The Status of the Nanika River Sockeye Rehabilitation Program 1960-65

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The Nanika River, which drains into Morice Lake, is the most valuable sockeye spawning stream in the Bulkley River system. The available data indicate that the pre-1954 escapements ranged within the general magnitude of 20,000 and 70,000 fish annually. Beginning in 1954, however, the population demonstrated an apparent collapse which extended to all cycles. The period of lowest escapement occurred during the period 1957-1959 when the Nanika River escapement actually totalled 1000 or less sockeye for three consecutive years.

This decline occurred in spite of the construction in 1951 of fishways which largely alleviated an obstruction to migration at Moricetown Falls on the Bulkley River. A second obstruction located in Hagwilget Canyon near Hazelton was assessed in 1954 and was determined to be a major block to migration. This last major obstacle to migration was removed in the spring of 1959.

Although by 1959 the migration route was cleared of all serious obstructions the Nanika River sockeye population had dropped to such a dangerously low level that some rehabilitation measures were considered essential. Since the timing of the Nanika River sockeye migration coincides closely with that of the early and middle Babine River runs, rehabilitation by specific regulation of the commercial fishery was deemed impractical. It was considered necessary therefore to implement some form of artificial propagation.

Since, in 1959, the requirements for successful operation of an incubation channel under conditions of extreme cold and heavy snowfall had not been determined, a hatchery incorporating some of the latest hatchery techniques was chosen as the most suitable method for the artificial propagation of sockeye at Nanika river. Also, because of the shortage of spawners in the Nanika River a transplant of eggs from the Babine system was considered necessary.

Hatchery techniques employed at Nanika include:

1. Vertical stack incubators These consist of a series of baskets stacked one above the other so designed that water entering at the top of the stack circulates throughout the baskets from top to bottom. These incubators permit a far more economical use of floor

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space and water than regular hatchery baskets. Each stack covers four square feet of floor space and uses 3-4 gallons of water per minute to incubate 250,000 sockeye eggs to the late alevin stage. The hatchery contains 50 stacks which give an incubating capacity of 12-13 million eggs.

2. Fry release tanks

As the time of release approaches the fry are transferred to two large circular wood stave tanks each provided with 12 pie-shaped screen pens. Water is introduced to the bottom of the tanks and is drawn off by surface outlets located in each of the 12 pens. The effect obtained, therefore, is one of slight but constant upwelling current. The twelve outlets lead to a common trough which empties into the river. The fry are held in the tanks until yolk absorption is complete and then permitted to leave the tank for discharge into the river. Release is restricted to the hours of darkness.

In 1964, an experimental incubation channel with a capacity of three million eggs was constructed in association with the hatchery. The channel was constructed in order:

1. to compare egg-to-fry survival rates and fry quality between the channel and the hatchery; and

2. to obtain information regarding the operation of this type of production unit under extreme winter conditions.

The Hatchery Operation

1. Fry Production

A summary of egg transfers and fry releases since the operation began in 1960 is presented in Table I. The 1960-61 operation was designed primarily as a test of equipment and conditions and as a result of experience obtained that season, several factors which contributed to mortality were corrected before incubation began at a production level. For the 1961-62 operation the hatchery was operated at approximately 50 percent of capacity but the unit was operated at full capacity during the three seasons 1962-63 to 1964-65. For the 1965-66 season, a total of only 3.4 million eggs were transferred to the hatchery and these were all subsequently planted in the channel at the early eyed stage. The channel was operated at one-half capacity in 1964-65 and was seeded to the full capacity of three million for 1965-66.

Table I. Numbers of sockeye eggs incubated and fry released at the Nanika River Hatchery and incubation channel, 1960-65.

Year	Hatching Site	No. of Eggs Incubated	No. of Fry Released	Percent Egg Fry Survival
1960-61	Hatchery	315,000	74,000	23.5
1961-62	Hatchery	5,200,000	3,900,000	76.0
1962-63	Hatchery	11,400,000	7,600,000	67.0
1963-64	Hatchery	12,000,000	6,600,000	55.0
1964-65	Hatchery	12,100,000	7,900,000	65.0
	Channel	1,500,000	1,200,000	80.0
1965-66	Channel	3,400,000		

2. Fry Quality

The hatchery produced fry have been consistently smaller than the native 15-Mile or native Nanika River fry during each year of operation. The average weights of fry produced since 1962 are present in Table II.

The channel incubated fry produced in 1965 averaged 0.16 grams in weight. The channel fry weighed approximately ten percent less than the native 15-Mile Creek fry which averaged 0.18 grams, but they were 25 percent heavier than the hatchery fry which averaged 0.12 grams

Juvenile Sockeye Salmon Studies

The juvenile sockeye salmon studies carried out on the Morice Lake system since 1962 have included: enumeration of both the native and hatchery fry output of the Nanika River; a tow-net index of summer fry and yearling sockeye in Morice Lake; and a measure of the smolt output of Morice Lake. These data are summarized in Table III.

As shown in this table, the hatchery production has exceeded the native Nanika River fry production in three of the past four years. In 1962, a total of 8.5 million fry were produced naturally from the river while 3.9 million were released from the hatchery. The August fry abundance was relatively high and the subsequent index of smolt output totalled 0.9 million yearlings and 0.4 million two year old fish. In 1963, the native fry production totalled 4.4 million and the hatchery production totalled 7.6 million. A large August fry abundance was recorded but the subsequent index of smolt production from this totalled a very low 0.1 million yearlings and 0.1 million two year old fish. In 1964, flood conditions precluded the accurate assessment of the native Nanika River fry production but based on potential egg deposition the output almost certainly could not have exceeded two million. The 1964 hatchery output totalled 6.6 million fry. A low August index of abundance was recorded in 1964 and the subsequent yearling smolt production totalled less than 0.1 million. In August of 1965 the yearling juvenile abundance in Morice Lake was also low. The 1962 and 1963 year classes are the only groups for which complete fresh water production data are available and because of this an accurate assessment of viability of fry on the basis of fresh water survival studies cannot be made at this time.

Table II. A weight comparison of hatchery fry and natural fry from 15-Mile Creek and Nanika River.

Year	Mean weight in grams		
	Nanika Hatchery	15-Mile Creek	Nanika River
1962	0.12	-	0.20
1963	0.15	0.18	0.19
1964	0.15	0.19	0.23
1965	0.12	0.18	0.19

Table III. Annual adult sockeye salmon escapements to the Bulkley River system, Nanika River and hatchery fry production, August density of fry and yearlings in Morice Lake and smolt production of Morice Lake, 1961-65 inclusive.

YEAR	ADULT ESCAPEMENT Total		NANIKA R.	HATCHERY FRY	MORICE LAKE TOW NETTING AUGUST DENSITY (Fish/acre)		SMOLT INDEX (Millions)	
	BULKLEY R.	NANIKA R.	FRY INDEX (Millions)	PRODUCTION (Millions)	FRY	YEARLING	AGE 1	AGE 2
1961	14,800	7,500			85	34	0.7	0.5
1962	10,300	3,500	8.5	3.9	175	22	0.2	0.4
1963	2,600	1,200	4.4	7.6	265	33	0.9	0.5
1964	7,000	6,000	<2.0	6.6	109	18	0.1	0.4
1965	18,000	9,700	4.2	*9.1	247	20	<0.1	0.1

* Includes 1.2 million channel fry

Moricetown Native Food Fishery

Moricetown Falls has for many years been the site of an intensive native food fishery. Although fishing is directed to all species, particular effort is applied to the capture of sockeye. In the nine years since 1945 for which data are available the native food fishery at Moricetown Falls has removed from 8.0 to 58.0 percent of the sockeye arriving at that point and since 1961 the exploitation rate has averaged 25.2 percent (updated from Palmer, 1964). Studies (Palmer, 1964) have shown that the fishery, which is primarily based on a gaffing technique, is particularly effective in years of low discharge.

From studies conducted in 1961 and 1962 it was determined that the fishery exerts an apparent severe scare reaction on the fish and when the fishery is operating, migration through the fishway is seriously restricted. In 1965, in order to reduce the build-up of fish below the falls, the fishing week was changed by regulation from a standard five days to a split four day week. In 1965 fishway counts increased sharply on the one day mid week closures as well as on the regular two day closures and as a result fish were cleared through the fishing area more rapidly and exploitation of sockeye was held to 13.5 percent despite intermediate to low river discharge.

Recent Escapements

Following the 1957-1959 period, the escapement to Nanika River has shown a marked improvement. As shown in Table IV in five of the six years since 1960 the population has totalled 3,500 or more and the very low escapement of 1200 sockeye in 1963 resulted to a substantial degree, from an unusually high exploitation rate of 58 percent by the native food fishery at Moricetown Falls.

The Moricetown Fishways were completed in 1951 and were operating prior to the period of major decline. The fishways have proven successful in passing sockeye salmon above Moricetown Falls, although delay still occurrs below the falls and an effective native food fishery still operates at that point.

In 1959 a major obstruction to migration was removed from Hagwilget Canyon which is located on the Bulkley River downstream from Moricetown Falls. This severe block to migration was completely removed at that point and also, since fish no longer accumulate in Hagwilget Canyon, a major native food fishery which operated in the canyon, prior to 1959 was virtually eliminated. Removal of this obstruction may have been the major factor contributing to the increased Nanika River escapements.

Table IV. Annual sockeye salmon escapements to the Nanika River for the period 1955-65.

Year	Number of Sockeye
1955	4000
1956	6000
1957	(1000
1958	(1000
1959	1000
1960	3500
1961	7500
1962	3500
1963	1200
1964	6000
1965	9700

Although the timing of the Bulkley River sockeye migration through the Skeena River commercial fishery has never been clearly defined the available data indicate that these fish are present in the commercial area during late June and July. Between 1956-65 the average annual rate of commercial exploitation in the Skeena River, prior to July 31, ranged between 0.5 percent and 48.2 percent and averaged 29.9 percent. There was no apparent decrease in average exploitation rate after the 1956-59 period and it would not appear that the increased escapements resulted from a reduction in commercial exploitation.

Future Hatchery Operation

In summary, the hatchery was kept fully operational throughout the period 1961-65. The survival rates to fry were maintained at a range of between 55 and 76 percent despite extreme operational problems. Unfortunately, the size and therefore, quality of the fry produced has been significantly lower than that recorded for fry from the donor stream and for fry resulting from an eyed egg plant in the channel which was constructed in association with the hatchery.

With regard to the contribution of hatchery fry to juvenile production, the assessment studies suggest that the hatchery production increased the summer fry abundance in Morice Lake but there is no real evidence to suggest that the subsequent smolt production has been similarly increased.

With regard to contribution to the adult return, the first return of fish at age 4 would have occurred in 1965. Analysis of age data collected on the Nanika River in 1965, indicated that the spawning stock of 9700 sockeye included approximately 400 age 4 fish. This total did not exceed the number of age 4 fish expected from natural production.

During the period of hatchery operation, the natural stock has demonstrated a substantial gain. Escapements for the 1955-65 period are shown in Table III.

The lowest return since 1960 occurred in 1963 and this stock was the resulting age 4-5-6 progeny from the extremely low broods of 1957, 1958, and 1959. Additionally, the stock was subjected to a 58 percent mortality by the Moricetown Falls native food fishery.

On the basis, therefore, that the natural stock had demonstrated a significant degree of recovery by 1964 and because of the

differences in fry quality that had been demonstrated between hatchery and channel produced fry, the 1965-66 operation was restricted to incubation of 3.4 million eggs to the eyed-egg stage in the hatchery. These were subsequently planted in the channel associated with the hatchery. The primary purpose of the channel was to assess operation under winter conditions.

Beginning in 1966, on the basis that the 1965 adult return further substantiated the recovery pattern of the natural stock; and this prior to the time that any significant effect could have occurred as a result of the hatchery operation, the artificial rehabilitation program will be suspended pending further developments regarding both the future size of returning stocks and the assessment of past hatchery contribution.

The assessment studies in the system will be continued with a view to:

1. maintaining a measure on the status of the stock;
2. assessing the effect of past hatchery production;
3. determining optimum escapement levels for both stream and lake spawning areas;
4. determining lake rearing potential;
5. providing necessary information for the management of the native food fishery at Moricetown Falls.

Reference

Palmer, R.N. 1964. A re-assessment of Moricetown Falls as an obstruction to salmon migration. Can. Dept. Fisheries, Vancouver. 31 pp.

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Additional Information for 1966 - 71

1.) Sockeye salmon escapements to Nanika River, 1966-71

1966	-	10,700
1967	-	4,100
1968	-	3,300
1969	-	3,400
1970	-	4,700
1971	-	4,300

2.) Morice Lake Sockeye smolt index for 1966.

		Millions of Smolts
Age 1 (from 1964 brood	-	0.3
Age 2 (from 1963 brood)	-	0.3
Total		0.6

3.) Nanika Incubation Channel - 1965-66

	Millions
Eggs held in Nanika Hatchery	3.4
Eyed eggs planted in channel after 11% hatchery mortality	3.0
Estimate fry output	2.1
Percent survival - 70%	