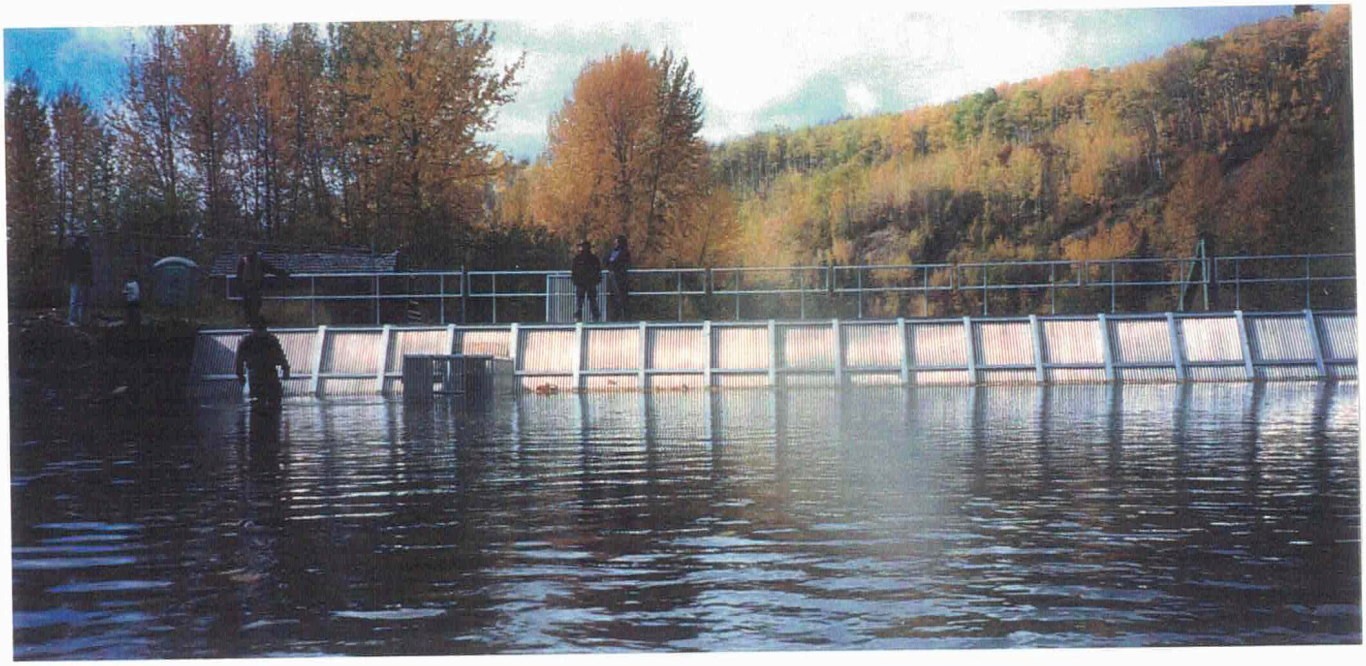
Upper Bulkley River Coho Assessment Fence 2000



Funded by Fisheries and Oceans Canada
Coordinated by Nadina Community Futures
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Report written by Angus Glass

1.0 Executive Summary

The operations of the Upper Bulkley River Coho Assessment Fence for the year 2000 were between August 23, and November 2. A new fence structure was installed this year, and although the fence was safer with the addition of a walkway and railing, several design features hampered the operations of the fence.

Weather also affected the operation of this year's fence. September and early October were characterized by extremely low flows. So low in fact that for long periods part of the old sill remained exposed to the air. This situation was dramatically reversed in the latter half of October, with snow melt and heavy rains resulting in prolonged debris build-up and water cascading over the top of the fence.

Coho returns were lower than in most previous years. For the duration of the study a total of 167 were countered swimming upstream through the fence. Only two of these coho were caught in the live trap box leaving the vast majority to be seine netted. Of those processed, 77.7% were of hatchery origin compared to 79.8% in 1999 and this year 47 adults were transported to Toboggan Creek Hatchery for enhancement purposes.

Thanks

Nadina Community Futures would first like to thank Jim and Tracy De La Mare, together with their assistants who worked hard this year at keeping the fence operating and the fish happy. Thanks to Brenda Donas and her staff at DFO, in helping out with the beach seining and fence cleaning...and for drumming up the extra help on fence dismantle day! Also we would like to thank the District of Houston for allowing the storage of the fence in the Works Yard, providing the portable toilet and their general support of the project.

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2.0 Background Information

2.1 The Fence

The Upper Bulkley Coho Assessment Fence is located 6 km upstream from the confluence of the Morice and Upper Bulkley rivers. It is funded through the Strategic Stock Assessment Program of Fisheries and Oceans Canada (DFO). A new fence was constructed in August of 2000, approximately 25 meters upstream from the previous location. The objective of the fence remained unchanged from past years, to create a barrier spanning the entire width of the river that would channel migrating coho into a live trap box where they would be counted, sampled and released upstream. A portion would also be kept for enhancement purposes.

Although the objectives of the fence remained unchanged, the design of the fence differed substantially from that used in previous years. The major difference was that this year the aluminium panels were slotted into a rigid structure, held in place by a series of 'A' frames bolted and clipped to a new wooden sill lying on the riverbed. Last year the panels were suspended from a pulley and cable system which allowed the operators to 'drop' the whole fence should there be excessive debris build up or exceptionally high water. The new fence was strong enough to withstand such pressures and could, if the need arose, allow the water to cascade over the top. The fence is shown below.

Two other major departures from last year's fence included the live trap box and the walkway. The new design allowed the trap box to be located in any one of the twenty sections along the fence to take advantage of the strongest flows which would attract the fish. This year the trap box was located in the fifth section from river bank left. On top of the nineteen supporting 'A' frames, a solid walkway was constructed, complete with safety barriers on the downstream side. This allowed the staff to clean the leaves from above, rather than be in the water and have to push the wet leaves and other debris from below.

The panels themselves also differed from last year. Although there were still twenty sections across the river, each section held two panels, slotted one on top of the other. The panels could be slid within their slots to allow removal for cleaning.

This year there was a stronger education component built into the project. An Open House on October 1 attracted approximately 40 people, with the new fence being officially opened by the Deputy Mayor of Houston, Sharon Smith. Every Saturday thereafter, two fence workers were always on hand between 2-4 p.m. to answer questions and discuss the operation and purpose of the fence with the public.

2.2 Operations of the Fence

The fence panels were installed on August 28, and remained in place except for cleaning purposes, until November 2, 2000. The trap box was not constructed in time for the start of operations of the fence. It was delivered and re-constructed on site on Sept 30. The fence was in operation for 65 days. The table below shows the chronology of the 2000 fence operations.

Date	Activity
August 2000	Fence Constructed by DFO Engineers
August 23	Panels Installed: Fence Begins Operations
September 6	First Coho Caught
September 30	Trap Box Installed
October 24	Last Coho Caught
November 2	Panels Pulled: Fence Ceases Operating
November 21	'A' frames and walkway removed and transported to District yard

The operations of the fence this year were generally a frustrating exercise for all of those involved. In many respects, the new design actually hindered proper operation of the fence rather than helping it. Ultimately only two coho entered the trap box, so nearly the entire catch was caught below the fence either using a seine net or a dip net. Of course, more fish may have entered the trap box if it had been available for the September portion of the run.

There were two aspects of the fence that hindered its operation: the panels and the trap box. The trap box itself was significantly smaller than that used in previous years and was not split into two sections for holding fish. More fully, the trap box was only 135cm (54") inches in height, allowing even moderate flows to submerge the trap. Flows can be extremely irregular this time of year, but can often increase quickly and significantly with snow melt and rainwater given the large watershed. This is exactly what happened, and at one time the trap box was under more than 50 cm (20") of water, and for two days the trap box remained submerged even with extensive cleaning activities.

The low trap box resulted in another implication. There was approximately a 65 cm (26") drop from the walkway to the top of the trap box. This meant that the operators had to

lash a step ladder onto the side of the panel to get down to the top of the trap box. In addition, the opening of the trap box hinged upstream, allowing the water pressure to close it creating safety concerns.

In comparison to last year, each panel, although more solidly constructed, was lighter because of its smaller size. If not clogged fully with leaves and if not held in place by water pressure, each panel could be lifted by a relatively strong individual. Thus, for the most part, the top layer of panels could be lifted and turned for cleaning purposes. This was not the case with the lower panels, however, as they were held fast in place by the river. As such, these panels which faced a rapid leaf build-up were difficult to clean.

The major flaw with the panels was that the vertical tubing was recessed in the frame by several centimetres. This had a significant adverse impact on the day-to-day operations. Because there were two panels laid on top of each other this meant that there were two lips to try and rake the leaves over...against the current of the river. Given the height of the walkway above the sill (measured at 10.5 ft from chest height of a staff member standing on the walkway to the base of the bottom panel), long handle rakes had to be used which broke on numerous occasions due to the pressures involved. Given the difficulty involved in the operation, only the top panel could be kept sufficiently clean during high debris loads and the bottom section remain clogged, acting like a dam and raising the level of the river for many days at a time. It is estimated that this design flaw added to the already physically-demanding nature of the work, and increased the labour costs over previous years by at least 20%.

Finally, the dismantling of the fence was a concern. The panels were pulled on November 2, but the water was too high to safely remove the 'A' frames and walkway. Workers waited for over two weeks until November 21 when the water dropped sufficiently to allow the fence to be dismantled. Even at this time the level was still 75 cms (30") at the sill – too deep to reach down with one arm. Dry suits had to be worn and DFO staff had to dive into the extremely cold water to undo the clips and bolts. The photos in Appendix III show the workers dismantling the fence.

The fence operated for the full term with the panels in place except for cleaning. When this cleaning was undertaken, the flows were observed carefully to see if any fish swam through. Only on one occasion was a coho identified swimming through. At its peak flow during the project, the river breached the bank on river right, creating a channel behind the supporting platform. Although no fish were seen moving upstream through this breach, some coho may have passed unnoticed.

After the fence was dismantled, staff met with DFO representatives to discuss how the design and operations could be improved for next year. Appendix IV gives the full list of recommendations.

2.3 Safety

As with previous years, safety considerations always remained at the forefront of any activities undertaken at the fence. A water safety expert (Raven Rescue Ltd) was brought in to provide safety training to all those working on the fence, full time and casual. This training was both class-room based and held on-site at the fence. The fence was inspected for potential danger areas. (Note: the inspection was held prior to the installation of the trap box).

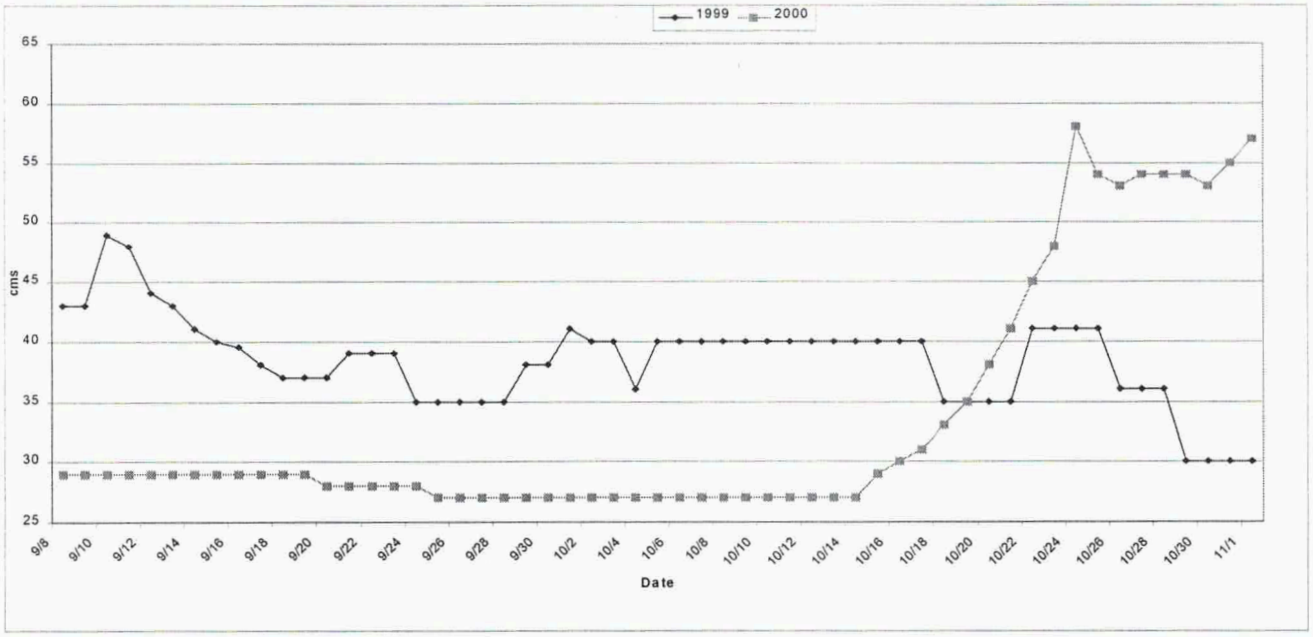
The solid walkway, allowed the staff to operate out of the water, providing a safer work environment. However, attention should be paid to the physical nature of having to bend over and pull the waterlogged leaves up and over the panels. During high water a number of large trees floated down into the fence and it was imperative to be out of the water during such circumstances.

Safety meetings were held every two weeks to discuss any changes in the work environment and to remind the Fish Techs of the safety issues.

2.4 River Conditions

The 2000 project experienced some very interesting weather characteristics that impacted the operations of the fence. Relative to other years, the first 6 weeks of operation exhibited extremely dry weather conditions and very low flows. In fact, for 70% of the duration of the project water levels remained lower than the very *lowest* level that was recorded last year (Figure 1). The low flows were easily observed during a three week period in late September and early October. Anywhere between 25-75% of the old sill remained exposed to the air. This sight has not been seen during the six years that Nadina Community Futures has operated the fence.

Figure 1: Discharge as measured at the Upper Bulkley Fish Fence in 1999 & 2000

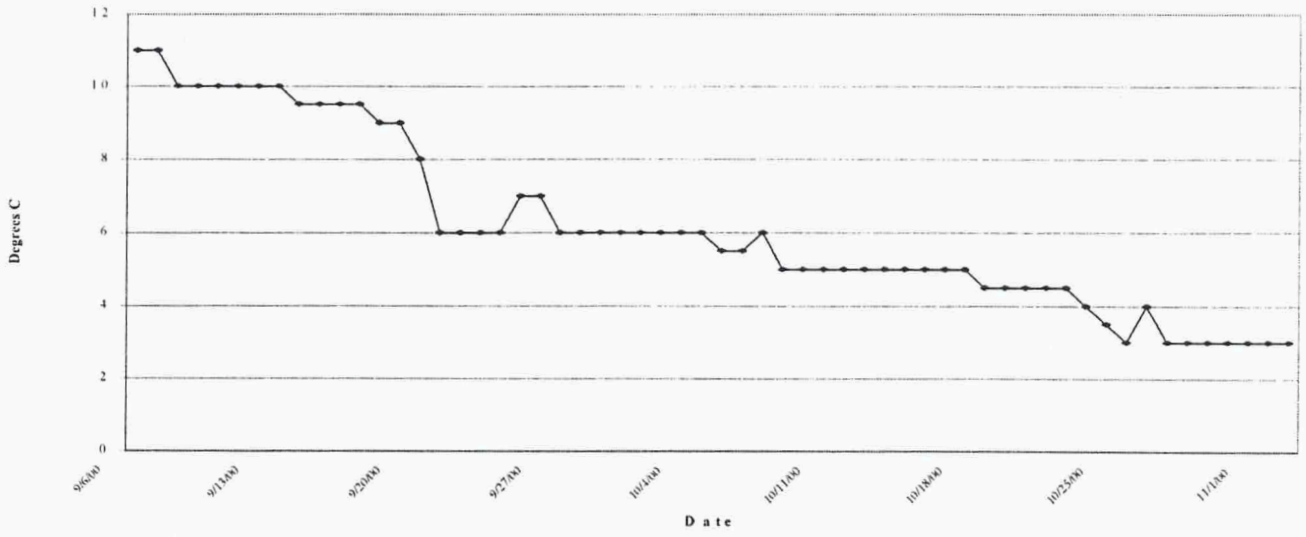


These low flows had an impact on the migrating coho. It is believed that they remained in the main stem of the Bulkley River for considerable time before attempting to swim up the Upper Bulkley River. Helicopter flights along the Bulkley river by DFO provided evidence of coho holding just downstream of the confluence of the Bulkley and Morice rivers and in deep pools in the lower sections of the upper Bulkley River. Some fish were in relatively poor condition having spawned prior to reaching the fence, as can be seen in Appendix I.

Early October rains never transpired and mild evening temperatures allowed the leaves to stay on the trees well into the third week of October. Snow fall and rains eventually came as shown in a dramatic increase in water levels (Figure 1, above). Due to the significant precipitation, the leaf and debris load was intense and lasted longer than usual. One of the reasons for this was the number of beaver dams, particularly in the Buck Creek system, which had the effect of flooding low lying areas. This flooding brought both larger than usual debris, and more of it.

Water temperatures dropped steadily from 11°C to 3°C over the course of the study (Figure 2). The panels were pulled on November 2, so that ice damage did not occur. Due to consistent high water levels, the supporting A frames and walkway were not removed until November 21.

Figure 2: Water Temperatures at the Upper Bulkley Fish Fence between Sept 6 and November 2, 2000



3.0 Methodology

Unlike in previous years, the vast majority of coho caught at the fence (98.8%) were caught through seining or dip netting, and not by entering the live trap box. The main reasons for this were two fold: firstly the trap box itself was not delivered until the fourth week of the September, so until then, netting was the only option. The second was that when the trap box did arrive, it came without the appropriate lead-in. Wooden doweling was fitted to form a lead-in but may have allowed the fish to enter the trap and then retreat out again. Other circumstances such as the shiny aluminium used to construct the fence and live trap box could have dissuaded the fish from entering the trap.

The water temperature and water level readings were also recorded on a regular basis. The water level gauge was the same one that was used in previous year's, attached to the side of the old trap box.

This year, under guidance from Department of Fisheries and Oceans staff, measurements, weights and scale samples of the coho were not taken. Each was identified by species, sexed, and observed for tags and other marks. The coho were then placed in transfer bags and quickly moved above the fence for release upstream of the fence. None of those fish released showed signs of undue stress and did not wash back onto the fish fence.

For the first time, the fish records were recorded on a customized form. This form is shown in Appendix II. Data was transferred from the field data book to these forms on a regular basis. These forms were then entered onto a computer data base every couple of weeks, or when large numbers of fish came though the fence together. The full breakdown of fish caught is shown in Appendix I.

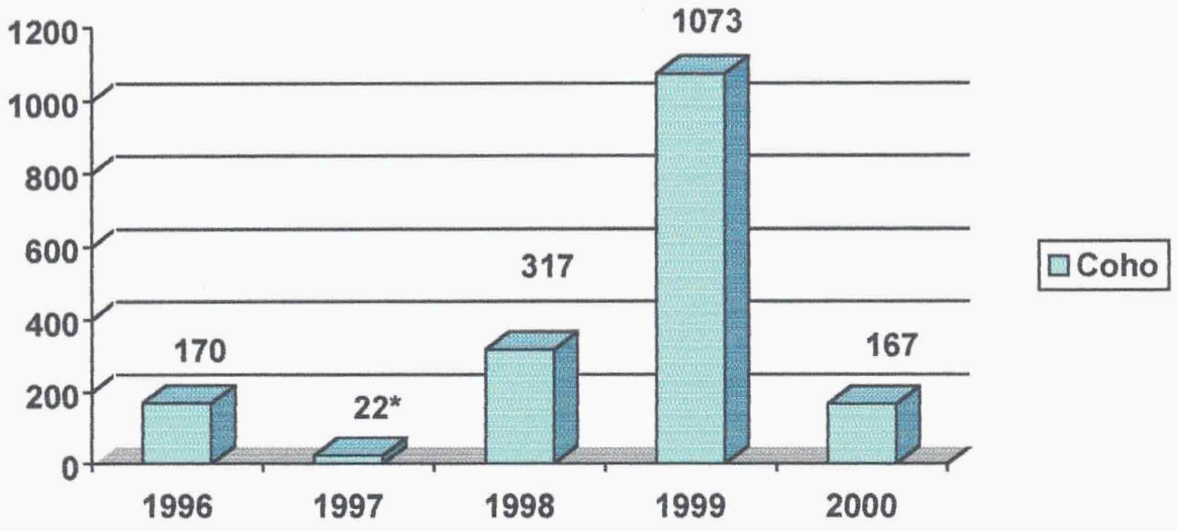
4.0 Results and Discussion

4.1 Coho Run

The 2000 run of coho for the Upper Bulkley system was relatively poor and continues to be one of prime concern for the future rebuilding of this particular stock. During the nine weeks of operation the number of coho processed – both going through the live trap box and capture by seining – totalled 166, plus one coho was identified passing over the fence when one of the panels was turned, making a total of 167. This is in contrast to last year's return of 1,073, representing an 84.7% decline. It also displays a differential from the estimate of 600-800 suggested by DFO for this year. 2000 is the return year for fish spawning in 1996 and, as can be seen the numbers are similar. However, high water and the resulting inability to seine may mean that this year's numbers are underestimating the returns.

Compared to the last five years, 2000 was the second lowest after 1997 and well below the mean average of 362. Figure 3 below shows the comparison return each year from 1996 to 2000. As can be seen there are significant fluctuations.

Figure 3: Coho Returns By Year to the Upper Bulkley.

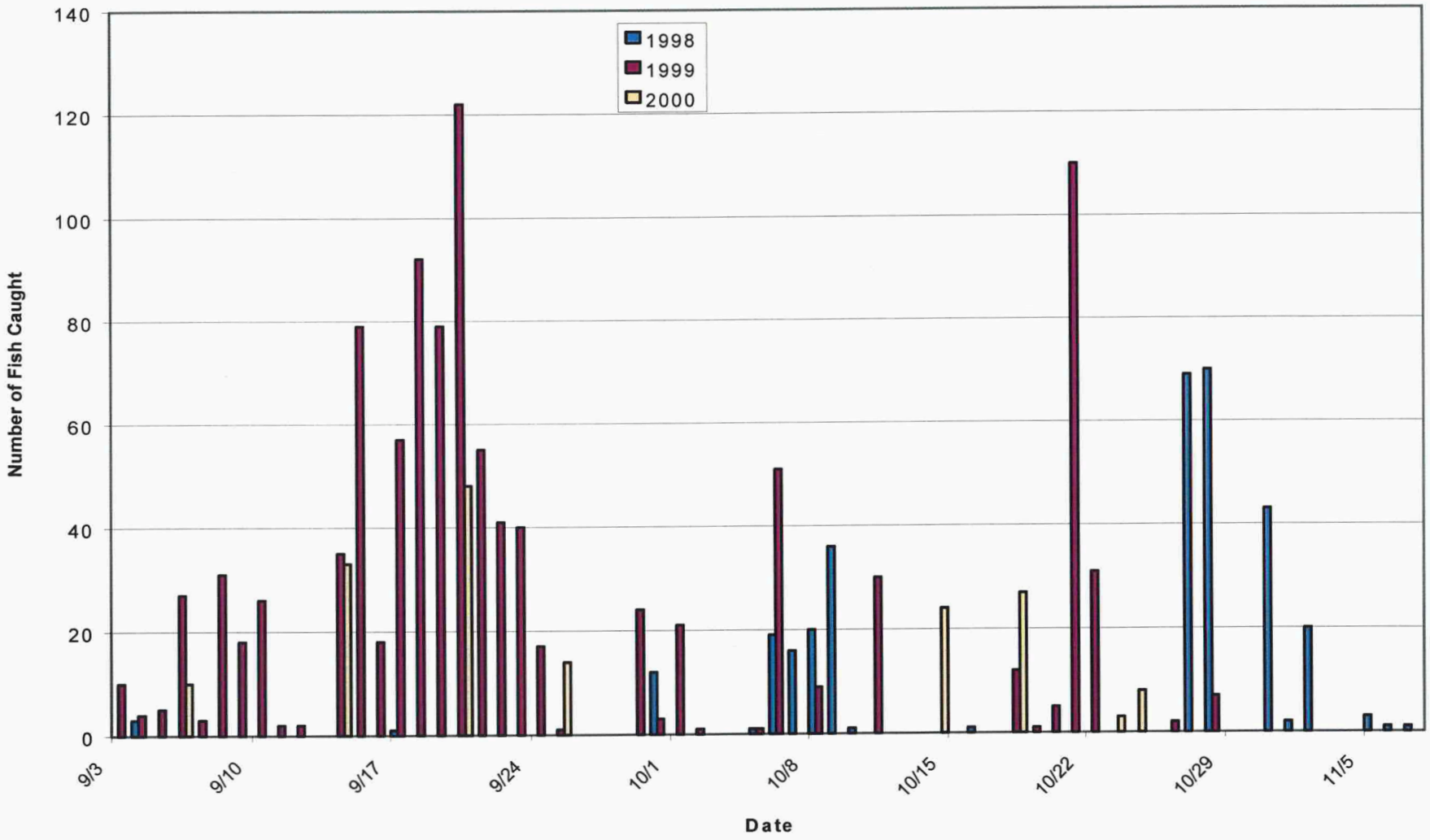


*Note that in 1997 this was an uncompleted count. The fence was laid flat after 6 weeks of operation due to extremely high water. Estimates of the 1997 returns are approximately 85.

In terms of run timing, the run showed no particular pattern, neither coming later or early, although the Fish Technicians believed that the coho were held back by the extremely low flows in late September and early October. The first seine was carried out on September 6, and the last coho was caught on October 24, 2000.

Figure 4 overleaf shows the coho captured by date for the last three years.

Figure 4: Coho processed by date, 1998 to 2000.

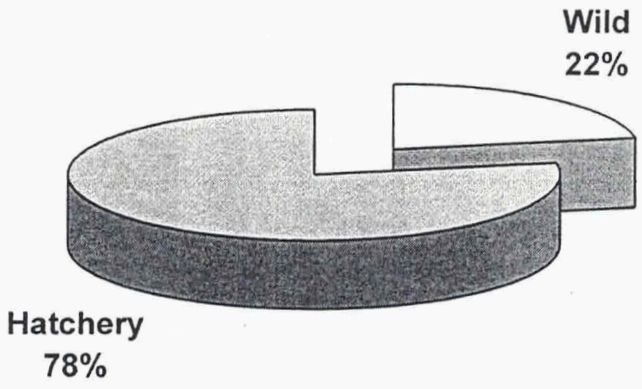


4.2 Hatchery and Unmarked Stock

Although total numbers of returning coho were significantly down from last year, the percentage of wild coho compared to hatchery stock increased marginally. Last year of the 1066 coho sampled, 20.2% were wild, compared with 22.3% of the 166 processed this year. The breakdown between hatchery and wild, and male and female coho is shown in the table below.

TOTAL: 166		
	#	%
Wild	37	22.3
Hatchery	129	77.7
FEMALES: 71		
	#	%
Wild	15	21.1
Hatchery	56	78.9
MALES: 95		
	#	%
Wild	22	23.2
Hatchery	73	76.8

Figure 5, Split Between Hatchery and Wild Returning Coho Stocks



4.3 Enhancement Stock

Of the 166 coho processed at the fence, a total of 47 coho were transported to the hatchery for enhancement purposes, representing 28.3% of the total caught. The first fish were transported on September 22, and the last one on October 18. The table below shows the breakdown of coho used transported for enhancement purposes.

Total Transported to Toboggan Creek Hatchery: 47 (28.3% of total)		
Females	Wild	8
	Adipose Ab	14
	Left Vent	1
Males	Wild	13
	Adipose Ab	11

On October 24, the Field Technicians were instructed by the hatchery staff to hold all remaining coho for possible use at the hatchery, but after this date none were caught.

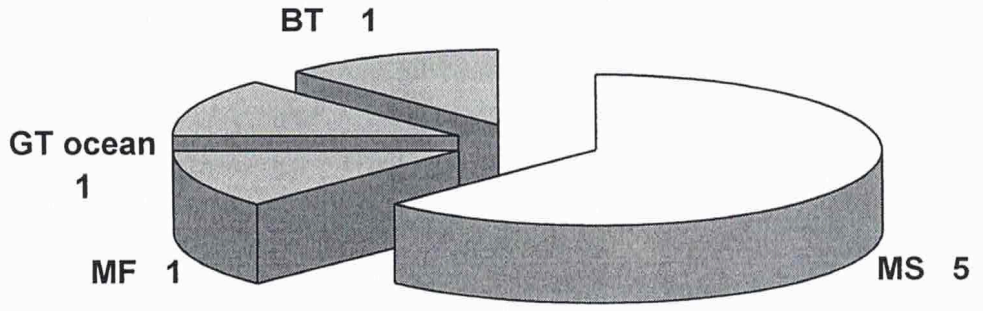
Two coho were held for the Community Advisor of DFO for cryogenic purposes on October 23.

4.4 Dorsal Fin Tagging

Of the 166 coho processed at the fence, 8 (4.8%) had dorsal fin been tagged. The tags were either put on as they went through the Moricetown Fishway (MF) or though seining (MS) at Moricetown, or when the coho had been previously caught in the ocean.

Figure 6 below shows the breakdown of the tags. For more detail of the tag numbers, see Appendix I.

Figure 6 Tagged Coho



MF Moricetown Fishway
MS Moricetown Seine
GT Green Tag (Ocean)
BT Blue Tag

All 166 coho were examined for marks. Numbers of coho captured by mark type are shown in the table below:

Mark Type	Number of Coho
Right Ventral	1
Left Ventral	14
Adipose/Left Ventral	1
Right Maxillary	4
Left Maxillary	1
Adipose/CWT	108

4.5 Other Species

Not including the whitefish, a total of 180 fish were processed. The table below shows the various catch of each species:

	Coho	Steelhead	Sockeye	Chinook	BT/Dolly
Male	95		6		
Female	71	1	1		6
Total	**166**	**1**	**7**	**0**	**6**

Appendices

APPENDIX I FISH RECORDS

UPPER BULKLEY RIVER FISH FENCE 2000

date	species	adult/jack	sex m/f	mark type	fork length	broodstock	tag #	comments
Sep-06	sk	a	m	w		n		
Sep-06	sk	a	f	w		n		
Sep-06	sk	a	m	w		n		
Sep-06	co	a	f	ad		n		
Sep-06	co	a	f	ad		n		
Sep-06	co	a	m	ad		n		
Sep-06	co	a	f	ad		n		
Sep-06	co	a	m	ad		n		
Sep-06	co	a	f	ad		n		
Sep-06	co	a	f	w		n		
Sep-06	co	a	f	ad		n		scar/parasites
Sep-06	ov/bt	a	m	w		n		
Sep-06	co	j	m	w		n		
Sep-06	co	j	m	ad		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	f	ad		n		
Sep-14	co	a	f	ad		n		
Sep-14	co	a	f	w		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	f	ad		n		
Sep-14	co	a	f	ad		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	f	ad		n		
Sep-14	co	a	f	ad		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	m	w		n		
Sep-14	co	a	m	rv		n		
Sep-14	co	a	f	w		n		
Sep-14	co	a	m	w		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	f	ad		n	bl50201	
Sep-14	co	a	f	ad		n		
Sep-14	co	a	m	lv		n	or2290m.s	
Sep-14	co	a	f	w		n		
Sep-14	co	j	m	w		n		
Sep-14	co	a	f	ad		n		
Sep-14	sk	a	m	w		n		fish condition
Sep-14	co	j	m	ad		n		good when
Sep-14	co	a	f	ad		n		released over
Sep-14	co	j	m	w		n		the fence
Sep-14	st	a	m	w		n		
Sep-14	co	j	m	ad		n		
Sep-14	co	a	m	ad		n		
Sep-14	co	a	f	w		n		

Sep-14 co	a	f	ad	n	
Sep-14 co	j	m	ad	n	
Sep-20 co	a	m	w	y	
Sep-20 co	a	m	w	y	Total Today 48, 26 to Hatch
Sep-20 co	a	m	ad	n	
Sep-20 co	a	f	lv	n	
Sep-20 co	a	f	w	y	
Sep-20 co	a	f	w	y	
Sep-20 co	a	m	w	y	
Sep-20 co	a	m	w	y	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	f	ad	n	
Sep-20 co	a	f	ad	n	
Sep-20 co	j	m	lm	n	
Sep-20 co	a	m	ad	y	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	f	w	y	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	f	ad	y	
Sep-20 co	a	m	ad	n	or2221ms
Sep-20 co	a	m	lv	n	
Sep-20 co	a	f	ad	y	
Sep-20 co	a	m	w	y	or4188ms
Sep-20 co	a	f	lv	n	
Sep-20 co	a	f	ad	y	
Sep-20 co	a	f	w	y	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	f	w	y	
Sep-20 co	j	m	ad	y	
Sep-20 co	a	m	rm	n	
Sep-20 co	a	m	ad	y	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	f	ad	y	
Sep-20 co	a	f	ad	y	
Sep-20 co	j	m	ad	y	
Sep-20 co	a	f	lv	n	
Sep-20 co	a	f	ad	y	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	m	ad	n	
Sep-20 co	a	f	ad	n	
Sep-20 co	j	m	ad	y	
Sep-20 co	j	m	ad	y	
Sep-20 co	j	m	ad	y	
Sep-20 co	a	f	ad	y	
Sep-20 co	j	m	ad	y	
Sep-20 bull/dv	a	m		n	
Sep-20 co	a	m	ad	n	

Sep-20 co	a	f	ad	n	
Sep-20 co	j	m	w	y	
Sep-21 sk	a	m			
Sep-21 sk	a	m			
Sep-25 co	a	f	ad	n	
Sep-25 co	a	f	lv	n	gr ocean tag 01640
Sep-25 co	a	m	ad	n	damaged head,parasites,bumps
Sep-25 co	a	f	ad	y	
Sep-25 co	a	f	ad	n	
Sep-25 co	a	f	ad	y	
Sep-25 co	a	m	ad	n	parasites,bumps
Sep-25 co	a	f	ad	y	
Sep-25 co	a	f	rm	n	
Sep-25 co	a	f	ad	y	
Sep-25 co	a	m	ad	y	
Sep-25 co	a	f	ad/lv	n	
Sep-25 co	j	m	w	y	
Sep-25 bull/dv	a	f	w	n	
Sep-25 co	a	f	w	y	
28-Sep sk	a	m		n	
14-Oct co	a	f	w	y	
14-Oct co	a	m	ad	y	
14-Oct co	a	m	lv	n	
14-Oct co	a	f	ad	y	
14-Oct co	a	m	ad	y	
14-Oct co	a	m	ad	n	
14-Oct co	a	m	ad	n	
14-Oct co	a	m	ad	n	
14-Oct co	a	m	ad	n	
14-Oct co	a	m	w	y	
14-Oct co	a	f	ad	n	
14-Oct co	a	m	w	y	
14-Oct co	a	f	lv	n	
14-Oct co	a	m	ad	n	
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14-Oct co	a	m	ad	n	
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14-Oct co	a	m	ad	n	
14-Oct co	a	f	rm	n	
14-Oct co	a	m	lv	n	
14-Oct co	a	m	ad	n	
14-Oct co	a	f	rm	n	bl 50676M.F.
18-Oct co	a	m	w	n	
18-Oct co	a	f	ad	y	
18-Oct co	a	m	w	y	
18-Oct co	a	m	w	y	
18-Oct co	a	f	lv	y	

18-Oct	co	a	m	ad	n	
18-Oct	co	a	f	ad	n	
18-Oct	co	a	m	w	y	
18-Oct	co	a	m	lv	n	
18-Oct	co	a	m	w	y	
18-Oct	co	a	f	lv	n	
18-Oct	co	a	m	ad	n	
18-Oct	co	a	m	ad	n	
18-Oct	co	a	m	ad	n	
18-Oct	co	a	m	ad	n	
18-Oct	co	a	f	ad	n	
18-Oct	co	a	m	w	n	
18-Oct	co	a	f	ad	n	
18-Oct	co	a	f	ad	n	
18-Oct	co	a	m	ad	n	Or5443M.S.
18-Oct	co	a	m	ad	n	
18-Oct	co	j	m	lv	n	
18-Oct	co	a	m	ad	n	
18-Oct	co	a	m	ad	n	
18-Oct	co	a	f	ad	n	
18-Oct	co	a	m	ad	n	
18-Oct	co	a	f	ad	n	
23-Oct	co	a			n	Escaped while panel turned
23-Oct	co	a	m	w	n	Held for Brenda
23-Oct	co	a	m	ad	n	Held for Brenda
24-Oct	bull/dv	a	m	w	n	
24-Oct	co	a	f	ad	n	Half Spawned out
24-Oct	bull/dv	a	f	w	n	
24-Oct	co	a	m	ad	n	
24-Oct	co	j	m	ad	n	
24-Oct	co	a	f	w	n	
24-Oct	co	a	m	ad	n	
24-Oct	co	a	f	w	n	Half spawned out
24-Oct	co	a	m	w	n	Or4205M.S.
24-Oct	co	a	m	w	n	
25-Oct						Unable to open trap box.
26-Oct	bull/dv	a	f		n	Water spills around
27-Oct						All panels top and bottom pulled and reversed. No coho seen.
						First day since 24 can enter trap

Appendix II DATA FORM

Upper Bulkley River Fence Data Sheet

Date: :_____ Page: _____ of _____

Times at fence: _____ Staff + note recorder: _____

Weather: _____ Discharge: L M H

Water temperature (°C)/ time: _____/_____

Water Level: _____

Amount of debris: L M H

Comments: _____

_____

Species Code*	Adult/ Jack (A/J)	Sex (M/F)	Mark Type**	Fork Length (mm)	Scale Book / #	Brood-stock (Y/N)	Fish condition / comments

* Species codes: SK, CO, CH, PK, ST, RB, DV, BT, WF

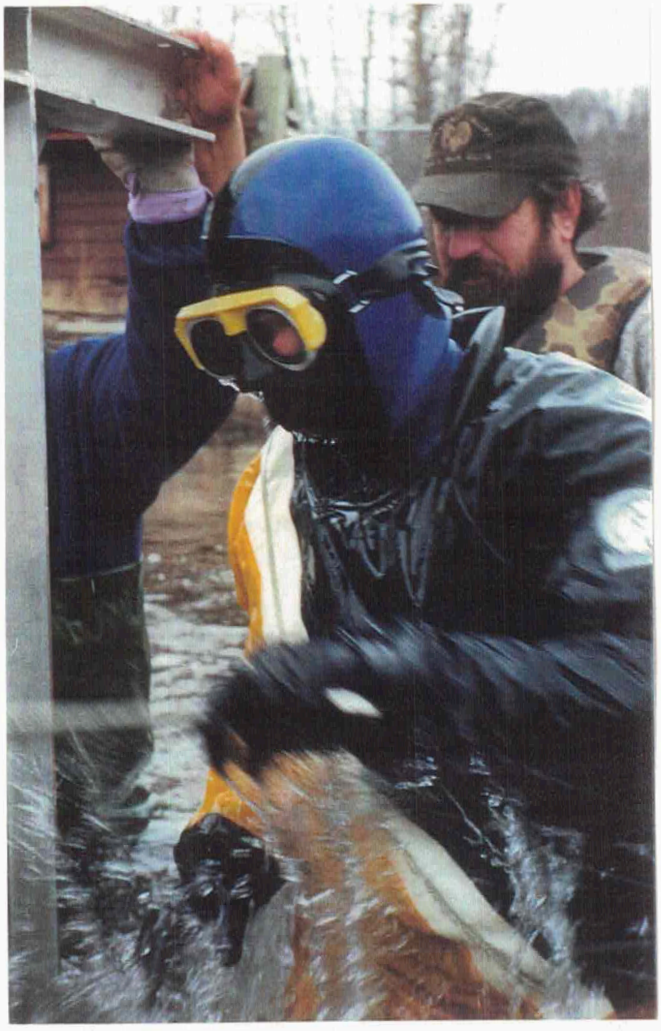
** Mark type:

- Left ventral = LV
- Left and Right Ventral = LRV
- Adipose = Ad
- Adipose / right maxillary = AdRM

Fence Open House, October 1.

Temporary shelter for night work and colder days.

Diving down to release the holding clips and undo bolts attaching the 'A' frames to the sill



APEENDIX IV
RECOMMENDATIONS FOR 2001

Estimated Labour requirements for fence operation:

In order to budget for next year's project, we need to more accurately gauge the labour required to run the fence. Estimates for this year are:

- Mid Aug to Mid-Oct: 2 people * 8 hrs per day * 61 days = 976 hrs
- Mid Oct to Oct 25: 10 days * 4 people * 24 hrs.= 960 hrs
- Oct 25 to Nov 3: 8 * 2 * 8 = 128 hrs
- + 25% overhead (UIC etc and admin costs).

Equipment Required

- 4 drysuits: 1 – XXL; 3 Larges – with booties
- Dry suit gloves – 4 pairs: XL, L
- 2 wet suit hoods
- 2 snorkle / mask assemblies – try on masks to ensure they don't leak – buy masks with silicone seals
- Lifejackets
- Helmets / hard hats
- Cover for intake
- Dipnets
- 6 locks with the same key (waterproof)
- hard bridge push broom
- case of night sticks.

Fence improvements for next year

- Replace every third regular panels with ¼ size panels with finger weirs (approx 6)
- Weld spacers (Triangular shaped?) on one end of panels so there are spaces between panels and between the lower panel and the sill - for cleaning and allowing passage of smaller fish
- Place winch hooks on all panels on opposite side to spacers (i.e. on the top)
- Use eye bolts / pins so don't have to use wrenches to undo bolts
- Install lights powered by a generator -suggestion – heavy gauge line for the generator
- Install a Staff gauge away from the fence – perhaps at old Water Survey of Can site, or at the Pleasant Valley Bridge.
- Build a covered area from old sill to trap box to provide cover for the fish.
- Rent a Porta-potty again next year – inquire with District of Houston re paying.

Live box Improvements

- A new box needs to be built.
- Suggestion is to keep the old one for a fish storage box.
- The new box should have the following features:
  - 2 trap doors opening to the sides

- Needs to be wider
- Have the box divided into two sections – one for fish swimming in, one to store fish that will be used for the hatchery or cryopres.
- Trapbox needs to be darkened – too shiny. Paint??
- Lead-in needs to be longer and narrower
- Box needs to be the same height as the fence.
- Should be a modular unit with panels that slide in so its is easier to move around. A larger unibody box will be too dangerous to move due to its weight. .
- Railing around box
- Walkway down the centre of the box – slightly recessed to support the two trap doors when closed.

Sam and Ian will be requested to do the following:

- Provide / build a winch to help remove the panels.
- Build the finger-weir panels / place spacers on panels
- Build rakes
- Purchase 2 pipe poles – 12 footers
- More armouring on river right at fence
- Design and build a new trap box
- Purchase facility (e.g. trailer) for fence staff (beds and heater)

Other suggestions:

- Move the fish to Toboggan Creek hatchery ourselves next year so we can work on our schedule and give Randy a break.
- Have supervisors (e.g Jim and Tracy) on a per diem which covers wage, vehicle, trailer, chainsaw etc.