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**Snootli Hatchery Chinook  
Augmentation  
Brood Year 2009**

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Prepared For:

The Pacific Salmon Commission  
600 – 1155 Robson Street  
Vancouver, BC  
V6E 1B5

## **Executive Summary**

The conservation status of Central Coast chinook has become a matter of concern. The number of returning Atnarko River chinook has declined in recent years, in spite of annual supplementation with 2 million juveniles from Snootli Creek Hatchery.

Assessment of coded-wire tag recoveries from Atnarko River chinook produced at Snootli Hatchery indicates that up to 43% are harvested in Alaska, 17% in the North Coast and 40% in the Central Coast, primarily in the terminal Bella Coola gillnet and FSC fishery. (Anon, 2001).

In order to reverse the decline of Atnarko chinook and provide additional fish to the Alaskan, North Coast and Central Coast fisheries, Fisheries and Oceans Canada (DFO) applied for and received funding from the Pacific Salmon Commission to supplement Snootli Creek Hatchery's production with 300,000 yearling smolts from the 2009 brood year.

In June 2011, 298,110 yearling Chinook smolts from the 2009 brood year were released – 103,145 were coded wire tagged. Recoveries of these tagged fish will facilitate assessment of numbers and location harvested, and overall returns.

## Acknowledgements

This project was funded by the Pacific Salmon Commission Northern Fund. When schedules coincided, staff from the Nuxalk First Nation Fishery Program assisted Snootli Creek Hatchery staff with brood stock collection, spawning and rearing. The Central Coast Fishermen's Protective Association provided fish culturists and taggers. The Mid Coast First Nations Training Society provided students to feed the fish throughout the summer.

### **Fisheries & Oceans Canada personnel included:**

Russ Hilland	WEM Snootli Hatchery
John Willis	Ops. Manager Snootli Hatchery
Lawrence Michalchuk	Fish Culture Officer Snootli Hatchery
Carl Siwallace	Fish Culture Officer Snootli Hatchery
Tom Loosmore	Fish Culture Officer Snootli Hatchery
Marshall Hans Jr.	Asst. Fish Culture Officer Snootli Hatchery
Sam Mack	Asst. Fish Culture Officer Snootli Hatchery
Denis Tippie	Maintenance Superintendent Snootli Hatchery
Blair Mack	Asst. Maintenance Supt. Snootli Hatchery
Marie Salome	Administrative Officer Snootli Hatchery
Wayne Levesque	Stock Assessment Technician Bella Coola

### **Other Personnel Included:**

Shirley Willson	CCFPA
Cathy Moody	CCFPA
Lori Casperson	CCFPA
Lucy Mack	CCFPA
Louise Hilland	CCFPA
Shawny Evans	CCFPA
Rory Villars	CCFPA
Colleen Gabriel	CCFPA
Ernie Tallio	Nuxalk First Nations Fisheries Guardian
Sasha Patrick	Midcoast First Nations Training Society (student)
Jalissa Moody	CCFPA student
Kaila Willis	CCFPA student
Francis Phillips	CCFPA student

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## **1. Introduction**

The Atnarko River is the dominant source of Chinook in the Fisheries Management Area 8 and the Central Coast. Central Coast Chinook spawner abundance has varied significantly over time, with peaks in the mid – 1960’s and early 1990’s (Wood, 2000). Since that time, Central Coast chinook escapements have stabilized at a level below target escapements. This is reflected in returns to the Atnarko River. Over the 10 year

period from 2001 - 2010, escapement averaged 15,590, which is approximately 62% of the target escapement of 25,000.

**Table 1. Atnarko Chinook Escapements, 1997 - 2006**

2010	11,3000
2009	10,600
2008	9,000
2007	11,000
2006	26,000
2005	17,500
2004	17,500
2003	15,000
2002	14,000
2001	24,000
<b>Average</b>	<b>15,590</b>

As defined by the Pacific Fisheries Resource Conservation Council (Anon. 2001), Atnarko chinook exhibit all three chinook life history types.\* Hilland (1979) called them yearling smolts, 90 day smolts and fry of the year.

The original strategy for supplementing the Atnarko chinook run with hatchery fish was to add ocean ready, ocean type juveniles, so as not to displace or compete with resident stream type fry and juveniles in freshwater and immediate type fry and juveniles in the estuary.

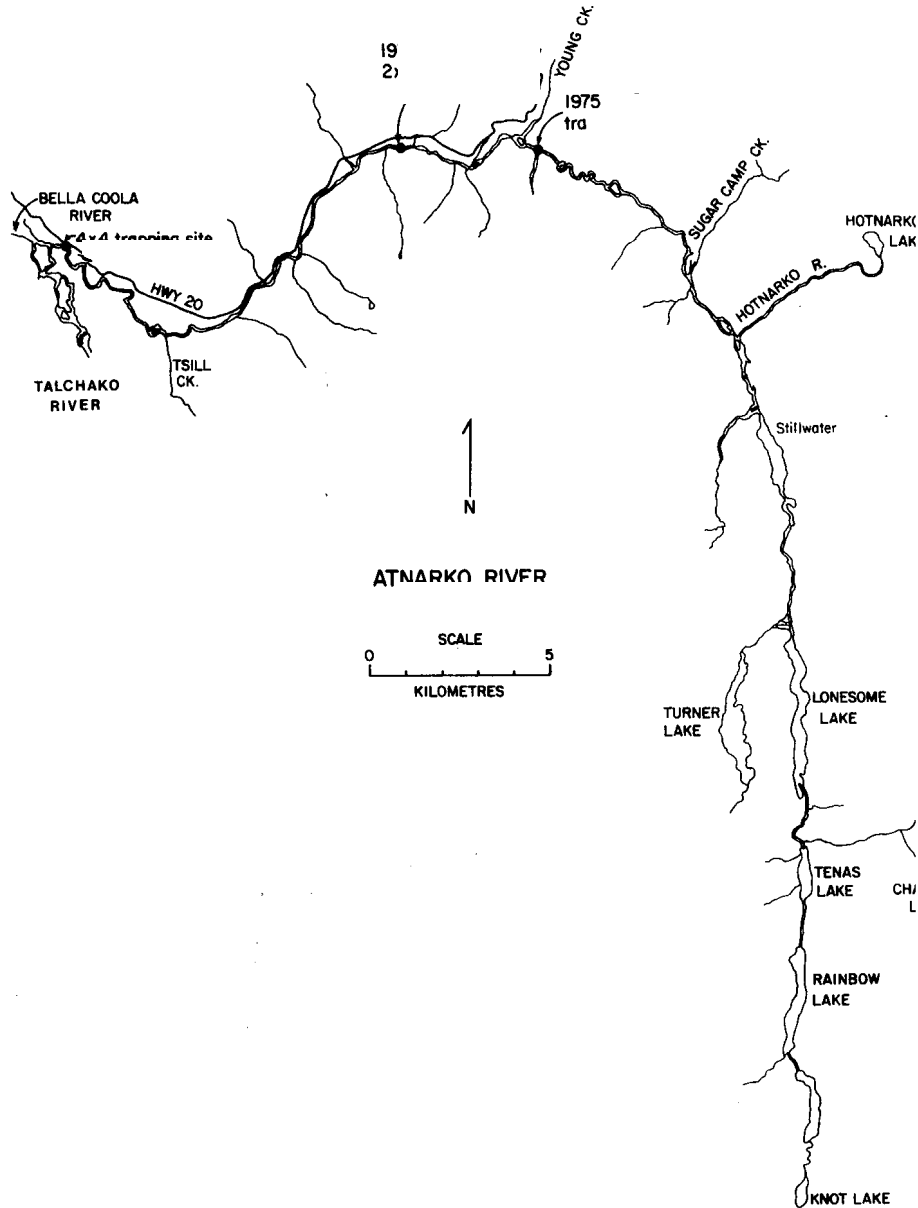
- \*1. "stream type" with an extended rearing phase of up to one year or more.
- \*2. "ocean type" with a limited freshwater rearing phase (60-150 days).
- \*3. "immediate type" which bypass the fresh water rearing phase and migrate to the estuary soon after emergence.

In 1990 to 1993 an experimental program to produce stream type smolts was undertaken at Snootli Creek Hatchery. The objective was to determine if smolt-to-adult survival differed between stream type and ocean type Atnarko chinook. Subsequent coded wire tag recoveries indicated that smolt-to-adult survival of stream type chinook was approximately double that of ocean type fish. This discovery had tremendous potential. The same number of adults could be produced from fewer brood stock, allowing more returning adults to spawn in the wild. Or, more adult chinook could be produced without increasing the number of brood stock taken. Unfortunately this program was cancelled during one of the many funding cuts to the Salmon Enhancement Program.

Atnarko chinook are caught in Alaska, Northern BC and on the Central Coast. To increase catches while maintaining escapement, Snootli Creek Hatchery proposed to supplement current wild and hatchery production with 300,000 to 400,000 stream type smolts from the 2007 to 2010 brood years. The proposal was approved and funded by the Pacific Salmon Commission Northern Fund. Results for the 2007 and 2008 brood years were reported in a previous report (PSC June 2009). Results for the 2009 brood are reported herein . Coded wire tag recoveries will be monitored to further evaluate success

## **2. Study Area**

The Atnarko River (fig 1. page 8) drains a 2,440 km<sup>2</sup> watershed, merging with the Talchako River to form the Bella Coola River, approximately 45 kilometres downstream from Knot Lake. With the exception of Charlotte Lake and the headwaters of the Hotnarko River, the Atnarko and its tributaries are situated within the boundaries of Tweedsmuir Provincial Park.



**Figure 1: Atnarko River from source to mouth**

Chinook spawning downstream from the Young Creek rapids spawn about a week later than their counterparts spawning upstream from the Young Creek rapids. Because of their spatial separation and difference in spawning times, these two populations have always been considered distinct and cultured accordingly.

In the Upper Atnarko, brood stock collection occurred from 'Line Cabin' to 'Robson's Farm'. In the Lower Atnarko, brood stock was collected from 'Flat Rock' to 'Belarko'.

### 3.0 Methods



### 3.1 Brood stock Collection

In the second week of September, when the chinook have moved out of the holding pools onto their spawning beds, 8”mesh , tangle hung (3:1) “Alaskan Twist’ gillnets are drifted through the spawning areas.

As soon as the net is beached, non-target species and unripe chinook are released. Ripe female chinook are dispatched with a swift blow to the head, hung head down and bled by severing the gill arch. Once bled, the fish are held tail down over a spawn collection pan and incision is made from the vent forward to free the eggs. (Fig. 2)



**Figure 2: Removal of Eggs from Female**

The eggs are then gently transferred to a sealed plastic container and placed on ice in a cooler for transport back to the hatchery. Milt from ripe male chinook is expressed into plastic ‘whirl pak’ bags (fig. 3) which are then sealed and placed on ice in the same cooler as the eggs. As per SEP guidelines, the number of males and females spawned is equal (1:1 spawning).



**Figure 3: Collection of Milt from Males**

The males are dispatched with a sharp blow to the head immediately after spawning and all the carcasses are returned to the river.

### 3.2 Fertilization and Planting

Upon return to Snootli Hatchery, the individual egg buckets and the individual 'whirl paks' are placed on the spawning table. Milt from male "1" is added to the eggs from female "1", milt from male "2" is added to eggs from female "2" and milt from male "3" is added to the eggs from female "3", and so on. The egg milt mixture from 3 males and 3 females is pooled in a spawning bucket, stirred by hand and water is added to effect fertilization (fig.4). The now fertilized eggs are rinsed several times to remove excess milt, blood clots and/or bile, then placed in an Atkins cell to incubate until they are eyed.

**Figure 4: Fertilization of Eggs**



### 3.3 Incubation

Atkins cells are loaded with 100,000 eggs per cell (fig. 5). Flows are maintained at 40-45 lpm, for each line of 4 cells. When the eggs reach the “eyed” stage of development (320 degrees Celsius ATU) they are shocked, dead eggs are removed and the live are transferred to vertical stack incubators (Heath Trays) (Figure 6) at a loading of 7500-8000 eggs/tray, 7 trays per stack. Flows are set at 12-15 lpm per stack. The eggs remain in the stacks until ponding.



**Figure 5: Loaded Atkins Cell**



**Figure 6: Heath Stacks**

### **3.4 Ponding and Rearing**

At “button up” (1000 degrees Celsius ATU), the fry are transferred from the vertical stack incubators to concrete rearing ponds. The rearing environment is maintained within SEP Standards (Shepperd, 1984). That is, flows are no less than 11pm/kg and density never exceeds 11.6kg/m<sup>3</sup>. In late fall, the juveniles are transported to the Atnarko rearing channels, reared until the following May, then released. Flows and densities are maintained within SEP Standards (see above). The food of choice is Skretting, fed at 1-2% of body weight, depending on fish size and rearing temperature.

### 3.5 Marking

Prior to transport to the Atnarko Rearing Channels, a portion of the juveniles are coded-wire tagged (Jefferts et al, 1963) and adipose fin clipped. (Fig 7 )



**Figure 7: Coded Wire Tagging**

### **3.6 Release**

2009 brood year juveniles were released by removing the screens at the Atnarko ponds, allowing the smolts to emigrate volitionally. (Figure 8)



**Figure 8: Volitional Release, 2009 Brood Yearling Smolts**

### **3.6 Release (cont'd)**

The 2009 brood juveniles all originated from parents which spawned downstream from Young Creek, so were released volitionally by pulling the rearing channel screens. (Fig. 10)

## 4.0 Results

### 4.1 Spawning

#### 2009 Brood

From September 9 to September 22, 1,130,636 eggs were collected from 247 females and fertilized with milt from 250 males below Young Creek; 1,099,956 eggs were collected from 238 females and fertilized with milt from 240 males above Young Creek.

### 4.2 Ponding and Rearing

#### 2009 Brood

In February 2010, 1,155,445 Upper Atnarko fry and 1,114,057 Lower Atnarko fry were ponded to the raceways at Snootli Hatchery. When the '90 day smolt' production groups were transferred to the Atnarko Channels in April, 150,000 Lower Atnarko juveniles and 150,000 Upper Atnarko juveniles were held back at Snootli Hatchery, reared until December, then transferred to the Atnarko Channels for over wintering.

**Table 2 – 2009 Rearing Summary**

Stock	# Held Back at Snootli for Yearling Group	# Transferred to Atnarko Rearing Channels	# Released
Upper Atnarko	150,000	149,179	149,040
Lower Atnarko	150,000	149,227	149,070



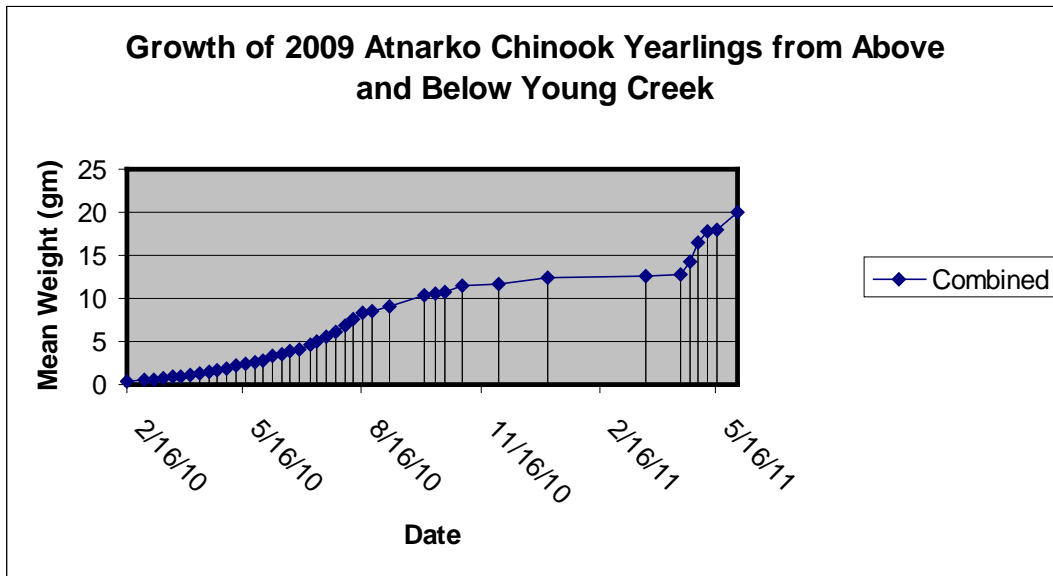


Figure 9: 2009 Brood Atnarko Chinook size over time.

### 4.3 Marking

#### 2009 Brood

Prior to transport to the Atnarko Channels, 53,264 (code 18/15/94) juveniles from below Young Creek and 49,881 (code 18/15/93) from above Young Creek were coded-wire tagged and adipose clipped.

### 4.4 Release

Table 3 - 2009 Marking Summary

Brood Year	Stock	Species	Fin Clip	CWT Code	# Released
2009	Upper Atnarko	Chinook	AD	181593	56,683
2009	Upper Atnarko	Chinook	AD	None	8,802
2009	Upper Atnarko	Chinook	None	None	90,357
Total					<b>149,040</b>
2009	Lower Atnarko	Chinook	AD	181,594	53,264
2009	Lower Atnarko	Chinook	AD	None	4,632
2009	Lower Atnarko	Chinook	None	None	91,174
Total					<b>149,070</b>

## 5.0 Discussions and Conclusions

Beginning in the 2005 entry year, survival rates of juvenile salmonids in the North Pacific Ocean declined below the norm. Reasons for this are discussed in “*State of the Pacific Ocean 2006 (DFO, 2007)*”. This adversely affected Chinook returns to the Atnarko River:

25 year average (1986 – 2010)	19,881
2009 return (estimated)	10,600
2010 return (estimated)	11,300

Therefore, we reduced the number of eggs taken for the yearling smolt program in 2009: 150,000 above Young Creek and 150,000 below Young Creek (total 300,000). We were able to produce 298,110 twenty gram yearling smolts from the 2009 brood. There are signs that ocean survivals are improving: “*State of the Pacific Ocean 2008*” (DFO, 2009). Monitoring of cwt recoveries from the yearling smolts released to date will indicate the success of the program.

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