or small categories and placed into separate tanks. This was the first time during the rearing process when a complete inventory of fish was established. Numbers for all prior milestones of development were then back-calculated from this point. The splitting of fish between tanks decreases densities and reduces tank effects on growth. Secondly, non-competitive access to feed is important to the smaller, downgraded fish. These fish will recover from any feeding competition and quickly establish a higher growth rate. As post-release survival has been shown to be positively influenced by size at release[1], target size for juveniles at release has increased over the life of this program. For the lower Columbia River, mean size at release has increased from 50 grams during the early years of the program (2002-2007) to 75 grams (2008-2014) and now to a minimum of 200 grams (2015-present) for fish of wild origin. Given the genetic diversity of wild origin fish is higher than that of those produced by traditional broodstock methods; the 200 gram target was established to further improve survival following release based. In the mid-Columbia River the target size at release has increased from 75 grams (2008-2012) to 150 grams (2013-2015) and now to 300 grams (2016-present). The increase in size at release in the mid-Columbia is an attempt to evaluate survival through the first winter following release as recaptures of hatchery-origin juvenile white sturgeon has been low to date.

As a standard fish culture practice, specific feeding rate is calculated based on fish size (weight) and water temperatures and follows information provided in Table 1. As biomass increases so does the size and amount of feed provided to ensure consistent growth. During grading, smaller fish remained in smaller circular tanks until they are caught up on growth. Further grading may occur, but care is taken to ensure that smaller fish are not excluded so that they will contribute to the final release numbers.

[1] BC Hydro. 2016 Lower Columbia River Juvenile Detection Program (CLBMON-29). Year 8 Data Report. Report by BC Hydro, Castlegar, BC, 88 pp.

Table 1. Fish Feeding Guidelines for fish rearing. Amounts of feed are based on water temperatures and fish size.

Sturgeon Feeding Table

$$SFR = a * W^{-0.3548}$$

Specific Feeding Rate (SFR) = (%) Feed / Day
W = Body Mass (g)
a = Constant for Temperature

Temp □C	8-10	10-12	12-14	14-16	16-18	18-20	20-22
Constant "a"	7.444	7.958	8.2968	8.6252	8.9145	9.1726	9.3994

Specific Feeding Rate

Temp □C Body Mass (g)	8-10	10-12	12-14	14-16	16-18	18-20	20-22
0.05	21.55	23.04	24.02	24.97	25.80	26.55	27.21
0.10	16.85	18.01	18.78	19.52	20.18	20.76	21.28
0.15	14.59	15.60	16.26	16.91	17.48	17.98	18.43
0.16	14.26	15.25	15.90	16.53	17.08	17.57	18.01
0.20	13.18	14.09	14.69	15.27	15.78	16.24	16.64
0.25	12.17	13.01	13.57	14.11	14.58	15.00	15.37
0.50	9.52	10.18	10.61	11.03	11.40	11.73	12.02
0.75	8.24	8.81	9.19	9.55	9.87	10.16	10.41
1.0	7.44	7.96	8.30	8.63	8.91	9.17	9.40
2.5	5.38	5.75	5.99	6.23	6.44	6.63	6.79
5.0	4.21	4.50	4.69	4.87	5.04	5.18	5.31
7.5	3.64	3.89	4.06	4.22	4.36	4.49	4.60
10	3.29	3.52	3.67	3.81	3.94	4.05	4.15
25	2.38	2.54	2.65	2.75	2.85	2.93	3.00
50	1.86	1.99	2.07	2.15	2.22	2.29	2.35
75	1.61	1.72	1.79	1.86	1.93	1.98	2.03
00	1.45	1.55	1.62	1.68	1.74	1.79	1.83
250	1.05	1.12	1.17	1.22	1.26	1.29	1.33
500	0.82	0.88	0.91	0.95	0.98	1.01	1.04
750	0.71	0.76	0.79	0.82	0.85	0.88	0.90
1,000	0.64	0.69	0.72	0.74	0.77	0.79	0.81
2,500	0.46	0.50	0.52	0.54	0.56	0.57	0.59
5,000	0.36	0.39	0.40	0.42	0.43	0.45	0.46
7,500	0.31	0.34	0.35	0.36	0.38	0.39	0.40
10,000	0.28	0.30	0.32	0.33	0.34	0.35	0.36
25,000	0.20	0.22	0.23	0.24	0.25	0.25	0.26
50,000	0.16	0.17	0.18	0.19	0.19	0.20	0.20
75,000	0.14	0.15	0.15	0.16	0.17	0.17	0.18

3.0 Juvenile Releases

This year the stocking number for the Lower Columbia section was to be composed solely of wild progeny sturgeon. A total of 2247 larvae were transported to the KTH, from several separate spawning "events" that were estimated to occur in the Waneta Eddy. Survival was approximately 57% from larvae to release age (see Table 2). Wild progeny are released as close to place of origin as possible, so Millennium Park and Beaver Creek were chosen as the release sites. A total of 800 juveniles from the 2016 wild progeny collection were released.

1589 juveniles from the 2014 year class wild progeny fish were released into the Mid-Columbia. These individuals were deemed too small to be released in the spring of 2015, and were held for an additional year to be grown as large as possible. These were released into the mid-Columbia reach at Shelter Bay near Revelstoke BC. DNA samples were taken from all wild progeny fish, either by preserving mortalities or tissue samples of live fish.

Juvenile releases took place in the spring of 2017 over a period of three days, May 9th, 11th, and 13th. Wild origin progeny were released at Beaver Creek near Trail, BC and at Millennium Park in Castlegar, BC. Wells Origin fish were released on May 9th at Shelter Bay, near Revelstoke, BC.

Table 2. Summary of hatchery-origin juvenile White Sturgeon released into the Mid-Columbia (Shelter Bay) and lower Columbia Rivers in spring 2017. Weight (g) and length (cm) represent averages across all individuals released.

Release Location	Release Date	River km	Number Released	Weight (g)	Fork Length (cm)	Total weight (kg)
Shelter Bay	09-May-17	178.0	1,589	313	38	497
Millennium Park	05-May-17	10.5	350	190	29	66
Beaver Creek (Wild Progeny)	11 & 13-May-17	49.0	450	200	30	90

Table 3. Numbers of wild origin White Sturgeon larvae transferred from the streamside incubation facility on lower Columbia River and transferred to KTH for rearing during June and July 2017.

Arrival at KTH	Number
15-Jun-16	366
17-Jun-16	335
22-Jun-16	177
24-Jun-16	67
29-Jun-16	104
01-Jul-16	506
05-Jul-16	687
12-Jul-16	3
	2,245

Table 4. Total number of hatchery reared juvenile White Sturgeon released annually into the Lower Columbia River in Canada from 2002 – 2005.

	Canada		
Release Year	Fall	Spring	Total
2002		8,671	8,671
2003		11,803	11,803
2004		9,695	9,695
2005		12,748	12,748
2005	5,039		5,039
	5,039	42,917	47,956

Table 5. Summary of all Columbia White Sturgeon released into Lower and Mid-Columbia by Brood Year 2006 – 2016.

	Lower Columbia	Lower Columbia	Mid-Columbia	
Release Year	Brood Origin	Wild Origin	Revelstoke Reach	Total
2006	12,165		4,288	16,453
2007	10,477		6,353	16,830
2008	4,141		8,118	12,259
2009	3,947		9,625	13,572
2010	4,010		8,078	12,088
2011	4,192		6,567	10,759
2012	4,037		5,944	9,981
2013	1,800		6,013	7,813
2014	2,800	1,095	3,283	7,178
2015		76	1,324	1,400
2016	800		1,589	2,389
	48,369	1,171	61,182	110,722

In March the juvenile fish were individually handled to insert a PIT tag into the dorsal musculature at the midpoint between the dorsal and lateral scute line inferior to the anterior margin of the dorsal fin (see Figure 1). PIT tag, length and weight data was recorded for each individual fish starting in mid-April, to be as close to release time as possible. This was done to ensure no additional growth occurred in-hatchery that may be attributed to post-release growth. Each individual fish can subsequently be identified to its release location and date of release in addition to family record. Juveniles are transported in FFSBC fish transport vehicles according to UCWSRI TWG transport protocols.

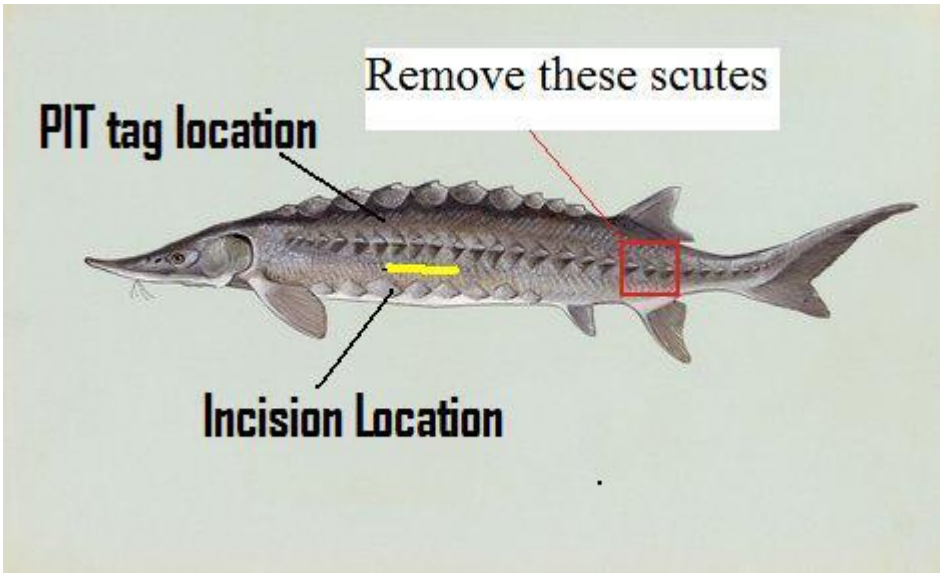

Figure 1: Scute removal and PIT tag locations. Note the incision location for application of telemetry tags if required.

3.1 Release Events

Each year school and public release events are planned and organized the Fish & Wildlife Compensation Program (FWCP) and FFSBC staff, along with the assistance of volunteers from other agencies. The FWCP works on behalf of its partners, BC Hydro, the B.C. Ministry of Environment and Fisheries and Oceans Canada, to conserve and enhance fish and wildlife populations impacted by the construction of BC Hydro dams in the Columbia Basin. The FWCP and BC Hydro are the primary funders for the Columbia River white sturgeon aquaculture program and FWCP is an active partner in the Upper Columbia White Sturgeon Recovery Initiative (UCWSRI). It also recognises that the sturgeon recovery work will take many years and will only be successful if the community and the younger generations become more connected with the fish. With that goal in mind FWCP organized juvenile sturgeon release events for the public on behalf of the UCWSRI for school children and public in Trail and in Revelstoke.

This year's release event in Shelter Bay saw approximately 200 students attending, while the release event at Millennium Park and Beaver Creek had close to 300 students each, while the Public event at Critters Days were also very well attended and received.

4.0 Fish Health Testing Summary

4.1 Virus Screening

30 fish were submitted this year on Dec. 14th for fish health screening. 11 fish from group 1, 5 fish from group 2, 10 fish from group 3 and 4 fish from group 4 were tested for viruses and bacteria. Results were negative for all three tests and are presented in Table 6.

Table 6. Results for 2016 fish health testing

Case	Stock	Date inoculated	Sample	Test	EPC	CHSE	WSSK	WSGo	Comments
2016-1106	Columbia Wild sturgeon larvae	Dec 15	30 fish	virus	Neg	Neg	Neg	Neg	No virus or filterable replicating agents detected
		Dec 15	30 fish	Bact - TSA	--	--	--	--	No pathogenic bacteria detected
				Bact -HS	--	--	--	--	3/30 YPB. Low growth. Not confirmed as Flavobacterium psychrophilum

4.2 Deformities

Very few deformities were observed in the 2016 year class holdovers. As there were so few deformities seen, monthly deformity checks were discontinued and deformities were then noted when fish were handled during the marking process. No pattern of deformities was observed, the majority noted were minor fin deformities.

5.0 Permits

In June of 2013 a five year SARA permit was obtained for all the Columbia sturgeon culture activities including adult transport, holding, spawning, rearing, research and releases. This permit is valid to June 2018. All necessary Introductions and Transfer Committee (ITC) permits for adult and juvenile transfers were obtained this February.

6.0 Autopolyploidy Assessment

The ploidy of wild white sturgeon has previously been determined to be 8N in Columbia and Kootenay River populations. Concern was raised when a large number of 12N white sturgeon were discovered in progeny family groups which were derived from wild Kootenay River white sturgeon brood and were being cultured in the artificial rearing environment at the Kootenay Tribe of Idaho's (KTOI) Sturgeon Hatchery. The mechanism of this ploidy shift is unknown but it is thought to occur at the fertilization stage. In partnership with a commercial sturgeon farm and with the assistance of University of California at Davis, blood samples were collected from family groups at KTOI and sent to UC Davis for Flow/Cytometry analysis. Through this process it was determined that some of the family groups at KTOI were composed of up to 50% 12N sturgeon. Given that there are potential implications to the Upper Columbia River recovery program, the Freshwater Fisheries Society, under the direction of the TWG, assessed the ploidy of all wild progeny white sturgeon families being reared at KTH. The final results for the 2016 BY Wild origin fished showed 1 fish sampled to be of 12N ploidy (Table 7).

Table 7. Ploidy for Columbia White Sturgeon wild origin larvae brood year 2016

Group	Slide range	Date imaged	Confirmed 12N	No image available for the following numbers
GrpA	1-100	Mar 31	--	
GrpB	101-200	Apr 7	--	
GrpC	201-300	Apr 13	--	
GrpD	301-400	Apr 24	--	#294
GrpE	401-500	Apr 24	--	
GrpF	501-600	Apr 28	--	#552
GrpG	601-700	May 3	--	
GrpH	701-800	May 4	#725	
GrpI	801-900	May 5	--	
GrpJ	901-1000	May 9	--	
GrpK	1001-1100	May 10	--	
GrpL	1101-1156	May 10	--	

Total slides = 1156
Total 12N = 1
% 12N = .087%
Completed = May 11th 2017
Note: All slides confirmed 8N with the exception of slide #725.

All suspect 12N slides were re-imaged and re-analysed for confirmation (Table 8). Sometimes slides are imaged out of focus or are of poor quality which can give a false result. Re-imaging and analysing new images can provide confirmation of actual ploidy. 2/3 suspect slides confirmed as 8N ploidy.

Table 8. Suspect 12N slides that were reanalyzed

Group	Total # slides re-imaged	Date imaged	Confirmed 12N	# confirmed 8N
GrpW	3	May 11	1	2

The holdover Wells fish DNA was also submitted for testing prior to release in the Mid-Columbia River. Of the 2154 fish tested, there were no confirmed 12n`s (Table 9).

Table 9. Ploidy results for wild larvae transferred from Wells pre-release testing BY2014

Group	Slide range	Date imaged	Confirmed 12N	No image available for the following numbers
GrpA	1-100	Dec 1	--	#24
GrpB	101-200	Dec 5	--	
GrpC	201-300	Dec 12	--	
GrpD	301-400	Dec 16	--	
GrpE	401-500	Dec 20		
GrpF	501-600	Jan 12	--	#596, #597, #598
GrpG	601-700	Jan 13	--	
GrpH	701-800	Jan 17	--	
GrpI	801-900	Feb 2	--	
GrpJ	901-1000	Feb 3		
GrpK	1001-1100	Feb 7	--	#1038
GrpL	1101-1200	Feb 9	--	
GrpM	1201-1300	Feb 15	--	#1276, #1300
GrpN	1301-1400	Feb 17	--	#1396
GrpO	1401-1500	Feb 22	--	
GrpP	1501-1600	Feb 28	--	
GrpQ	1601-1700	Mar 7	--	
GrpR	1701-1800	Mar 9	--	
GrpS	1801-1900	Mar 10	--	#1824, #1834, #1838
GrpT	1901-2000	Mar 29	--	
GrpU	2001-2100	Mar 28	--	#2100
GrpV	2101-2154	Mar 29	--	

Total slides = 2154
Total 12N = 0
Completed = April 24th 2017

All suspect 12N slides were re-imaged and re-analysed for confirmation. All suspect slides were confirmed as 8N ploidy (Table 10).

Table 10. Suspect 12N slides that were reanalyzed

Group	Total # slides re-imaged	Date imaged	Confirmed 12N	Confirmed 8N
GrpW	66	April 23	0	66