

## Puntledge River Summer Chinook Captive Brood Program

### Intro

The Puntledge River Summer Chinook is one of only two **Summer Run Chinook** stocks on Vancouver Island. Historical abundance of this stock ranged from approximately 3500 to 6000 returning adults.

Habitat and migration problems created by the construction and operation of two dams on the Puntledge River contributed immensely to the decline of these Summer Run Chinook. During construction, a coffer dam failed, depositing thousands of cubic yards of material on the main Summer Chinook spawning grounds downstream. Upstream migration to traditional holding, spawning and rearing habitats was cut off due to these structures. A large portion of the traditional spawning grounds were flooded behind the diversion dam. DFO and B.C. Hydro have worked together on many initiatives to help restore this stock back to its historical levels.

In 1965 B.C. Hydro built a spawning channel between the 2 dams in compensation for the lost spawning habitat. Survival from the channel was poor and over time the channel was converted to a hatchery. B.C. Hydro has maintained the pumping systems delivering water through the facility and DFO operates the hatchery for the enhancement of Summer Chinook and Summer Steelhead, both in danger of extinction. The numbers of returning adults to be spawned as brood stock had dropped to historical low numbers and these few fish were now more vulnerable to other factors limiting their survival including predation by seals. A committee was formed in the Comox Valley ( the Puntledge River Seal Predation Committee) to identify these factors and to form a plan of action to address the main issues compromising the survival of these stocks. Issues identified for study included:

Predation by seals

Fishing pressure

Habitat Issues

- lack of spawning gravel and rearing habitat
- water flow and high temperature
- water quality
- the state of the estuary

Recommendations by the Puntledge River Seal Predation Committee resulted in a cull of problem seals, closure of local fisheries, the start of habitat studies and restoration work, an estuary management plan and a “Captive Brood Stock” program.

It was proposed to assist the rebuilding of Puntledge Summer Chinook by raising selected brood stock from fry through to maturity at the Rosewall Creek Hatchery and harvesting eggs to supplement the Puntledge Hatchery summer chinook program. This captive brood stock program would only succeed if the program was carried out in concert with the other measures listed above to increase the survival of the summer Chinook.

## **Objectives & Plans**

The objective of this program is to rear enough Puntledge River Summer Chinook fry to mature adult brood stock in fresh water to produce 1 million smolts per year from 4 separate brood years. This program was started in the fall of 1997 when adult brood stock was collected at Puntledge Hatchery. Rosewall Creek D.F.O. Research Facility was the site selected for carrying out the Summer Chinook Captive Program because of water quality, temperature and location. A partnership was formed between Puntledge Hatchery and Big Qualicum Hatchery in the operations and maintenance of the Rosewall Creek facility. Funding has been supplied through the Strategic Stock Enhancement Program (DFO) for 4 years operational costs (\$600,000), B.C. Hydro for capital funding of 5 – 20 foot diameter circular fibreglass tubs complete with lids, automatic feeders, re-circulating pumps and oxygen supplementation (\$115,000) and Fisheries Renewal B.C. for manpower to conduct portions of the program in its initial stages.

## **Research Background**

The Captive Brood Program was modelled after successful captive brood programs done in the United States. One of these is the Hurd Creek Hatchery located near the town of Sequim Washington, about 30 kilometres Southeast of Port Angeles. The Hurd Creek Captive Brood Program has been enhancing Chinook since 1992, and is the main function of this hatchery. The hatchery supplies broodstock for the Dungeness River that has been plagued with unstable spawning grounds for years. This particular hatchery model was chosen for several important reasons:

- 1) They successfully enhance the Dungeness River Chinook stock. It works!
- 2) They utilise well water and have similar temperatures for incubation and rearing as Rosewall Creek Hatchery.
- 3) They utilise the optimum genetic enhancement techniques that are available.
- 4) The survival from fry to spawning adult is around 80%!
- 5) Hurd Creek Hatchery will be able to keep escapements going until the spawning grounds can be improved to acceptable conditions.

## **1997 Brood Year**

The Puntledge Summer Chinook Captive Brood Program began in the fall of 1997 when 98 females were spawned for hatchery brood purposes. After disease scening and D.N.A. sampling, a total of 77 females were used for the captive brood. At this time we were not sure how many fish were needed to complete a full brood cycle of 5 years so we used 130 fish from each individual female (Feb.98). A total of 10,000 fish were to be reared on ozinated water at Puntledge Hatchery in four separate cap troughs. These four separate female groups would be combined into 2 separate distinct groups for spawning purposes. One of these distinct groups was adipose clipped to prevent sibling spawning crosses. On Dec. 01/98 after securing Rosewall Creek Hatchery, the fish were moved to

10-foot circular tubs on site. These fish were to be reared to adult size on well water with average temperatures between 7.5-9.5 degrees Celsius.

On July 27/99 after 1.5 years of rearing, it was decided that 500 fish from each of these groups, for a total of 1000, would be sufficient for future brood purposes. These fish were moved to a 20' diameter **Cement Tank**. As 2 year olds the 1997 brood males started to premature jack, and a die off of 18% (all males) occurred (Oct-Nov./99).

After the premature jack die off, the remaining 1997 brood were reared in the cement 20-foot tub until a new rearing tank was installed on site. On June 27/00 a total of 628 fish were moved to a newly installed 50% re-circulating, fibreglass 20-foot tank paid for by B.C. Hydro. One week after transferring fish, several formalin flushes were carried out to prevent fungus infection caused from handling the fish.

During the months of August and September 2000 approximately 15% of the 1997 brood started to develop signs of spawning coloration. These fish sexually matured during the months of October to December 2000 and a total of 47 males and no females reached maturation. As these fish grew in size, more rearing space was required and over the next 5 months 4 more 20 foot fibreglass tubs were constructed and installed with monies from B.C. Hydro. 550 fish were divided into 2 new 20-foot re-circulating tubs. Average weight for the 1997 Brood fish at this time was approximately 2 kilos each. These fish should reach sexual maturation during the fall of 2001. We expected to spawn our first 4 year old females during the fall of 2001.

### **1998 Brood Year**

A total of 66 females were spawned from the 1998 Adult Summer Chinook Brood program at Puntledge. From this total 59 females were screened into the Captive Brood Program. After DNA, B.K.D. and C.W.T. data was compiled, a total of 50 fish from 37 individual females were to be used for Captive Brood purposes. From each female, a group of 50 fish were reared individually in 3' tubs to 4 grams and then moved into four 10-foot tubs. A total of 1000 adipose clipped and 1000 unmarked fish were reared to 100 grams in the 10-foot outside tanks. On Aug.31/00 a combined mark/unmark total of 740 fish were moved into the 20-foot cement circular tank. These fish started to exhibit the same premature jacking characteristics as 1997 brood. Between Oct and Dec.2000 a total of 292 jacks were removed from the program. This constituted roughly 39% of our 1998 Captive Brood Stock. At this point we were hopeful we would be left with 10% males and 50% females for spawning as 4 year olds. This trend had occurred at Hurd Creek Hatchery and they have been using the 2 and 3-year-old males for brood fertilization. On Jan.30/01 we moved the 1998 brood to the 3<sup>rd</sup> of 5 20-foot fibreglass tanks.

## **1999 Brood Year**

Our 1999 Brood had a total of 143 Puntledge Summer Chinook females that were spawned. Out of that we utilised 114 separate groups with 10 fry from each female for a total of 1140 fish. On May 31/00 we divided this group into an adipose clipped lot of 570 and an unmarked group of 570 fish. These fish were moved from four 10' tubs to the 20-foot cement tank on Feb.07/01.

## **2000 Brood Year**

This Brood year consisted of 101 Puntledge Summer Chinook females that were spawned. A total of 66 fish were utilised for the Rosewall Captive Brood Program. To date we have removed 50 fry from each of the 66 females at Rosewall. These fish will stay in 3' tubs till marking occurs and then will be moved to four 10' tanks.

## **Rearing and Handling**

All captive brood fish are fed Ewos feeds at or above the recommended feed rates and size of pellets. Once fish are up to .5 of a kilo or minimum 10 months prior to anticipated spawning, these fish are fed a specialized "brood" feed. These brood feeds are specially formulated with higher levels of protein, pigments, minerals, vitamins and fatty acids to mimic wild salmon diets.

Sampling of fish for weights / lengths etc. are kept to a bare minimum to reduce stress and handling. Mortalities are weighed for calculating a rough estimate of the average size.

Ambient rearing temperatures for Rosewall Hatchery usually average 7.5 to 8.5 degrees Celsius through the year.

The primary goal of this program is to yield 280 mature females from each brood year that can be spawned as 3, 4, 5 and 6 year olds. This will average 1 million eggs for any particular brood year. This program will incorporate 4 separate brood years from 1997 to 2001 for a grand total of 4 million eggs. A sunset for this program may extend to 2007 if we use 6 year olds from 2001 brood.

## **Concerns associated with this program have been and are:**

Water quantity and temperature. At full production we will be using 6- 20' tubs, 20- 10' tubs, plus over 150 intermediate 3' and 1' tubs for rearing. Incubation of 1,000,000 eggs would also have to be included in our overall requirements for water. This will constitute a considerable water use and plans are now being made to install a new larger pump and aeration system that will tap into a different aquifer.

Utilizing a ground water supply results in a different temperature regime that pre-spawning adults would normally be exposed to. In a wild river system in the Pacific

Northwest, the water temperature during the fall spawning period would be decreasing. At Rosewall, utilizing the ground water, the temperature is constant or rising slightly at spawning. We are looking at warming the water during the summer and then cooling again just prior to maturation as would happen naturally. Solar Panels already installed but not tested may be used to accomplish this in conjunction with heat exchangers.

Handling of fish can take its toll. Scale loss and reluctance to feed for days are evident. Once you handle adults or 3 year olds and up, a Formalin flush regime is necessary to prevent fungus problems. To date, mortality has been extremely low.

This stock of Chinook normally spawn at 3, 4 and on occasion at the 5 year age class. The captive brood are maturing as 4, 5 and 6 years. This will extend our program by 1 full year.

- To date there is no funding committed for the program beyond March 31/2003!

### **Conclusion and New Updates to program!!**

- We have as of Dec 31, **2002** successfully spawned **115** females from 97 and 98 Brood.
- Female average fecundity was 3000 – 3500 eggs per fish. (Historically 4000 – 4200)
- Survival from Green Egg to ponding was 89%. (similar to Puntledge Hatchery)
- Fry ponded were considerably smaller .25-. 30gm but so were the spawned females.
- After rearing and C.W.T. marking at Rosewall, approximately 263,616 fry were transported to the Puntledge Upper Site for imprinting and release as smolts.
- Fall 2002 – successfully spawned 406 females from the 1997 and 1998 brood fish and have reached our first target of 1,000,000 eggs (1,227,641 actual taken) to supplement the Summer Run Chinook smolt release from Puntledge Hatchery.

### **Contributors:**

Strategic Enhancement- For financial support and securing the Rosewall Facility

Big Qualicum Hatchery- For the operational, technical and standby support.

B.C. Hydro Bridge Coastal Fish and Wildlife Restoration Program – For money invested for five 20-foot re-circulating tanks, lids, feeders and oxygen supplementation.

Fisheries Renewal B.C.- For manpower to conduct portions of this program.

Puntledge Hatchery- For Bio. Technical and operational support.

Bob Addy - Enhancement Technician in charge of the program, Bill McLean – Support Biologist and Ted Sweeten – Consultant for all the biological and technical support that has enabled this program to be a success so far.



Rosewall Facility



20 Foot Tubs



Intermediate Tubs

<u>Date</u>	<u>JE</u>	<u>Description</u>	<u>Memo</u>	<u>Deposit</u>	<u>Expenses</u>
01/10/99		Deposit		30,000.00	
23/11/99	1	Independent Shipw rights	443911//97004 Oct15 recirculation tank		- 8,580.00
03/12/99	2	PRAqua	110/Nov25 design engineering services		- 3,800.00
20/12/99	3	CPI Equipment	460738/Nov24		- 966.48
		CPI Equipment	460739/Dec02		- 72.26
10/01/00	4	PRAqua	112/Nov29 Rotron Regenerative blow er		- 4,258.10
10/01/00	5	PRAqua	113/Nov29 Oxygenation equipment		- 2,636.79
10/01/00	6	PRAqua	114/Nov29 equipment training		- 1,700.00
10/01/00	7	Gencoast Construction	F152894514//96959 Dec10 tank removal		- 2,831.94
23/01/00	8	Keenan Backhoe Service	F152894522//Jan14 backhoe		- 4,284.00
18/02/00	9	Wilkinson Steel	57737 Jan19 frame for blow ers		- 274.50
01/04/00		Deposit	for receipt 53090056H	85,000.00	
01/06/00	1	Akva Feed Systems	F157207002//1883 Apr14 feeders		- 4,808.90
28/07/00	2	Independent Shipw rights	F1572-0-7007//371791 No09 4 tubs		- 48,720.00
05/01/01	3	Keenan Backhoe Service	5//Dec08 bobcat, backhoe		- 3,005.50
05/01/01	4	International Plastics Ltd.	13403 11/28 tub installation		- 728.51
05/01/01	5	International Plastics Ltd.	13416 11/28 tub installation		- 1,124.62
05/01/01	6	International Plastics Ltd.	13417 11/28 tub installation		- 42.61
05/01/01	7	International Plastics Ltd.	13721 12/05 tub installation		- 1,393.74
05/01/01	8	International Plastics Ltd.	13372 11/27 tub installation		- 15.53
05/01/01	9	International Plastics Ltd.	13093 11/21 tub installation		- 83.05
22/01/01	10	Muis Controls Ltd.	301315 12/04 flow meters		- 1,564.00
02/02/01	11	Keenan Backhoe Service	6//Jan08 backhoe		- 945.00
07/02/01	12	International Plastics Ltd.	809521 Aug12 tub installation		- 21.79
		International Plastics Ltd.	811579 Dec15 tub installation		- 219.48
		International Plastics Ltd.	811581 Dec15 tub installation		- 22.32
		International Plastics Ltd.	811629 Dec15 tub installation		- 259.59
		International Plastics Ltd.	811582 Dec15 tub installation		- 30.42
		International Plastics Ltd.	811583 Dec15 tub installation		- 160.74
		International Plastics Ltd.	811587 Dec15 tub installation		- 26.40
		International Plastics Ltd.	811591 Dec15 tub installation		- 338.69
		International Plastics Ltd.	811661 Dec15 tub installation		- 115.49
		International Plastics Ltd.	1543 Jan09 tub installation		- 4.34
21/02/01	13	International Plastics Ltd.	4963 Jan23 tub installation		- 46.25
		International Plastics Ltd.	4343 Jan22 tub installation		- 151.69
		International Plastics Ltd.	4962 Jan23 tub installation		- 351.96
21/02/01	14	Gencoast Construction	068908 tub installation		- 8,351.61
		Gencoast Construction	068909 tub w ater supply, drains		- 2,783.87
01/04/01	1	Independent Shipw rights	371734/20' circular tub lid		- 5,992.00
		Independent Shipw rights	371733/4-10' circular tub lids		- 3,852.00
14/05/01	2	Loomis Courier	533L659629122 03/01 Muis		- 16.18
26/06/01	3	BCG Services	63317 Jun26 fish transport supplies		- 384.85
<b>TOTALS</b>				<b>115,000.00</b>	<b>- 114,965.20</b>
<b>Balance Remaining</b>					<b>34.80</b>