Age And Size Of Nahmint River Summer Steelhead In Anglers' Catches, 1973

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Pacific Biological Station, Nanaimo, B.C.

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INTRODUCTION

When considering summer steelhead, most anglers and biologists agree on two thoughts: (1) that those remaining in their near former abundance are among our most precious fisheries resources, and (2) that summer steelhead may be more detrimentally affected by man's activities than most other forms of anadromous salmon and trout. On Vancouver Island, summer steelhead occur in most of the west coast river systems. In the past we have neglected many of these summer races. Because of diversions two of the best summer steelhead runs--those in the Ash and Heber Rivers--have been reduced to remnants. Other runs such as those in the South Sarita River, China Creek and Cous Creek have experienced similar severe reductions in the numbers of returning adults, possibly due to both logging and overfishing. A number of other systems believed to support summer steelhead are as yet inaccessible by road--a situation likely to change rapidly with implementation of the B.C. Forest Service's coast logging guidelines, requiring much broader dispersal of logging operations. On southwest Vancouver Island rivers such as the Nahmint, Henderson, Toquart, Effingham, Klanawa and Clayoquot would be affected. In each watershed extensive inventories of fish, streams, soils and vegetation will be required prior to identifying and protecting critical areas. If this prelogging, planning phase is done carefully and thoroughly, it should be possible to maintain both a recreational fishery for summer run steelhead and forest harvesting in the watersheds.

The Nahmint River is essentially pristine at present. Relative to many other streams, fishing pressure is light. The only logging in the watershed was conducted in the 1940's on the northeast side of the river from the lake to tidewater. However, the timber resource upstream from the lake and on the southwest side of the river below the lake is substantial. The Nahmint watershed is in Tree Farm Licence 21 owned by MacMillan Bloedel Ltd. Long range plans are being developed by the company and the B.C. Forest Service to log in the watershed. It is the stated intention of MacMillan Bloedel Ltd., as well as the B.C. Forest Service, B.C. Fish and Wildlife Branch and the Fisheries and Marine Service, DOE, to obtain complete resource inventory (forest cover, soils, wildlife, water, fisheries, etc.) on which to base logging plans.

Much of this inventory work will be undertaken in 1974. Initial steps in this direction were two Fish and Wildlife Branch-Federal Fisheries Service snorkle surveys of the lower river in the summer of 1973 when initial information on adult and young fish distribution and stream morphology was gathered (Appendix I and II). Knowledge of the freshwater life history of the summer steelhead is a small but vital part of the prelogging inventory of the Nahmint River. Information basic to any watershed management plan is how many years the juvenile steelhead spend both in fresh water and in the ocean and how fast they grow. This is information that can be obtained from adult steelhead scales and is the subject of this report.

The Nahmint River has a substantial population of summer steelhead with a mean estimated annual catch of 168 with a range of 49 to 461 (Fish and Wildlife Branch, 1966-72). Apparently only a small run of winter

steelhead occurs in the river[1]. Adult summer run steelhead enter the system mainly in spring and early summer. The fish apparently move quickly through the lower river and into Nahmint Lake about 7 miles from tide water. Sport fishing is conducted in the lower river and in the lake. What information is available suggests that the adult steelhead oversummer in the lake and ascend the tributary river in the fall. Some steelhead probably also spawn in the lower river; snorkle surveys of the river downstream from the lake on June 13 and August 23 revealed three size groups of juvenile steelhead (Appendix I and II). Spawning must be relatively early in the winter because kelts were abundant in the lower river in mid-February 1973.

In addition to steelhead, the Nahmint River supports chinook, coho, chum and sockeye salmon. The lake contains cutthroat trout and kokanee. The latter is probably the source of adult sockeye observed in the lower river. Two falls in the upper end of the canyon about 2 miles from tide water are apparently a total block to salmon and at low summer flow are also a block to steelhead (Appendix II). Presumably cutthroat also occur in the small tributaries.

METHODS

Steelhead scale samples were collected from anglers by Mr. J.D. Lee, a long-time Nahmint River angler from Nanaimo. Essentially the methods of scale collection were the same as reported by Narver and Withler 1971. About 10-20 scales were taken from the 3 scale rows above or below the lateral line in the area lying between the rear of the dorsal fin and the front of the anal fin. The scales from each fish were deposited in a 2 1/2 × 4 inch envelope. On the envelope for each fish was recorded the locality, date, sex, fork length (tip of nose to fork of tail), weight (round or dressed), the lure used to catch the fish and other information that the angler might think important. Mr. Lee was urged to collect scales from all fish, not just the largest, in order to obtain a truly representative sample of the anglers' catches.

From the sample of scales for each fish the best 2 were removed, placed on a gummed card from which a plastic impression was made under heat and pressure (Narver and Withler 1971; Narver 1969). The ocean growth zone was interpreted at a magnification of 100× and the freshwater zone at 247×. The anterior radius from the scale focus (central plate) to each freshwater annulus and to the end of plus growth was measured at 247×. The relationship of juvenile fish fork length (Y) against scale radius (×) established by Hemus (1974) for Dean River summer steelhead ($Y = -.3499 + .890\times$) was used to estimate for each fish in the sample its length at time of first, second, etc. freshwater annulus formation. The author interpreted these scales for age on two occasions about 24 hours apart and found little discrepancy between readings.

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[1]The information in this and the following paragraph comes from personal experience, personal communications with J.D. Lee (Nanaimo) and Ted Burns (Fish and Wildlife Branch, Nanaimo), and Federal Fisheries and Marine Service, DOE, stream survey records.

In this report the most widely accepted notation of age for salmonids is used. For example, 3.2S1 represents a fish that spent three winters in fresh water, returned to the river after two winters in the ocean, spawned the following winter, went back to the ocean where it spent one winter before returning to the river where it was caught. This fish was in its 8th year of life.

RESULTS

A total of 70 scale samples made up the 1973 Nahmint River sample. All of these 70 were suitable for interpreting ocean age and 58 were suitable for freshwater age interpretation. Scales showing any regeneration in the center of the freshwater zone were not used for freshwater age interpretation.

Total age

The majority of fish in the sample were age 3.2 (70.7%) with the second most common age being 2.2 (19.0%) and the third being 3.1 (5.2%) (Table 1).

Freshwater age

The dominant freshwater age was 3. (77.6%) with the second most common age being 2. (20.7%) (Table 1). The sex ratios among age 2. and age 3. were not very different.

Ocean age

The ocean age of steelhead in the sample was almost entirely .2 (87.8%) (Table 1). However, the proportions of the sexes were distinctly different between different ocean ages with more males than females returning after 1 and 3 winters in the ocean. Age .2 fish comprised 95% of the females but only 76% of the males. There were no age .3 females in the sample.

Sex ratio

The overall sex ratio of Nahmint River steelhead in anglers' catches was 25 males to 40 females or 1:1.6 (Table 1).

Repeat spawners

Repeat spawners in the sample of 70 fish totalled 5 (7.1%) (Table 2). All of these were returning for the second time: one at age 3.1S1 and four at age 3.2S1. The sex ratio of repeat spawners was 1 to 5 in favour of females (80% ♀).

Table 1. Numbers and percentages of male and female steelhead of different age groups in anglers' catches from the Nahmint River in the spring and summer of 1973. Fish that had spawned previously, as determined by scale examination, are not included.

		Total age						
		2.2	2.3	3.1	3.2	3.3	4.2	Total
♂	n	3	1	2	12	1		19
	%	15.8	5.3	10.5	63.1	5.3		100.0
♀	n	8		2	28		1	39
	%	20.5		5.1	71.8		2.6	100.0
Total	n	11	1	3	41	1	1	58
	%	19.0	1.7	5.2	70.7	1.7	1.7	100.0

		Freshwater age			
		2.	3.	4.	Total
♂	n	4	15		19
	%	21.1	78.9		100.0
♀	n	8	30	1	39
	%	20.5	76.9	2.6	100.0
Total	n	12	45	1	58
	%	20.7	77.6	1.7	100.0

		Ocean age			
		.1	.2	.3	Total
♂	n	2	19	4	25
	%	8.0	76.0	16.0	100.0
♀	n	2	38		40
	%	5.0	95.0		100.0
Total	n	4	57	4	65
	%	6.1	87.8	6.1	100.0

Table 2. Numbers and percentages of different age groups of repeat spawners in anglers' catches from the Nahmint River in the spring and summer of 1973.

		Age		Total	Total in sample
		3.1S1	3.2S1		
♂	n	-	1	1	26
♀	n	1	3	4	44
Total	n	1	4	5	70
	%	20.0	80.0	(7.1)	

Lengths and weights

The fork length vs round weight relationship of adult summer steelhead in Nahmint River catches in 1973 is shown in Fig. 1. Only fish actually reported as weighed rather than estimated were included. Also no kelts were included. The relationship is very similar to that reported elsewhere for winter steelhead (Narver and Withler 1971). For example, on average a 25-inch fish weighs 6 pounds, a 28-inch fish weighs 8 pounds, a 30-inch fish weighs 10 pounds, and a 32-inch fish weighs 12 pounds.

Average weights and lengths of adult Nahmint summer steelhead of different ocean ages are shown in Table 3. Among the age .2 fish the males averaged about 1.6 pounds and 2.5 inches larger than the females. On average, the males over 12 pounds and 32 inches were most likely to be fish having spent three winters in the ocean. Similarly, although none occurred in this sample, females over 9 pounds and 28 inches are probably .3 fish.

Freshwater length

The estimated fork lengths at time of annulus formation and at time of presumed smolt migration are shown in Table 4. Only the 2.2 and 3.2 fish were numerous enough in the sample to be considered. The 2.2 fish grew faster in their 2 years in fresh water than did the 3.2 fish in their first 2 years. It appears that, on average, if fish do not reach about 152 mm (6 inches) by the end of their second winter they will stay over another entire year in fresh water. Age 2.2 fish were smaller as smolts (168 mm; 6.6 inches) than were the 3.2 fish (185 mm; 7.3 inches). The mean estimated smolt length of the combined 2.2 and 3.2 fish was 181.6 mm (7.1 inches) and ranged from 117 mm (4.6 inches) to 279 mm (11.1 inches).

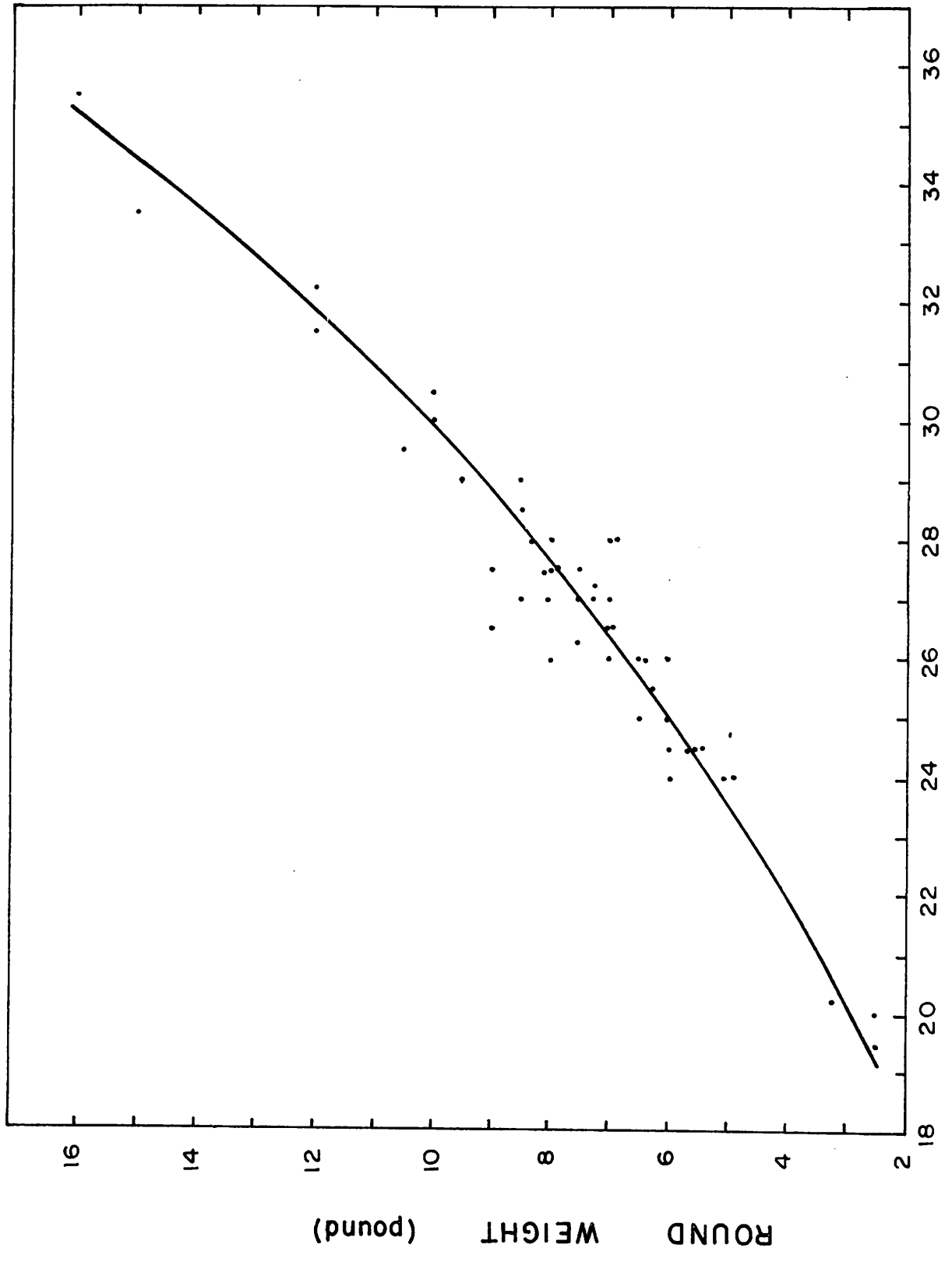

Fig. 1. Lengths and round weights of individual steelhead reported by anglers on the Nahmint River in spring and summer of 1973. The line is the average relationship between round weight and length for this sample of fish (fitted by eye--not calculated). Kelts are not included.

Table 3. Round weights (pounds) and fork lengths (inches) of male and female steelhead of different ocean age in anglers' catches from the Nahmint River in the spring and summer of 1973. (Fish that had spawned previously are not included. Weight information was not submitted for all fish.)

Sex	Ocean age	Weight (pounds)			Length (inches)		
		Average	Range	Number	Average	Range	Number
Male	.1	3.3	2.5-4.0	2	20.0	-	2
	.2	8.4	7.0-12.0	16	28.3	26.5-32.5	14
	.3	13.8	12.0-16.0	4	33.7	31.5-35.5	4
Female	.1	3.3	-	1	20.3	-	1
	.2	6.7	5.0-9	25	25.5	24.0-28.0	25
	.3	-	-	-	-	-	-

DISCUSSION

The age composition of maiden Nahmint River summer steelhead in anglers' catches in 1973 is compared with similar data for five other British Columbia streams in Tables 5, 6 and 7. The most common age groups in catches is 3.2 in all rivers except the Coquihalla where 3.3 was most common (Table 5). The second most common age group was 2.3 in 3 rivers, 2.2 in 1, and 3.3 in 2.

For catches from all 6 streams the majority of summer steelhead (60 to 83%) had spent 3 years in fresh water (Table 6). In 5 of the 6 streams, the second most common fresh water age in catches was 2.; the exception was the Babine River where 4 winters in fresh water was the second most common age group in the catch sample.

The most common ocean age among summer steelhead in catches from 5 of the 6 streams was .2 (55-88%) with the exception being the Coquihalla River sample where .3 (78%) was most common (Table 7). The second most common ocean age in all stream samples except the Coquihalla was .3.

The proportion of repeat spawners in anglers' catches from the Nahmint River was 7.1%. This figure is only slightly greater than that reported for 4 other summer steelhead samples: 3 in the lower mainland ranging from 4.4 to 6.3% (Withler 1966) and the Babine River figure of 3.3% (Narver 1969). However the proportion of repeat spawners in the 1971 and 1973 Dean River summer steelhead samples was much greater (11.1 and 17.9%) (Hemus 1974) but the Dean River is also relatively lightly fished.

Table 4. Means and ranges (mm and inches) of estimated fork length at time of formation of each freshwater annulus and smolt migration for Nahmint River steelhead in 1973 according to age group. Sexes are combined; repeat spawners are not included.

Age group	n	1st year	2nd year	3rd year	4th year	Smolt
2.2	11	75.6 (52.2-106.4)	152.6 (117.1-193.7)	-	-	168.4 (117.1-279.1)
		3.0 (2.1-4.2)	6.0 (4.6-7.6)	-	-	6.6 (4.6-11.1)
2.3	1	94.9	170.5	-	-	170.5
		3.7	6.7	-	-	6.7
3.1	2	78.9	168.7	-	-	255.9
		3.1	6.6	-	-	10.1
3.2	41	60.9 (42.4-88.6)	119.3 (86.9-185.7)	180.3 (150.9-247.1)	-	185.2 (150.9-247.1)
		2.4 (1.7-3.5)	4.7 (3.4-7.3)	7.1 (5.9-9.7)	-	7.3 (5.9-9.7)
3.3	1	48.1	112.7	167.0	-	167.0
		1.9	4.4	6.6	-	6.6
4.2	1	44.1	77.0	113.6	150.9	150.9
		1.7	3.0	4.5	5.9	5.9

Table 5. Percentages of age groups in anglers' catches from Nahmint River and 5 other summer steelhead streams. Repeat spawners are not included.

Stream	1.2	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	Sample size
Nahmint			19.0	1.7	5.2	70.7	1.7			1.7			58
Capilano[1]	1.3		5.7	10.3	1.2	48.3	32.0	1.2					86
Seymour[1]			16.0	24.0		48.0	12.0						25
Coquihalla[1]	0.7		2.0	15.3	0.7	8.0	62.6	4.7	2.0	4.0			150
Babine[2]		1.0	1.0		3.0	62.0	18.0		5.0	8.0	1.0	1.0	100
Dean[3]		.8	7.3	6.8	6.5	65.8	10.3		1.9	.5			368

[1]Withler 1965

[2]Narver 1969

[3]Hemus 1974

Table 6. Percentages of freshwater age groups in anglers' catches from Nahmint River and 5 other summer steelhead streams. Repeat spawners not included.

Stream	1.	2.	3.	4.	5.	Sample size
Nahmint		20.7	77.6	1.7		58
Capilano[1]	1.3	16.0	81.5	1.2		86
Seymour[1]		40.0	60.0			25
Coquihalla[1]	0.7	17.3	76.0	6.0		150
Babine[2]		2.0	83.0	14.0	1.0	100
Dean[3]		14.9	82.6	2.4		365

[1]Withler 1965

[2]Narver 1969

[3]Hemus 1974

Table 7. Percentages of freshwater age groups in anglers' catches from Nahmint River and 5 other summer steelhead streams. Repeat Spawners not included.

Stream	.1	.2	.3	.4	Sample size
Nahmint	6.1	87.8	6.1		65
Capilano[1]	1.2	55.3	42.3	1.2	86
Seymour[1]		64.0	36.0		25
Coquihalla[1]	2.7	14.7	77.9	4.7	150
Babine[2]	10.2	69.5	20.3		117
Dean[3]	8.0	74.0	18.0		395

[1]Withler 1965

[2]Narver 1969

[3]Hemus 1974

The sex ratio of repeat spawners in the Nahmint River sample was 1 male to 5 females. Samples from other summer steelhead rivers range (♂:♀) from 1:2.5 to all female (Hemus 1974). Certainly females appear to be able to survive the rigors of spawning better than males. This is true for winter steelhead as well (Narver and Withler 1971).

The estimated smolt length is useful when attempting to manage a spring season trout fishery and yet maximize smolt survival. The current 8-inch limit appears to protect the majority of downstream migrants, although an argument could be made for a 10-inch limit on the Nahmint. Some caution should be exercized when using smolt lengths estimated from adult scales since the adult scales represent the survivors of a particular smolt migration and were probably among the largest smolts.

ACKNOWLEDGEMENTS

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APPENDIX I

TO: George Reid, Fish and Wildlife Branch, Nanaimo.

FROM: D.W. Narver, Pacific Biological Station, Nanaimo.

RE: Nahmint River Snorkle Survey - June 13, 1973.

Snorkle observations from lake to canyon (approximately 4 1/2 miles).

Personnel

Dave Bustard (UBC), Dave Narver (FRB), Dave Lightly (Fisheries Operations), Bill Hazeldine (FWB), and George Reid (FWB).

Logistics

Flew Fish and Wildlife Branch chartered Beaver aircraft from Port Alberni to Nahmint Lake where Bustard, Narver and Lightly were let out. Flew to Nahmint Lodge in Nahmint Bay where Reid and Hazeldine took an outboard upriver to lower end of canyon (Dan Lee's cabin). Dan Lee had come in independently by outboard boat the previous night to warn the swimmers in the upstream segment from entering the canyon area.

General description of river

The river from the lake outlet to the estuary is about seven miles long. At the outlet is a 30 foot long chute that is probably an obstruction to upstream-migrating steelhead at certain water levels. The river in the first two miles below the lake is very bouldery with a fairly steep gradient and numerous small pools. The next 2 1/2 miles is characterized by smaller substrate, gentler gradient and few large pools. The canyon is 1/2 mile long, composed of sheer bedrock walls and at least three falls with the uppermost being impassible to salmon and caused in part by a log jam. Some of the canyon pools are said to be holding areas for summer steelhead (see August 27 survey). The lowest two miles displays a low gradient and small substrate with several wide gravel bars. In general the river channel appears to be very stable throughout its 7-mile length.

River bank description

In the 4 1/2 miles of river above the canyon the streambanks appear extremely stable. Only a few areas were observed where active bank erosion was occurring. Sand and gravel bars were scarce. River margin was mainly rock ranging from cobble to large boulders to bedrock. The indications were that large freshets do occur from debris left in streamside brush 6 to 7 feet above river level.

The northeast side of the river from the lake to salt water was logged in the 1940's. The south side is essentially unlogged except near the mouth. The river is bordered by hemlock, spruce, cedar, alder, maple (both big leaf and Douglas) and thick growths of minor vegetation. The timber

quality near the stream on the south side varies from sparse, giving the appearance of insect or disease problems, to a few rather impressive stands.

River tributaries

Apparently there are two tributaries above the canyon--one from the south and one from the north. These could be important nursery areas but we did not survey them.

Biological observations above the canyon

Because of heavy rains the previous night, the river had risen about one foot making velocities great (terrifyingly so at times) and observations more difficult. Underwater horizontal visibility was reduced to about 15 feet.

Stream benthos that should normally be visible to a swimmer, such as case-carrying and net-spinning caddis larvae, were not abundant and near the canyon were scarce. In comparison with the Stamp River just below Great Central Lake (swam June 5 by Bustard and Narver) where caddis larvae were abundant, the Nahmint is a distant second.

Trout in the 15-16" range were common just above and within about 1/2 mile of the outlet. We (Narver and Bustard) felt that these fish were cutthroat, but we did not identify them positively. Yearling and age II rainbow trout were common in the first mile of river below the lake outlet. If the water had been at its normal (lower) flow we might even have said they were abundant. In the rest of the river to the canyon (3 1/2 miles) yearling and age II trout occurred only occasionally in small pockets of a few dozen or more fish. These small aggregations were always associated with boulders and swift, broken water. No fry were seen. One adult steelhead was seen about two miles below the lake.

Recommendations

This section probably should be examined again in August. The most recent observations do not indicate that the main river is an important rearing area but Hazeldine's earlier observations on foot suggest that the area is important.

APPENDIX II

TO: George Reid, Fish and Wildlife Branch, Nanaimo.

FROM: D.W. Narver, Pacific Biological Station, Nanaimo.

RE: Nahmint River Snorkle Survey - August 27, 1973.

As agreed, Dave Bustard and I swam the Nahmint River from the lake to tidewater on August 23, 1973 as a conclusion to our assistance in your inventory survey prior to the development of logging plans for that watershed. Since we swam part of this same section of river on June 13th when you were short of manpower, I think it was valuable for us to repeat these observations under low water conditions even though your manpower situation has much improved in the interim. Besides, these first hand observations of juvenile steelhead distribution and abundance are useful to us in relation to our "baseline" studies of steelhead and coho at Carnation Creek.

We landed on Nahmint Lake at 1000 hours in a FWB chartered Beaver aircraft, were met at 1700 hours at the Boiler Pool (tidewater) by Ted Burns of your office, and flew from Nahmint Lodge to Port Alberni via your Beaver at 1900 hr. The river was about 17°C and very low (about 50 cfs). Water level was from 2-3 feet lower than during our June 13 survey. I briefly described the banks, vegetation, etc. in the June report. It still sppears that the river channel above the canyon is very stable.

1. Upper 3/4 mile. This stretch contains a falls at the lake outlet and two very large pools. Rainbow trout (by adipose) and ages I, II and some older (by size) were impressively abundant everywhere except in the center of the large pools and quiet runs. A very few larger trout (14-16 inches) were seen. Age 0 rainbow trout occurred but were not as apparent as older fish, and possibly were closer to shore. One dead sculpin (C. aleuticus) was found. This section of stream is very bouldery and swift with little spawning gravel. There is moderate algal growth on the substrate--actually quite thick in the shallow, exposed runs, but the substrate is not particularly slippery. Insect life appears to be quite sparse.

2. Mile 2. This stretch consists of rapids and runs, no large pools; it is bouldery with few gravel pockets; rainbow trout not as dense as upstream but three age groups must still be classed as abundant. We saw one adult steelhead.

3. Mile 2 3/4. At the lower end of big island. This section has one big pool, the rest is rapids and runs, very bouldery. Age 0, I and II rainbow trout were still abundant. We saw 2 adult steelhead. We found a fibreglass canoe in fair shape that must have drifted from the lake.

4. Top of canyon (≈ 5 miles). The two miles upstream from the canyon contain much flat water and only two pools; rainbow trout are common in the rapids but not in the flat runs, and are not as dense as upstream. Rainbow trout fry were more common than upstream, two adult steelhead were seen; this is a much less bouldery area, mainly rubble with some gravel areas.

5. Bottom of canyon (Lee's cabin). The 1/2 mile of canyon is composed of solid bedrock with sheer walls and about 6 distinct falls. Only the 3rd and 4th falls appear to create any problem to fish passage. The 3rd falls is a 8 to 10 foot high cataract (as opposed to a straight plunge) with a 60' × 30' pool below that contained about 100 steelhead and several sockeye. A few of the fish had apparently been injured in jumping at the falls. The 4th drop apparently is also impassable at low water since there were about 75 steelhead and 30 sockeye in the pool below. An additional 6 steelhead and 16 sockeye were seen in the lower canyon including the pool at Danny Lee's cabin. Rainbow trout of age 0, I and II were abundant in the canyon pools.

6. Lee's to the Boiler Pool (tidewater). Virtually no age I+ rainbow trout and no adults were seen; substrate is entirely clean gravel to small rubble; coho fry and rainbow trout fry occurred sporadically; there was much flat water.

We were impressed with the density of juvenile rainbow trout in the three miles below the lake. This is obviously an important production area. I would hope that the runs above the lake contain similar densities for an even greater distance. You will know this from your current surveys. There is no major mid-summer holding water for adult summer runs between the lake and the canyon. It might be that fish holding in the canyon do so involuntarily and might not be found there (at least in the numbers we observed) in a high water summer. It was our feeling that the fish in these two pools were extremely vulnerable to angling, or more specifically, jigging. I found one treble hook rig in a pool. With a little bushwacking one can get to these pools easily. Incidentally, Danny Lee said before the survey that we should find at least 100 adults in the canyon. He also mentioned sockeye which I had discounted (progeny of kokanee?).