

WHITEHORSE FISHWAY KING SALMON ESCAPEMENT STUDIES
1973

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Introduction

The Whitehorse dam fishway is located on the Yukon River, 1,745 miles upstream from the mouth (Figure 4). It is just outside the city of Whitehorse and is the farthest upstream king salmon escapement monitoring site on the Yukon River. Since 1969 the annual fishway counts and the age and sex composition of the run have been used as a possible indicator of the effects of the downriver fishery on king salmon escapement in the Canadian portion of the Yukon drainage.

As part of a cooperative data exchange and assistance program with the Canadian Department of Fisheries, the Alaska Department of Fish and Game supplied a technician to monitor the fishway in 1970, 1971, and 1973. The objectives of the study during these years have been to (1) obtain a daily and seasonal count of king salmon escapement through the fishway and (2) determine the age, sex and size composition of the Whitehorse escapement.

The Whitehorse fishway is a weir and pool-type fishway. It is a trough-like timber structure with baffles to create a series of stairway-like pools which the fish must negotiate to reach the impoundment above the dam. About two-thirds of the way up, there is a holding pool with a gate and a viewing window where the salmon can be counted and sampled before being released to continue through the fishway.

Methods and Materials

The holding pool was checked three times each day. Each time the pool was checked, the number and sex of king salmon in it was recorded. At least once a day all the kings in the pool were sampled as follows; each

fish was removed with a dip net, the length from mideye to fork of tail measured, and a scale sample removed for age determination. The sex of all the king salmon in the sample and in the total escapement was determined from external morphological characteristics. A record was kept of all salmon which showed evidence of gill net marks. After sampling the salmon were released and allowed to complete passage of the fishway.

Results

A total of 228 king salmon was enumerated at the Whitehorse fishway in 1973 (Table 16). These fish were composed of 118 males (52 percent) and 110 females (48 percent).

Seventy-three king salmon were sampled for age, sex, and size composition, however, only 49 of the scale samples were legible. These fish were composed of 61 percent males and 39 percent females. Age classes 5₂ to 7₂ were represented with age classes 5₂ and 6₂ comprising 41 and 47 percent of the sample respectively (Table 17). One of the 73 kings in the sample showed evidence of net marks.

Discussion

The 1973 escapement was the poorest on record and was far below the 15-year escapement average of 680 kings. A comparison of the annual escapement counts since 1959 indicates that the Whitehorse run has experienced a gradual decline. The few Alaskan streams being monitored exhibit no strong trend of either decreasing or increasing escapements. Most of this information has been obtained from aerial surveys flown under highly variable weather conditions which may mask escapement trends.

Several factors exist which could contribute to the apparent decline in the Whitehorse run. These include: (1) the downriver fishery may be overharvesting the stock; (2) some of the salmon may not find or successfully negotiate the fishway; (3) some of the adult kings may be injured or exhausted in passage through the fishway; (4) a significant number of smolt may be killed or injured when they pass through the dam's turbines on their downstream migration.

There are indications that the downriver 8-1/2" gill net fishery, which is selective for the large 6₂ to 7₂ age class king salmon, may have affected the age and size composition of the Whitehorse king salmon escapement in some years. This was especially evident in 1970 when 87 percent of the

Table 16. Cumulative daily Whitehorse fishway king salmon counts, 1965-1973.

Date	1965	1966	1967 ^{2/}	1968	1969 ^{1/}	1970	1971	1972	1973
8/ 1	5	4	38	4					
2	9	10	53	5	8	1			1
3	16	24	67	11	16	4			2
4	30	40	87	18	28	5		1	3
5	49	54	106	43	43	6		3	3
6	58	74	121	70	99	12		9	8
7	93	97	136	107	118	18	3	20	20
8	124	120	172	152	149	24	5	24	24
9	150	139	196	173	181	47	7	31	29
10	197	188	233	173	187	77	10	33	41
11	282	214	263	174	210	108	27	47	50
12	382	248	306	180	239	136	36	61	56
13	510	304	344	205	260	202	60	105	64
14	542	357	397	239	273	284	87	139	84
15	583	388	417	267	297	313	127	184	97
16	630	427	429	290	316	346	195	233	110
17	670	478	454	339	322	415	287	269	120
18	688	500	478	359	324	436	358	293	130
19	728	518	494	363	324	511	447	300	150
20	785	532	506	369	324	560	493	316	167
21	817	536	516	376	328	576	534	347	187
22	843	548	520	389	328	595	607	355	203
23	864	554	526	392	328	610	643	369	211
24	883	557	530	405	328	617	683	382	214
25	893	560	532	405	331	622	727	386	220
26	898	562	532	405	334	624	762	386	220
27	902	562	533	405	334	625	788	388	224
28	903	562		405	334	625	812		224
29		563		406	334	625	835		224
30				406	334		841		227
31				406			842		
9/ 1				406			849		
2				407			855		
3				407					
4				407					
5				407					
Totals	903	563	533	407	334	625	856	392	228

^{1/} First fish on 7/23.

^{2/} First fish on 7/25.

Table 17. Age, sex and size composition of Whitehorse fishway king salmon escapement sample, 1973

	Age class			Totals
	5 ₂	6 ₂	7 ₂	
Males				
Number	23	7	-	30
Percent	47	14	-	61
Mean length (mm)	750	860	-	780
Females				
Number	2	16	1	19
Percent	4	33	2	39
Mean length (mm)	800	870	890	810
Combined				
Number	25	23	1	49
Percent	51	47	2	100
Mean length (mm)	750	870	890	810

escapement was male king salmon and 76 percent of these were in the 4₂ and 5₂ age groups (Lebida, 1970).

It cannot be determined that the 1973 escapement showed evidence of gear selectivity because the age and sex sample was biased toward male kings and this would affect the reported age and sex composition of the escapement. The sample was composed of 61 percent males and the total escapement of only 52 percent male king salmon. Variability in sampling, errors, interpretation of data, year class strength, and genetic characteristics may also influence the age and sex composition of the Whitehorse king salmon escapement.

Although no conclusive data is available on the effect of fishery mortality on the size of the Whitehorse escapement, the continuing high level of exploitation of Yukon River king salmon stocks by Japanese, Alaskans and Canadians indicates that it is probably a significant factor.

The Whitehorse dam may present an insurmountable obstacle to a certain percentage of the king salmon even with the fishway in operation. A study at Rock Island dam fishway on the Columbia River, Washington State, indicated that 23 (7%) out of 311 chinook salmon, which were destined for spawning streams above the dam, failed to make it through the fishway (Zimmer and Broughton, 1965). Other studies have indicated that a percentage of the salmon suffer injuries in negotiating a fish pass (Zimmer, et al). These injuries could result in delayed mortality or reduced spawning success. The lack of a strong current in the impoundment above the dam may disorient salmon resulting in failure to reach the grounds or spawn at the optimum times.

A significant percentage of the salmon smolt may be killed or injured as they pass through the dam's turbines on their downstream migration. In a study conducted by the Fisheries Division of Environment - Canada at Whitehorse in 1973, approximately 11 percent of the salmon smolt suffered injuries which would probably result in mortality (Walker, 1973). An unknown number of smolt may have suffered less obvious injuries which could result in delayed mortality.

The primary value of the Whitehorse escapements has been as an indicator of the effects of the downriver fishery on upper Yukon king salmon stocks. There is evidence to indicate that the Whitehorse king salmon escapement may be affected by factors other than fishery mortality. It is impossible to separate fishery mortality from the previously discussed deleterious effects of the Whitehorse dam. It is, therefore, recommended that an alternate escapement monitoring site be found in the upper Yukon drainage. This site should be located on a stream where accurate escapement enumeration is feasible, a

substantial king salmon run occurs, and no factors other than fishery and natural mortality influence the size of the escapement.

Summary

1. A total of 228 king salmon was enumerated through the Whitehorse fishway in 1973.
2. The 1973 escapement was composed of 110 females (48%) and 118 (52%) males.
3. The age, sex and size samples was composed of age class S_2 through 7_2 salmon. Age classes 5_2 and 6_2 comprised 51 percent and 47 percent of the sample respectively, and male kings composed 62 percent of the sample.
4. One of the 73 kings examined had gill net marks.
5. The Whitehorse run is apparently declining. This could be due to the effects of the downriver fishery and the dam itself.
6. It is recommended that an alternate site be found to monitor king salmon escapement in the upper Yukon.

