A post season assessment report of the sentinel stock program on the Kaouk River, 2009 for the Pacific Salmon Commission.

DFO StAD South Coast WCVI and the Nuu-chah-nulth Tribal Council

Executive summary

- *Stock description*: The WCVI Chinook stock aggregate consists of production primarily from 27 spawning streams that are represented by six escapement indicator index streams identified in Attachments IV of the PST: Marble River (Area 27), Tahsish, Artlish, Kaouk (Area 25), Tahsis, and Burman Rivers (Area 25); and an eleven stream index including additional stream to those in Attachments IV. WCVI Chinook are far north migrating and assumed ocean distributions are similar to the Robertson Creek Hatchery (RCH) Chinook indicator stock for the stock group (Figure *i*). RCH coded wire tags are regularly recovered from sampling in the SEAK, NBC and WCVI AABM fisheries and from Central Coast and WCVI ISBM fisheries. Kaouk River Chinook are not exposed to directed ISBM terminal commercial net, First Nations Economic Opportunity freshwater net fisheries (Canada Net), nor directed sport fisheries in the terminal area as are the RCH stock in Barkley Sound, so relative exploitation rates in the seaward fisheries are likely somewhat different than indicated in Figure *i*. The RCH indicator stock is assumed to represent other WCVI naturally spawning and hatchery Chinook populations.

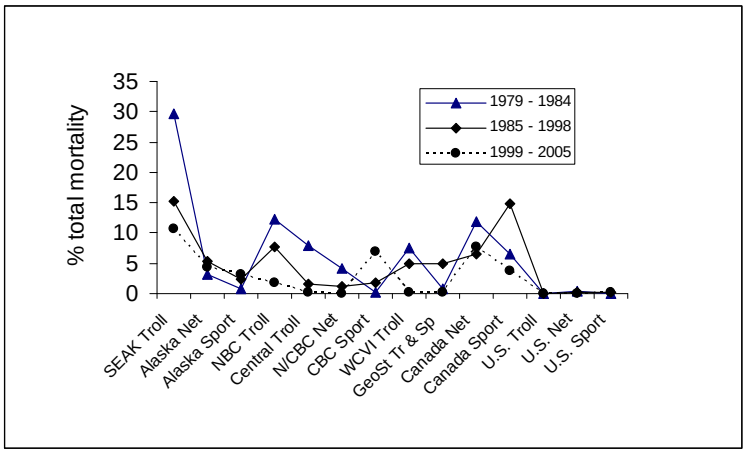

Figure *i*. The average period distribution of total fishing mortalities of Robertson Creek fall Chinook salmon (without escapement proportions shown) (from Appendix E6 of TTChinook(08)-3.

It is uncertain how accurately and precisely Kaouk River Chinook match the distribution of RCH Chinook. Past coded wire tagging programs at the nearby Conuma Hatchery and the Marble River indicated distributions similar to RCH, so further CWT applications were terminated. No age data is available to assess maturation rates or other biological characteristics of the escaping population.

Based on the catch of 30 CTC model stocks the WCVI hatchery and natural Chinook stock group, that includes the Kaouk River, contributes significantly to the SEAK and NBC AABM fisheries, and the WCVI hatchery component also contributes to the Central BC ISBM fishery (Table *i*). Since 1995 no directed WCVI troll fishing for Chinook has occurred during the summer and early fall to

avoid WCVI Chinook. Canada has limited allowed exploitation rates on WCVI Chinook in the NBC troll fishery to minimize catch of WCVI wild Chinook since the mid 1990s.

Table *i*. Percent catch of WCVI hatchery and wild Chinook in 2006 and 1985 – 2005 averages (from TTChinook(08)-3).

		Average 1985 – 2005 Catch as % of:		
WCVI stock	2006 Catch as % of Fishery	Fishery	All Fisheries	Total Return
	SEAK			
Hatchery	16.47	16.56	48.13	16.20
Wild	1.85	3.64	48.19	16.24
	NBC Troll and Sport			
Hatchery	5.49	6.55	14.70	5.57
Wild	0.62	1.49	14.60	5.57
	Central BC Troll and Sport			
Hatchery	25.00	17.84	3.42	1.35
Wild	0.0	3.67	3.37	1.34
	WCVI Troll and Outside Sport			
Hatchery	0.0	5.07	8.28	3.59
Wild	0.0	1.28	8.26	3.60
	Strait of Georgia Troll and Sport			
Hatchery	1.25	0.85	1.36	0.45
Wild	0.12	0.18	1.35	0.44

- *Methods*: A floating weir was built with a concrete fishway and an aluminum trap box to enumerate escaping adult Chinook. A secondary mark-recapture study was also planned using 60 radio tagged Chinook.
- *Estimate comparisons*: Due to severe weather in the month of September and the tidal influence at the weir site Chinook were not counted through the weir. The weir was topped a total of three times, therefore the only escapement estimate produced was the normative, swim based AUC. The AUC estimate for Kaouk River Chinook in 2009 was 550, which is above the fifteen year average. Assessments from past escapement programs based on AUC estimates have resulted in annual escapement estimates ranged from as low as 110 fish in 2000 to a high of 820 fish in 1998 with a fifteen-year average of 380 fish (1995-2008).
- *Results summary*: An escapement estimate based on weir counts was not possible due to the weir flooding events. The bulk of Chinook escapement passed over the weir during the September 18th flood event, based on a swim survey completed September 24th. Since a weir based estimate was not produced, calculating an expansion factor for AUC estimates was not possible.
- *Future method exploration*: a live mark-recapture study has been proposed for 2010. Further, the proponent of the 2010 study will assess whether remote sensing methods such as DIDSON or video monitoring can be used on this system after the implementation of the Maa-nulth treaty.
- *Final monetary amount*: $321,945.78 was allocated to the study from the SSC

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Introduction

The Kaouk River Sentinel Stock program was established to estimate the total escapement of Chinook salmon to the Kaouk River on the west coast of Vancouver Island (Area 26). We proposed to enumerate Chinook escapement using a weir modeled after the floating fence constructed on the Cowichan River. We also proposed backing up the weir count with a Peterson mark-recapture estimate in case the weir was topped by high flows. Although we did not achieve the goal of a high precision escapement estimate, several project milestones were achieved and the efforts made in 2009 have left the program in good standing to achieve these goals in 2010.

Project Objectives

The objectives of the project were:

1. to census the 2009 Chinook salmon escapement to the Kaouk River by means of a floating weir; and,
2. to implement a mark-recapture estimate of the annual total escapement of age 3.0 and older Chinook salmon in the Kaouk River such that the precision of the estimate is consistent (defensibly accurate) and lies within the coefficient of variation of <15% data standard, on average, (as a backup procedure, in the event that the weir fails to census the 2009 Chinook salmon escapement); and,
3. to estimate the age and sex composition of the escapement of Chinook salmon in the Kaouk River in 2009 such that all estimated fractions are within ± a 10 percentage margin of the true value 95% of the time.

Tasks associated with the project:

1. to conduct carcass surveys to document hatchery strays (if any in the escapement) and obtain otoliths required for origin determination, to obtain additional fish length data, and to confirm visual sex identification at the weir and downstream tagging site; and
2. to compare the census of the 2009 escapement of Chinook salmon in the Kaouk River with estimates as derived from the normative WCVI escapement methodology as applied to the Kaouk River.

Significance to the Pacific Salmon Commission's Sentinel Stocks Program: Please see the amended proposal from March, 2009 for details.

Methodology and Project Design

Escapement Assessment

The primary method for assessing the total escapement was going to be the count through the floating weir which housed an operating trap box (Objective 1 above). Further, the weir count was going to be calibrated and a secondary escapement estimate achieved

through a Petersen capture-recapture experiment using radio-tagged and secondarily marked Chinook that were marked and released below the weir (Objective 2 above).

The trap on the fishway was closed when the fence was not manned and at night and prevented fish passage upstream. Each crew member was trained by the project biologists and technician so that all the required elements of the program, methods, rationale, data collection and recording procedures were understood. In addition, to operating the weir and sampling fish the crew tagged fish below the weir, conducted carcass surveys and assisted with radio telemetry surveys.

Please see the amended proposal from March, 2009 for complete details of the proposed methodology, data analysis and associated rationale.

Risks to success

1. The main environmental risk to the success of the project is heavy precipitation and flooding. Radio tags were applied below the weir as a means of providing a backup mark-recapture estimate and calibrating the weir count, which was intended to address the possibility of the fence being topped and the weir census being incomplete.

2. Recovering carcasses for bio-sampling and when attempting to estimate tag loss during prior re-sight programs have been a problem due to scavenging and predation of carcasses and live fish by bears and wolves. However, the fence crew were directed to search for and recover carcasses throughout the program when not busy operating and maintaining the fence. The fence will also provide an opportunity for recovering drift carcasses that was not formerly possible.

3. Human capacity for analysis and reporting is an issue on this project related to meeting the SSP timelines. For this reason it was strongly recommended that a consultant analyst be retained to complete the analysis and reporting for this program. This capacity need has been accommodated in the budget.

4. The principal investigators and the Ka:yu:k't'h/Che:ktles7et'h have worked together for 15 years on a wide variety of fisheries related projects including an adult and juvenile fence on Jensen Lake Creek and tagging for mark-re-sight estimates on the Kaouk River in 2007. The same Ka:yu:k't'h/Che:ktles7et'h crew members already familiar with fence operation and the Kaouk River will be employed on the project.

5. In-kind funding from the Nuu-chah-nulth Tribal Council and from DFO for staff members time are secure. Funding for swim surveys for the AUC_{index} is a core DFO assessment activity and funding is also secure.

6. An opportunity for mentoring a new biologist was available. The Uu-a-thluk Fisheries program has hired a recently graduated First Nation biologist. Funding has been gathered from a number of capacity building sources, including the BC Capacity Initiative, the Living Rivers Trust and other sources to support her employment and development as a biologist. The Kaouk weir project was an ideal project that required a technician/biologist onsite to supervise the field crew and would assist this young lady gain valuable experience while being mentored by the proponents and consultant. This recent graduate will be employed in that position should this application be approved. She will also work on the analysis and reporting aspects of the program with the intent that she will replace the consultant analyst in future years. This employment opportunity will also further the relationship building that is occurring between DFO, the PSC, CTC and Nuu-chah-nulth and British Columbia First Nations in general.

Results

Project milestones

Major achievements were made in the first year of this project. The site was cleared and roadway and boat launch access to the river was created allowing for the field camp and weir to be set-up. A buried power line was installed to provide electricity at the site. Further, pathways on the field camp site were built which allowed easy walking access to the fishway on the weir and the river's edge for launching boats and field gear.

Other major achievements include the construction and placement of all the weir hardware (e.g. fence panels and fishway) on the river bottom and edge. Construction commenced august 4th. The abutment, fishway and sill rail anchors of interlocking concrete blocks were installed between August 7th and 13th. The sill rail was installed August 13th and 14th. The weir panels with the resistance boards were installed August 19th and 20th. The fishway was blocked with plywood and the structure was considered fish tight on August 20th. The fence portion of the weir including fitting the north (right) abutment and fishway with safety railings and gratings was completely installed August 24th. Delivery of the trap box was delayed until September 9th and the trap was installed September 10th. The Ka: yu:kt'h'/Che:ktles7et'h crew was trained August 28-29 and the program began September 10th after the trap box was installed. Beach seining and radio tagging of Chinook began September 10th and the final tags were applied September 30th. The program ended October 20th when weir disassembly began.

Synopsis of 2009 program results

Objectives 1 and 2: Weir and mark recapture based escapement estimates

Due to heavy precipitation and flooding events in September and October the weir was only partially operational, as a result Chinook by-passed the fence without being counted (Table 1). Weir topping events (flooding) occurred on September 9th, 18th and October 17th (Figure 1 and Figure 2).

Table 1. The number of individual fish counted through the Kaouk weir from September 10 through October 17th, 2009 (CN = Chinook; CO = coho and CM = Chum).

Species	Count
CN	0
CO Adults	100
CO Jacks	17
CM	20

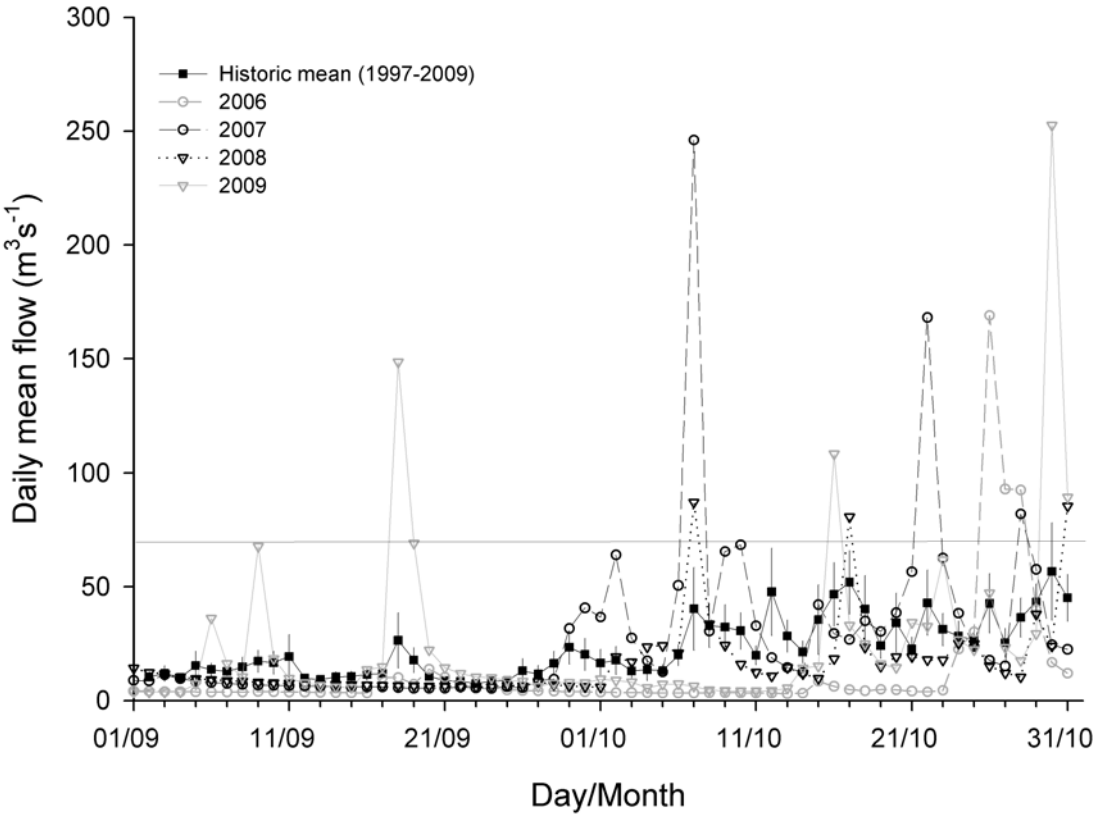

Figure 1. The daily mean flow (cm^3m^{-1}) on the Zeballos River during the months of September and October (Water Survey of Canada Station 08he006); the horizontal line represents the predicted threshold of the floating weir based on 2009 observations (error bars on the historic mean represents 1 SE).

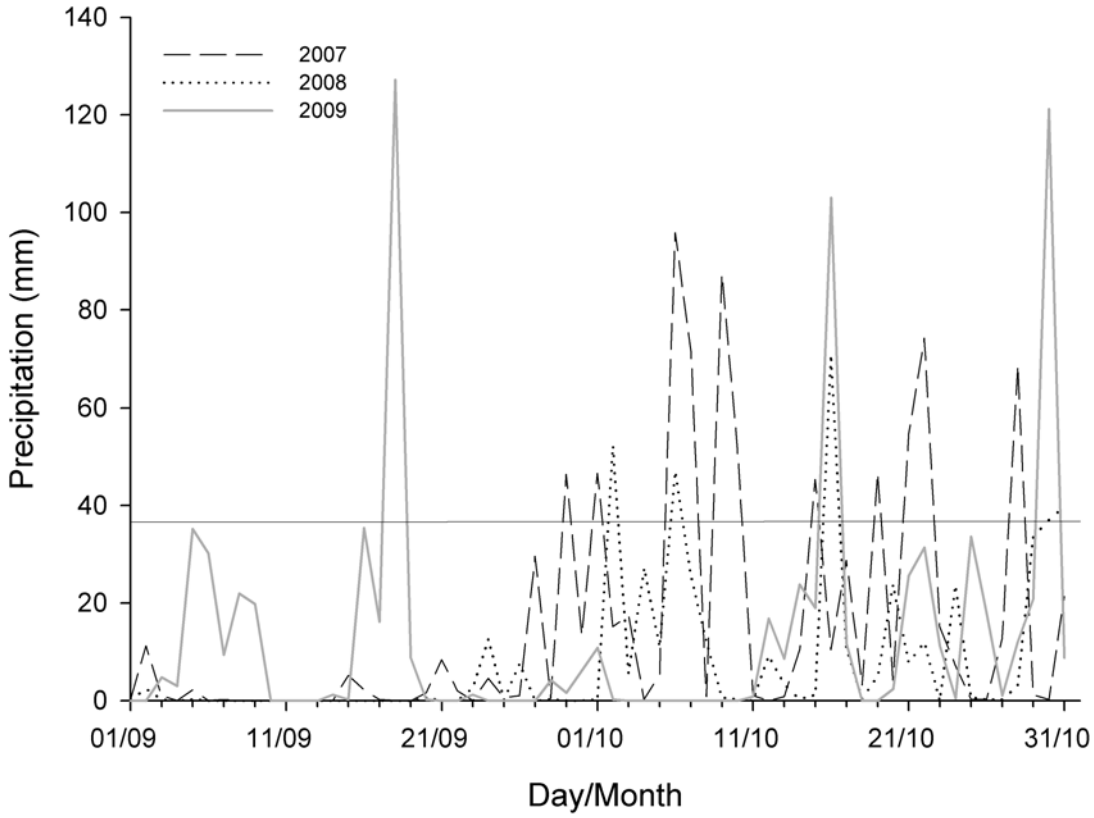

Figure 2. The daily cumulative precipitation (mm) on the Artlish River (BC Forest Service Fire Weather Station); the horizontal line represents the predicted threshold of the floating weir based on 2009 observations.

The first swim survey was completed September 10th in order to determine the number of Chinook and other salmonids that may have moved upstream prior to fence installation or during the first weir topping event on September 9th. During the first swim 19 adult Chinook were counted upstream of the weir. Further swim surveys conducted during normative AUC escapement program suggest that peak escapement may have occurred after the second flooding/topping event on September 18th; contracted swimmers saw 427 adult Chinook on September 24th. Further, four out of the five fish tagged prior to September 18th were later detected upstream of the weir during radio telemetry surveys (Table 2).

Although substantial efforts were made by the crew, NTC and DFO staff, only 13 Chinook were tagged below the weir. Five of these radio tagged fish were detected upstream and records suggest that they moved upstream during the flooding events of September 18th and October 17th (these events are discussed in detail in the later in the Weir topping section). Information from the stationary telemetry unit at upstream border of the swim survey area indicated that the five tags "never detected again" did not pass upstream beyond the swim survey area. We do not know what happened to these fish.

Since the proposed number of tags needed for the mark recapture estimate was 60 and Chinook did not migrate through the fishway calculating the associated escapement estimates was not possible.

Table 2. The summarized data from radio tagging and telemetry efforts on Kaouk River, 2009.

			Found upstream of weir			
Fish no	Date tagged	Code	Yes/No	When	Station	Comments
1	17-Sep	18	Y	14-Oct	9	Seen by swimmers Sept 24
2	17-Sep	17	Y	06-Oct	13	Seen by swimmers Sept 24
3	17-Sep	16	Y	06-Oct	2	Seen by swimmers Sept 24
4	17-Sep	29	N			Detected as dead tag downstream of weir Oct 8
5	17-Sep	30	Y	07-Oct	8	Seen by swimmers Sept 24
6	24-Sep	15	N			Never detected again
7	25-Sep	11	Y	29-Oct	8	Detected as dead tag
8	25-Sep	25	N			Never detected again
9	29-Sep	27	N			Detected as dead tag downstream of weir Oct 15
10	29-Sep	22	N			Detected as dead tag downstream of weir Oct 8
11	29-Sep	19	N			Never detected again
12	30-Sep	20	N			Never detected again
13	30-Sep	24	N			Never detected again

Objective 3: Age composition and mean length of Chinook escapement

Although Chinook were not sampled for scales and length at the weir some samples were acquired during radio tag application below the weir and when carcasses were recovered. The mean length of male and female Chinook caught below the weir was 831 mm and 910 mm, respectively. The proportion of age classes found in both sample types indicate Chinook ages 4 and older dominated the escapement (Table 3), however caution is warranted when interpreting these results as the sample sizes were small. Carcass survey sample sizes were small as the crew was otherwise occupied with duties associate with the other program objectives. Data from the DNA and otoliths collected are not available at this time.

Table 3 The proportion of Chinook scale ages on the Kaouk River 2009.

Sample Type	Gilbert-Rich Age	Proportion
Beach seine	3M	8%
(n=13)	31	33%
	41	42%
	51	17%
Deadpitch	1M	25%
(n=8)	21	38%
	41	25%
	51	13%

Issues experienced-Technical

Weir topping

The fence was topped a total of four times after the weir was installed, and three times after the weir and trap were fully operational. Three of these topping events occurred in September during unusually high fall rain levels. This is apparent when 2009 levels were compared with the historical daily mean flow in September on the Zeballos River (Figure 1). These flood events occurred on September 9th when 41.8 mm fell during the previous 48 hours, the 18th of September when 152.2 mm fell within a 72 hours period and October 16 when 122 mm of precipitation fell in the previous 48 hrs (Figure 2). If the flow on the Zeballos River and precipitation at the Artlish Fire weather station can be used as a proxy for events on the Kaouk River, then the threshold of flow, cumulative precipitation over 24 hours and the river height the weir can withstand are approximately 65 m^3s^{-1}, 40 mm and 120 cm, respectively. Although cumulative precipitation and flow levels in September were unusually high, October levels may not have been. The mean daily flow levels and cumulative precipitation in October are high and historically variable therefore; weir topping events in early October are still a possibility (Figure 1 and 2).

The largest of theses topping events occurred on September 18th and the weir was not operational again until 4 pm on September 23rd. During the October 16th event the steel railings on the fishway were cut by a member of the Ka:yu:kt'h'/Che:ktles7et'h nation as the river rose quickly and resulted in a large log snagging the rail. Proper fence operations stopped entirely after October 17th as one side of the weir was weighed down by sediment until fence removal began October 20th.

It is important to place these topping events in the context of the program operations and regular conditions at the weir. The river height at the fence site was normally around 80 cm at low tide. During these smaller topping events the river rose up to 2 m in height, while it rose to over 3 m during large events. In most cases the water rose to these heights within hours of the rain starting. It is really important to note here that all efforts were made to keep the weir clean during these events. The weir topping was largely due to high flows and not debris build-up. Only after the fence was topped did large amounts of debris and sediment build up, once topped cleaning was too dangerous.

Sediment deposition

After the topping events of September 18th and October 17th the fence was weighed down on the river left side with several inches of leaves, sand, gravel and cobble. The left bank of the river at the weir site is the inside of a meander and a sediment deposition zone. After the September 18th event a number of sand bags were deployed 2 layers wide and 2 high on the upstream side of the left abutment. This appeared to have the desired effect of reducing (not eliminating) gravel on the fence during subsequent high water with the exception of topping events. A method to reduce this deposition in the future is necessary as removing this sediment is extremely labor intensive, time consuming and physically difficult work.

Tidal influence and weir alignment

The design of the fence and location of the site within tidal influence combined to limit attraction flows at the downstream entrance to the fishway. The fence sill rails, to which the panels were anchored, were aligned with the upstream ends of the concrete abutments. The right abutments and fishway were purposely positioned as tightly to the right bank as possible to minimize constriction of the channel and scouring of the sill rail. Interlocking concrete blocks were used as recommended by the hydraulic engineering contractor to prolong the life of the structure. The concrete blocks were employed in building the pier containing the fishway were wider that those of wooden fish ways built in other systems. The wider blocks combined with the abutment position impeded flow through the fishway. fence does not line up with the downstream edge of the fishway. While this wasn't an issue for other floating weirs currently running on Vancouver Island, the Kaouk weir is influenced by tides. During normal river conditions the majority of fish move towards the fence at high or falling tides when there is no attraction flow through the fishway; regular downstream flow ceases and reverses as the tide crests. Fish held beneath fence panels on the upstream edge of the fence between the resistance boards and the sill rail. Once there they tend to hold there until the tide subsides again and they move back downstream into a pool as water depth decreases. As a result fewer fish than expected made their way into the fishway during rising tides when recruitment should be high, especially at night.

Radio tagging

Radio tagging of Chinook occurred downstream of the fence at one of the three pools that exist between mouth of the estuary and the fence site. Only one of these pools is conducive to beach seining. On the 16th of September all three pools were swum to see what was holding and if the pools could be seined. Very few Chinook were seen in these pools (under 10). On September 17th, five of the seven Chinook caught were radio tagged in the pool. Radio tagging and swims below the fence occurred within 48 hours of the estimated peak escapement, yet we did not see hundreds of Chinook in the river. This indicates that Chinook are either holding further downstream or at the mouth of the estuary due to their natural behavior or avoidance of the fence.

Radio telemetry

We had serious issues picking up the radio tags during telemetry surveys on the road. This was due our inexperience with this method, the nature of the system and the ordered tags. Although were under the impression that an 'H' antenna would pick up the radio tags along the road side telemetry stops, it was not. Only after consulting a Lotek technician and changing the 'H' antenna to a 4 element antenna attached to a 2" by 4" piece of lumber on the back of the truck did we successfully detected tags along the road.

Trap box construction

There are two major outstanding issues with the trap box. First, it did not trap fish as planned. Although Chinook were not trapped some Coho were (Table 1). Even though

these fish went through the fishway and were caught in the trap, most escaped back downstream before they could be counted or biosampled. The fyke opening of the trap was too wide. After some advice and help from the Tony Hanson, Ka:yu:kt'h'/Che:ktles7et'h fisheries manager, the fyke was fitted with a swinging 'door' which held fish in a little longer. A permanent, well designed trap door will need to be fitted on the trap for the 2010 season. The second issue with the trap is the upstream opening, which is not conducive to easy sampling from the trap. At the moment the upstream opening is 2-3' from the floor of the trap. Although we didn't get many fish through the trap in 2009, it will likely pose a problem in 2010 if the majority of the Chinook, chum and coho runs go through the trap. Lifting several thousand fish 2-3' through the opening will take its toll on the crew.

Fence removal

The weir removal was labor intensive due to the steep embankment and sharp turn on the field camp road. It took 4 days of work with a crew of 5-6 people.

Issues Experienced-Management

Crew guidance and capacity

There were issues with crew capacity and training. More effort needs to be directed toward ensuring that the crew understand the objectives of the project and has the proper training to complete the field tasks. Related to this issue, is the need to ensure that there is sufficient leadership in the field and capacity in terms of the real labour required to achieve the tasks.

Crew Size

A crew of three consisting of one leader and two workers was clearly not enough staff to complete all the program objectives and their associated tasks (see Objectives section above). Regular fence duties were not completed for many reasons and the full program was not implemented due to the severe weir topping events. Full carcass surveys, radio telemetry surveys, fence counting and biosampling by the crew did not occur in 2009. Given that the crew had difficulty with the minimal duties of fence operation and maintenance because of the nature of this system, substantial adjustments in crew hiring and organization will have to be done in 2010. Several programs on Vancouver Island have crew sizes that are much larger than that on the Kaouk River in 2009.

The crew sizes on the Cowichan River and Stamp Falls are much larger than the Kaouk crew, but their program objectives and goals are fewer than those of Kaouk SSP. The counting operation on the Stamp Falls indicator stock is different in scope than Kaouk but the crew consists of 2 crews of 2 working 4 days on, 4 days off up to 14 hours per day on the fishway. The fishway crew maintains the video equipment and records a live count of fish by species alone. The carcass survey portion of the program operates with a separate crew of 2-4 people. Their duties include setup/take down of equipment, collecting carcasses using a jet boat and biosampling fish at permanent stations.

On the Cowichan River a crew of ten is hired each year. This crew rotates in shifts of 2 people during program operation. The Cowichan is also a floating weir and it is manned with two staff members 24 hours a day, seven days a weeks. The objectives of Cowichan River indicator stock are also far fewer than those of the Kaouk SSP program.

Budget issues

Some time and aggravation could have been saved if DFO had a better understanding of where the overall budget stood, what had been spent, outstanding obligations and timing of future payments. Some time could have been saved in purchasing/deployment of the crew trailer and an earlier purchase of the large storage container would have been preferable. Further, the estimated budget for the over time and travel expenses incurred by DFO was severely under estimated due the unanticipated involvement in regular program operations.

Potential solutions for Technical Issues

Weir topping

Several ideas have been suggested by DFO and NTC staff, the most important of which is implementing secondary method to estimate Chinook abundances that is totally independent of the weir count (e.g. a live mark recapture or mark resight estimate). Other ideas include:

- Modifying the fence panels that experience the most of the flow. Some design ideas include extending them by another 10' and putting a secondary resistance board at their downstream end.
- Ordering inflatable air bladders that can be deployed when the river flashes or other hard shelled floats.
- Closing off the fishway and positioning the trap adjacent to the right abutment where flow is the highest, aligned to the downstream entrance to the trap aligned with the sill and fence panels so fish searching the fence will find the trap entrance.
- Installing a second permanent radio telemetry station at the fence to determine if Chinook are by passing the fence during topping events.

Sediment deposition

Some possible solutions include building a wall of concrete lock blocks at a 45 degree angle from the upstream bank of the river a 100 m or so upstream from the fence that points downstream. Digging a deep pool behind this wall will likely allow fine sediment to accumulate there and not on the fence. This pool may need to be recreated on an annual basis. An engineer will have to be consulted for this work and the benefits of this approach need to be weighed with its down sides.

While this wall and pool will be advantageous during low to mid level flows, when the river rises during large rain events this wall could stop large logs creating dangerous log jams and the trapped sediment could end up on the fence in one fell swoop. Purchasing a heavy duty power washer (2" fire pump) may be the simplest solution for this problem.

An assessment by a third party contractor or hydrologist experienced with these issues would be useful in order to determine if these methods are appropriate.

Tidal influence and weir alignment

Some solutions have been suggested by DFO and NTC staff:

- Removing some of the bottom concrete lock blocks from the fishway in order to create a darkened tunnel near from the upstream edge of the fence that leads into the fishway.
- Creating a deep pool with a connecting channel and woody debris on the downstream edge of the fishway would entice Chinook to stay closer to the fence as the tide and ebbs and flows. This may increase the fish movement through the fishway. This pool and channel on the downstream end of the fishway were part of the 2009 proposal plans, but it was not completed; budgeted machine time likely ran out.
- Move the fence site location upstream away from tidal influence.
- Moving the trap box out of the fishway and placing it along the upstream edge of the panel railing was also suggested at the Dec 2nd CTC meeting this year. This trap box was designed to move up and down with the tide to allow for biological sampling and moving it would also entail creating new hardware and structural reinforcements.
- Many believe Chinook display fence avoidance behavior that is enhanced by the white colour of the fence. Painting the fence panels a dark colour in early August before fence construction may help to deter this behavior.

Radio tagging

Several suggestions have been made to improve the tagging success of the program in 2010.

- In early August, swims and stream/marsh walks of the entire downstream section of the river may reveal more potential beach seining sites. Regular downstream swims and stream walks should become part of regular crew duties to determine when and if Chinook are holding in order to optimize the time invested and increase our tagging rate.
- Order a larger, deeper beach seine net (24' by 250') that will improve seining success in the deeper pools located downstream. A jet boat may also need to be used.
- Use a small commercial fishing vessel, like a gillnetter fitted with a small purse seine, to catch and tag Chinook in the inlet before they begin their upstream migration. The mouth of estuary may be a good seining site. A boat from the Ka:yu:kt'h'/Che:ktles7et'h First Nation may be available, but a new seining net will have to be purchased as it currently has a gill net. This could be tied to an AFC catch allocation for Coho for the Ka:yu:kt'h'/Che:ktles7et'h nation. Consulting both DFO and the Ka:yu:kt'h'/Che:ktles7et'h Fisheries managers will be necessary to determine if this is in the interest of the community and if it is at all possible.

Radio Telemetry

Most of the issues were due to our own inexperience with radio telemetry, the nature of the system and the tags we ordered. After several attempts to determine how to detect the tags efficiently we discovered the best methodology for 2010. This will require ordering a larger antenna, mounting it high off the back of a truck and describing the methodology effectively so the crew can easily and accurately capture the telemetry data.

Trap box issues

The trap box can easily be fixed to fish/work as initially intended during design. The initial design called for removable screens on the upstream side of the trap from base of the trap to its top to permit easy release of captured fish. Adjustments to the trap should be easily accomplished. A permanent, functioning trap door will also be easy to build.

Fence Removal

The boat ramp on field camp that leads to the river's edge will have to be widened in 2010. The bend in the road is too severe to bring a trailer up or down to the water's edge. Alterations to the field camp such as softening the bend and laying finer gravel over the rock lined boat ramp will be required in 2010 prior to removing the fence. Further, the removal dates and arrangements for hiring the hiab and machine for weir disassembly should be done well before the program begins.

Potential solutions for Management Issues

Crew guidance and capacity

The following solutions have been suggested and should be discussed among all the interested parties before the 2010 proposal is written:

- Hire a contractor to organize crew schedules and supervise the crew on site on a consistent basis (e.g. MC Wright & Associates).

Crew Size

At the very least the weir counting and maintenance crew should be doubled (6-7) to allow for proper staff rotation, fence maintenance and full program implementation. Working closely with the current Ka:yu:kt'h'/Che:ktles7et'h Fisheries Manager will be necessary in the spring of 2010 to determine if this number of suitable personnel is possible.

Hiring another casual crew of at least 4-5 suitable people will also be necessary when work loads are heavy in order to fulfill all the program objectives (e.g. biological sampling at the weir, beach seining, and carcass and telemetry surveys). If hired, the third party contractor would arrange this and train all crews.

Budget

Administration and over head costs will be charged by DFO in 2010. Portions of the budget will also need to be transferred from NTC to DFO before the program begins in order to cover significant overage in project hours travel costs incurred by DFO.

Discussion

Even though we did not meet the program objectives in its first year, several important milestones were reached. These milestones should not be overlooked as they along with the careful consideration and implementations of these recommendations will minimize the risks to future success. Several of the risks described above (see Risks to success above) played a role in our ability to fulfill the programs objectives. These risks included heavy precipitation and flooding as well as human capacity.

Although heavy precipitation was described as a risk in the proposal, the extreme weather conditions in September could not have been foreseen as they were unusual when compared to historical data. Based on these historical data further flooding events are likely to occur, but not so early in the program season. If peak Chinook escapement on the Kaouk occurs before this time frame than accomplishing the program objectives will be possible in the future. Secondly, if consensus is reached and many of the suggested recommendations are implemented (see Potential solutions for Technical Issues), the weir will be better able to withstand moderate precipitation events in the future. Human capacity was also described as a risk, but it impacted the success of the program in a different fashion than outline in the proposal.

Human capacity was described as a risk for data analysis and report writing, this did not occur as minimal data were recorded in the first year. However, human capacity became an important issue with respect to both partners involved and the field crew. As mentioned above the crew guidance, capacity and its size affected the ability to carry out all the program objectives. This not only affected the implementation of the program, but also the budget as DFO staff assisted the crew and filled in the gaps. This led to significant overage and travel costs that were not budgeted for in the proposal.

The environmental and human capacity risks are not independent from one another, but with significant improvements in the crew size and hiring of a third party contractor recovery from these flooding events will be quicker and likely result in a more accurate count from the weir. Further, the crew will be able to complete tasks associated with other program objectives (e.g. radio telemetry and carcass surveys). The budget and management of the project brought up other risk factors that were not described in the proposal. Specifically, the nature of the partnership and the respective responsibilities of each partner were not clear before the program began.

The most significant changes in future proposals will be the hiring of a third party contractor to oversee the training and field operations as well as a change in the programs management structure. The budget allocated for field and DFO operations will also increase significantly if the appropriate numbers of crew members are hired in the future. DFO will also be charging administration fees and travel costs, which will increase in some portions of the budget in the coming year. Although there will be changes in the budget proposal to improve the program, they leave us in good standing to achieve and attain the program goals.

The success of a program such as this, in a remote and dynamic system relies on a realistic assessment of the risks and their solutions. With this in mind it is important that successes of the 2009 Kaouk 2009 SSP are not over shadowed by the lack of data collected on Chinook escapement. Substantial accomplishments were achieved and lessons learned that leave this project in good standing for future success.

Acknowledgements

This program could not have been run so successfully in its first year without the partnerships among the South Coast Stock Assessment Division at DFO, the NTC staff and Ka:yu:kt'h'/Che:ktles7et'h First Nation. We would like to thank all the partners for your hard work, feedback and assistance this year. We would also like to thank: Tony Hanson the Ka:yu:kt'h'/Che:ktles7et'h Fisheries Manager for supporting this venture and helping with crew hiring; Dave Key for his help with the fence, insights and training assistance; Dave Banks and Glen. Thanks everyone for going above and beyond what was required to achieve this success.