

Fishels Brook and the Upper Humber River
A Comparative Evaluation

by

Lester G. Riche

Progress Report No. 56

Resource Development Branch

Department of Fisheries and Forestry
St. John's, Nfld.

May 1969

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RIVER**

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INTRODUCTION

Preliminary biological investigations on west coast river obstructions were completed during the summer of 1967*. Following this study, a priority obstruction list was prepared and forwarded to the engineering side of the stream obstruction team. In early 1968, the engineering crew surveyed obstructions on three of the rivers, namely, Robinson's, Fishals, and the Upper Humber, and estimated the cost for suitable by-pass facilities.

Construction of fishway facilities on Robinson's River, to permit adequate upstream migration, would cost an estimated four hundred thousand dollars (\$400,000.00). The unfavourable cost-benefit ratio necessitated postponement of this project at this time. Installation of by-pass facilities on the Upper Humber and Fishals was estimated at one hundred thousand dollars (\$100,000.00) each, a figure which could be realized under present financial policies.

To expedite further engineering design work, a decision to proceed with construction was necessary on one of the two rivers, i.e. Fishals or the Upper Humber. To obtain background information for this choice, further biological work was completed in early August, 1968.

MATERIALS AND METHODS

The size and accessibility of the two rivers prevented a detailed foot survey. To speed up the biological analysis both rivers were studied

* Report in final draft stage

from a Bell GHA helicopter at low altitude and at the minimum permissible air speed. Prior to flying the river, a small section was walked and pertinent features such as width, depth, bottom composition and velocity noted. This sample area was then flown at varying altitudes and the various features observed for reference when flying the study rivers. An occasional check on our observations was made at various stages in the study to keep all data as consistent as possible. This method was found to give information of good quality while considerably speeding up the survey.

Prior to flying, a complete map was drawn and the main river and larger tributary streams were marked off in sections. Stream characteristics of each main river section and tributary stream were recorded on the map or on tape. Use of the tape-recorder permitted more time to view the river bottom and consequently better quality data.

Immediately after the river survey pertinent information was transposed from the map or tape-recorder onto suitable stream survey sheets. Bottom types were described using the lagler (1955) classification and were listed by percent composition.

FISHELS BROOK

Watershed

Fishels Brook is a moderate-sized stream with a watershed area of 139 square miles, with a total axial length of 30.3 linear miles. A 19 foot high falls, located 13 miles from the mouth, halts upstream salmon movement, leaving approximately 34 sq. miles of drainage and 17 linear miles of main river ⁱⁿaccessible. Eighteen linear miles of tributary streams are also utilisable above the main falls.

Rising in the Long Range Mountains, the river has a maximum relief of 1,950 feet and flows in a general westerly direction into the Gulf of St. Lawrence. The river exhibits a well-interpersed drainage pattern, from wide shallow areas to narrow gorge sections. Bottom types are well distributed except for a noticeable lack of bedrock.

Table I. Fishels Brook Tributary Streams Showing Present Lengths and Obstructions

Trib. No.	Total length (mi.)	Amount accessible (mi.)	Obstruction type	Degree of obstruction
1	1.7	0.25	Falls 100' high	Complete
2	3.0	0.25	Falls 30' high	Complete
3	4.0	Nil	Falls	Complete
4	1.5	1.0	Falls 15'	Complete
5	0.5	0.00	Dries out	Partial
6	1.8	0.00	Falls 5, 8, 10 & 15	Partial Complete
7	6.0	6.0	Nil	-
8	2.6	0.25	Falls 15'	Complete
9	4.0	3.50	Nil	-
10	1.6	1.60	Nil	-
TOTALS	26.7	12.85	-	-

Fish Populations

Atlantic Salmon - Based on angling data for the period 1952-66,

Fishels Brook ranks twenty-sixth among Newfoundland and Labrador salmon rivers. Although it is not one of the larger streams, it is a preferred fishing area because of its better ratio of large salmon and of ready

accessibility from the T.C.H. Table II lists the angling catch summary for the period 1952-66.

The average weight of large salmon is approximately 7.6 lbs., while the average weight of the grilse is approximately 3.7 lbs.

Table II. Salmon Angling Catch Summary, Fishole Brook, 1952-66.

	Total number	Ave. catch per year	% of Total Ave.	Total wt. in lbs.	Ave. wt. in lbs. Each Season	% of total of ave. wt.	
Grilse	2,462	164	70	9,011	3.7	600	54
Salmon	1,008	67	30	7,542	7.6	502	46
TOTAL	3,470	231	100	16,553	11.2 4.8	1,102	100

If we assume a twenty percent annual angling catch, this river probably supports a total river population of 1,000 to 1,500 fish. Applying the average ratio of 70 grilse to 30 salmon, we can estimate that this river probably produces 250 to 500 large salmon annually.

Salmon are known to migrate to the base of the falls, dropping back in late fall to spawn in the lower reaches. Studies to determine the extent of this migration have not been carried out.

Eastern Brook Trout (Sea Run) - Angling statistics for the eastern brook trout are only approximations of the numbers and weight landed. The figures listed in Table III are presented to indicate the time distribution of the catch. The author's experience on salmon rivers, during the fishing season, indicates that when salmon begin entering the rivers, little attention is given to angling for sea trout. This oversight, it is believed, causes additional bias in the trout catch data.

In 1968, 450 sea trout were angled weighing approximately 154 lbs., an average weight of 0.34 lbs. per fish.

Table III. Angling Catch, Sea Run Brook Trout, Fishels Brook, 1968.

<u>Week ending</u>	<u>Number of fish</u>	<u>Weight in lbs.</u>
May 11	40	13
May 18	30	10
May 25	30	10
June 1	35	12
June 8	50	16
June 15	25	8
June 22	80	26
June 29	105	35
July 6	15	10
July 13	-	-
July 20	20	8
July 27	20	6
TOTAL	450	154

Since sea trout are not angled extensively throughout the entire fishing season, it is felt that only a small portion of the total run may be caught. If we assume a 10 - 15 percent angling catch, this river probably supports a run of 3,000 to 4,500 sea trout.

Bottom Composition

Main River - Prior to the field survey, a map of the river was drawn, and sections were marked off on the main river. The larger tributaries were also marked to indicate priority areas which should be flown first and, if time permitted, additional tributaries would be surveyed. Bottom composition for each section was indicated on the map by percentage. Other relevant features, such as width, depth, shade, and current speed, were also indicated.

For each section, the number of 100-square-yard units has been calculated and these estimates are presented in Table IV. Figure 1 shows the drainage area above the obstruction and the sections indicated in Table IV.

Each section includes only the riffle area excluding areas of steady water, such as ponds and long, deep steadies. These areas, although possibly offering some potential for rearing, are excluded because of the lack of sufficient information indicating their value.

Table IV. Bottom Composition in 100-sq.-yd. units, Main River, Fishers Brook.

Section	Total length (mi.)	Average width (ft.)	Bedrock	Boulder	Rubble	Gravel	Total
1	2.0	100	-	-	938	235	1,173
2	2.8	75	-	231	770	579	1,580
3	1.6	80	-	187	562	187	936
4	2.0	70	-	440	440	-	880
5	1.2	50	-	114	13	-	127
6	2.0	100	-	820	352	-	1,172
TOTALS	11.6	80	-	1,792	3,075	1,001	5,868

River depths were moderate, ranging from 6 inches to 2 feet. Water speeds were also moderate, and nowhere were there any rapid areas. During the survey period, water levels were low, and a 10% to 15% exposure of the river bed was common. This unwetted area has not been included in the areas in Table IV.

All of the boulder and rubble area, plus 80% of the gravel, has been considered to be potential rearing area. Gravel in the main river was predominantly coarse, and only 20% of the existing 961 units were rated ideal for spawning. It is estimated that in the main river there are 5,676 units suitable for rearing and 192 units suitable for spawning.

Tributary Streams - Practically all of the tributary streams accessible to Atlantic salmon provide rearing areas. Table V lists the tributary streams above the falls and the unit breakdown by bottom type that could be utilized if the main river obstruction were removed.

Table V. Bottom Composition, Tributary Streams, Upper Fishels Brook.

Trib. No.	Length (mi.)	Av. width (ft.)	Bottom				Totals
			Bedrock	Boulder	Rubble	Gravel	
1	0.25	20	-	7	19	-	26
2	0.25	30	-	22	22	-	44
4	1.00	15	-	31	53	4	88
7	6.00	20	-	444	189	-	633
8	0.25	15	-	11	11	-	22
9	3.50	30	-	308	308	-	616
10	1.60	10	-	34	34	16	84
TOTALS	12.85	20	-	857	636	20	1,513

Of the 1,513 units in the tributaries, it is estimated that 1,473 units are suitable for rearing and 40 units are suitable for spawning.

Estimation of Potential Salmon Production

Various Authors have reported smolt production per 100 yds.² of rearing area from a low of 0.9 fish per unit in Little Cedroy River, Nfld., to a high of 6 fish per unit in Pollett River, N.B., (with bird control). The most frequent production rate estimates range 1-3 smolts per 100 yds.²

Sea survival of marked smolts returning to natal streams has ranged from a low of 0.1% to a high of 5.6% in the River North Esk, Scotland. Survival rates as high as 19.9% have been reported from Swedish rivers, notably River Ricklean. However, Swedish results are not strictly comparable because of the confined fishery in the Baltic Sea which takes Swedish fish at all sizes in the sea.

Very little information is available on the survival of unmarked smolts. Saunders and Allen (1967) have indicated that unmarked smolt survival to the river as grilse may be as high as 31% with a lower limit of 8%. These estimates are based on some conjecture but appear to be reasonably valid.

For the present purpose at Fishals Brook, smolt production will be estimated for 1, 2, and 3 smolts per 100 yds.², and sea survival at rates of 2, 5, 10, and 15% (Table VI). The main river and tributary streams have a total of 7,149 units suitable for salmon rearing and 232 units suitable for spawning.

Table VI. Estimation of Atlantic salmon production from 7,149 units in Fishals Brook at selected rates of smolt production and smolt to adult survival.

If smolt production per 100 yds		<u>1</u>	<u>2</u>	<u>3</u>
Smolts produced		7,149	14,298	21,447
Adult return to sea survival is	2%	143	286	429
	5%	357	714	1,072
	10%	715	1,429	2,145
	15%	1,072	2,143	3,219

UPPER HUMBER RIVER

Watershed Description

The Humber River is the second largest river in insular Newfoundland, with a watershed area of 2,900 sq. miles. Rising in the Long Range Mountains near Western Brook, it runs a southeasterly course toward Birchy Basin, then it turns southwesterly to enter the Bay of Islands, near the city of Corner Brook. In some 95 linear miles, the drainage exhibits a variety of geologic features of the Mississippian, Ordovician, and Cambrian periods, with rock types from sedimentary to intrusive volcanics.

The river basin for many years has provided industry in Corner Brook with a source of pulpwood and water power, as well as agricultural opportunity in some of the smaller towns. The Atlantic salmon resource has contributed significantly to the ~~economics~~ of the region.

Sixty-five miles from the river mouth, Main Falls, a twenty-one foot high obstruction, prevents salmon from utilizing ^(Fig 2 197 mi²) 255 sq. miles of the drainage. This upper drainage comprises some 30 miles of main river and 39 tributaries with a total length of 119 miles. Lakes and ponds cover 86 sq. miles.

The main stem above the falls can be generally described as a wide stream of medium velocity and moderate depth. Toward the upper end, wide steadies and long, shallow lakes are common. The terrain is gentle in slope, lending itself to the formation of ideal gradient for rearing areas with an absence of falls and rapids.

Figure 2 illustrates the upper drainage and lists the tributary streams and the mileage of each. Of the 39 tributaries, 20 of the larger were surveyed by air. Table VII lists all tributaries and the accessible

areas of each (47.5 miles of tributary streams were not flown). It was assumed that an equal proportion of these unsurveyed streams is accessible as for the surveyed streams (Table VII). Presence of low-lying terrain in the upper section, which generally does not lend itself to the formation of falls nor heavy rapids, suggests the 80% figure estimated is realistic. It was also estimated that 10% of the tributary mileage is intermittent during the summer months (based on data obtained during 1967 and 1968 surveys).

Table VII. Tributary Streams, Upper Humber River.

Tributary No.	Length (mi.)	Amount Acc. (mi.)	Obstruction type
1	1.60	1.60	Nil
2	1.36	1.36	Nil
3	4.00	4.00	Nil
4	10.00	1.00	Falls, 20' & 15'
5	2.08	2.08	Nil
6	7.20	7.2	Nil
7	27.00	20.00	Headwater dries out
8-9-10	3.2, 1.0, 8.0	Nil	Dries out
11, 12, 13 & 14	2.4, 1.6, 1.2, & 0.4	Not flown	Probably dries out
15	7.2	7.2	Nil
16	1.36	Nil	Dries out
17	8.8	8.8	Nil
18	0.3	Nil	Dries out
19	8.0	8.0	Nil
20	1.44	Not flown	Probably dries out
21	6.08	6.0	Nil
22	1.8	1.8 (not flown)	-
23	9.6	9.6	Nil
24, 25, 26, 27, 28	1.2, 3.8, 0.9, 1.5 & 3.4	Not flown	-
29	9.6	9.6	Nil
30-39	27.9	Not flown	-
TOTAL	156.92	88.24	

Total river mileage not surveyed = 47.5

Total river mileage surveyed = 109.4

Total mileage of surveyed area accessible = 88.2 (81.0%)

= 81% of 47.5 = 38.5 mi.

Percentage of tributary mileage
inaccessible due to drought

= 10% = 3.5 mi.

Total mileage not surveyed but
estimated to be accessible

= 35 miles

Total estimated accessible
tributary mileage

= 88.2 + 35 = 123 miles

Fish Populations

Atlantic salmon - Mercer (1967) estimates that anglers take approximately 40% of the river escapement on the Humber River. Using this figure as a guideline and the angling figures for 1966, he estimates a total river escapement of 11,000 Atlantic salmon. He augments his information with data obtained from trap counts on Adies Stream and Birchy Basin* (Table VIII).

Table VIII. Number of Adult Salmon in Humber River (known and estimated), 1966.

Location	No. of fish (known and est.)
Adies Stream area	2,825
Birchy Basin area	1,375
Main Humber	2,000 est.
Tributaries (below Adies Stream)	2,000 est.
Angling Catch	3,600
Total run, known and estimated	11,800

* From Mercer, K. H. (1967). A Report of a Biological Survey on the Humber River 1966, p. 10, Table IV.

The average annual angling catch for the period 1952-1966 was 2,496 fish, composed of 2,325 grilse and 162 salmon per year (Table II). The catch ranged from 736 fish in 1954 to 5,685 fish in 1964.

Fish move to the base of Main Falls throughout the summer months. In 1967, 160 fish passed through a counting fence located 2 miles below the falls.

Table IX. Salmon angling catch summary, Humber River, 1952-1966.

	Total number	Ave. no. per yr.	% of Ave.	Total weight (lbs.)	Ave. wt. (lbs.) Ind. Seasonal		% of Ave. wgt.
Grilse	34,884	2,325	93	144,969	4.1	9,664	82
Salmon	2,439	162	7	29,034	11.9	1,935	18
TOTALS	37,323	2,496	100	174,003	12.0 ^{4.7}	11,718	100

Eastern Brook Trout (Sea Run) - Anadromous brook trout disperse throughout the river and are caught from early June to late August. Although trout are present over the period of several weeks, the largest catches are reported in late August. The author has caught sea trout weighing up to 4 lbs. 65 miles up the Humber River in early August. Table I lists weekly catches for 1968 from the lower river. Although these figures are approximations, they do give some insight to the sea run brook trout in the Humber system.

Table X. Anadromous Brook Trout Angling Statistics, Humber River, 1968.

Week ending	Number fish	Total wt. (lbs.)	Ave. wt. (lbs.)
June 1	400	100	0.25
8	350	90	0.20
15	300	75	0.25
22	596	182	0.30
29	477	151	0.30
July 6	414	125	0.30
13	362	145	0.40
20	194	35	0.15
27	-	-	-
Aug. 3	515	155	0.30
10	418	227	0.50
17	1,065	390	0.30

Bottom Composition

Table XI lists the sections of the main river and the composition of bottom types in each. Contents of this table do not include areas of steady waters such as ponds or lakes. It should also be pointed out that this table includes only the river bottom area actually covered by water during the survey period. Due to low flows river bottom exposure varied from 10-20% of the bed width.

Table XII lists the bottom composition of the surveyed tributary streams. In addition, some 35 miles were not surveyed, but were assumed to be potentially productive rearing area. If we assume a proportional distribution of bottom types, these unsurveyed tributary streams averaging

35 ft. wide should contribute an additional 7392 units, composed of 1478 units of bedrock, 3072 units boulder, 2661 units of rubble, and 222 units of gravel.

Table XI. Bottom Composition, Main Stem, Upper Humber River.

Sect.	Stream lg.(mi.)	Ave. width (ft.)	Units				Total
			Bedrock	Boulder	Rubble	Gravel	
1	2.8	200	-	703	2110	-	2813
2	1.6	250	-	701	1636	-	2337
3	1.6	300	-	1408	1408	-	2816
4	2.8	100	1.64	492	984	-	1641
5	4.0	100	234	1400	700	-	2344
6	2.0	150	-	1760	-	-	1760
7	1.2	200	-	1406	-	-	1406
8	1.6	150	422	422	563	-	1408
9	7.2	100,	1620	2024	404	-	4048
TOTALS	24.8	170	2440	10316	7805	-	20573
PERCENT OF TOTAL			12	50	38		100

Table XII. Bottom Composition, Tributary Streams, Upper Humber River.

Trib. No.	Stream lg. (mi.)	Av. stream width (ft.)	Units				Total
			Bedrock	Boulder	Rubble	Gravel	
1	1.6	25	-	140	140	-	280
2	1.3	25	-	134	134	-	168
3	4.0	15	84	127	-	-	211
4	1.0	60	-	75	177	-	252
5	1.6	20	84	42	42	-	168
6	7.2	20	383	191	191	-	766
7	20.0	40	823	1830	1830	93	4576
15	7.2	25	304	405	253	51	1013
17	8.8	50	991	743	743	-	2478
19	8.0	30	563	563	282	-	1408
21	6.0	20	-	316	316	-	632
23	9.6	30	-	1013	676	-	1689
29	9.2	100	537	2054	2054	537	5376
TOTALS	85.5	35	3769	7633	6838	681	19017
PERCENT OF TOTAL			20	41	36	3	100

Additional units from unsurveyed tributaries assuming similar distribution of bottom types = 7392 units,

Potential Salmon Production Above Main Falls

The main stem and tributary streams above Main Falls have an estimated 32,592 units of river bottom suitable for the production of Atlantic salmon smolts (Tables XI and XII). There are an estimated (Boulder and Rubble Types) additional 5733 units available on the tributary streams not flown (Table XII).

If we calculate salmon production on a basis similar to that outlined for Fishels Brook, the Upper Humber River will produce a maximum of 14,666 (17,246) plus an estimated 2580 adult Atlantic salmon (Table XIII).

Table XIII. Estimation of Atlantic salmon production from 32,592 units in Upper Humber River at selected rates of smolt production and smolt to adult survival.

If smolt production per 100 yd ²		1	2	3
Smolts produced		32,592	65,184	97,776
Adult return if survival is	2%	652	1,304	1,955
	5%	1,629	3,259	4,888
	10%	3,259	6,518	9,777
	15%	4,888	9,777	14,666

Additional number from estimated
5,733 units

If smolt production per 100 yd ²		1	2	3
Smolts produced		5,733	11,466	17,199
Adult return if survival is	2%	114	229	344
	5%	287	573	860
	10%	573	1,146	1,719
	15%	860	1,719	2,580

Total salmon production

2%	766	1,533	2,299
5%	1,916	3,832	5,748
10%	3,832	7,664	11,496
15%	5,748	11,496	17,246

DISCUSSION

Both Fishels Brook and Upper Humber River possess enough gravel to spawn the maximum potential estimated in Tables VI and XIII. Pratt (1968) indicates a requirement of 6.4 yds.² per female at the Indian River spawning channel with some superimposition of redds. If we assume a similar requirement for fish in the natural environment, then Fishels Brook and the Upper Humber River can support relatively large populations of spawning salmon (Table XIV).

Table XIV. Calculated Spawning Potential for Atlantic Salmon in Upper Fishels & Humber River, Based on Required 6.4 yds.²/female fish.

	<u>No. units spawning gravel</u>	<u>Est. potential no. spawning females</u>	<u>Est. potential total number fish supported</u>
Fishels Brook	212	3,312	6,624
Humber River	903	14,109	28,218

An abundance of spawning gravel means very little if it is not distributed throughout the stream. Tables IV and V, and Figure 1, outline the distribution on Fishels Brook, indicating an even spread. On the Upper Humber River, the gravel is located primarily on the uppermost tributaries (Tables XI and XII and Figure 2). Pratt (1968, Pers. Comm.) indicates that the uneven distribution of spawning gravel on Indian River may be a limiting factor in the population size there. The distribution of spawning gravel in the Upper Humber River may not permit maximum utilization of the rearing areas available in sections nearer Main Falls. Other bottom types are well interspersed throughout both systems.

RECOMMENDATIONS

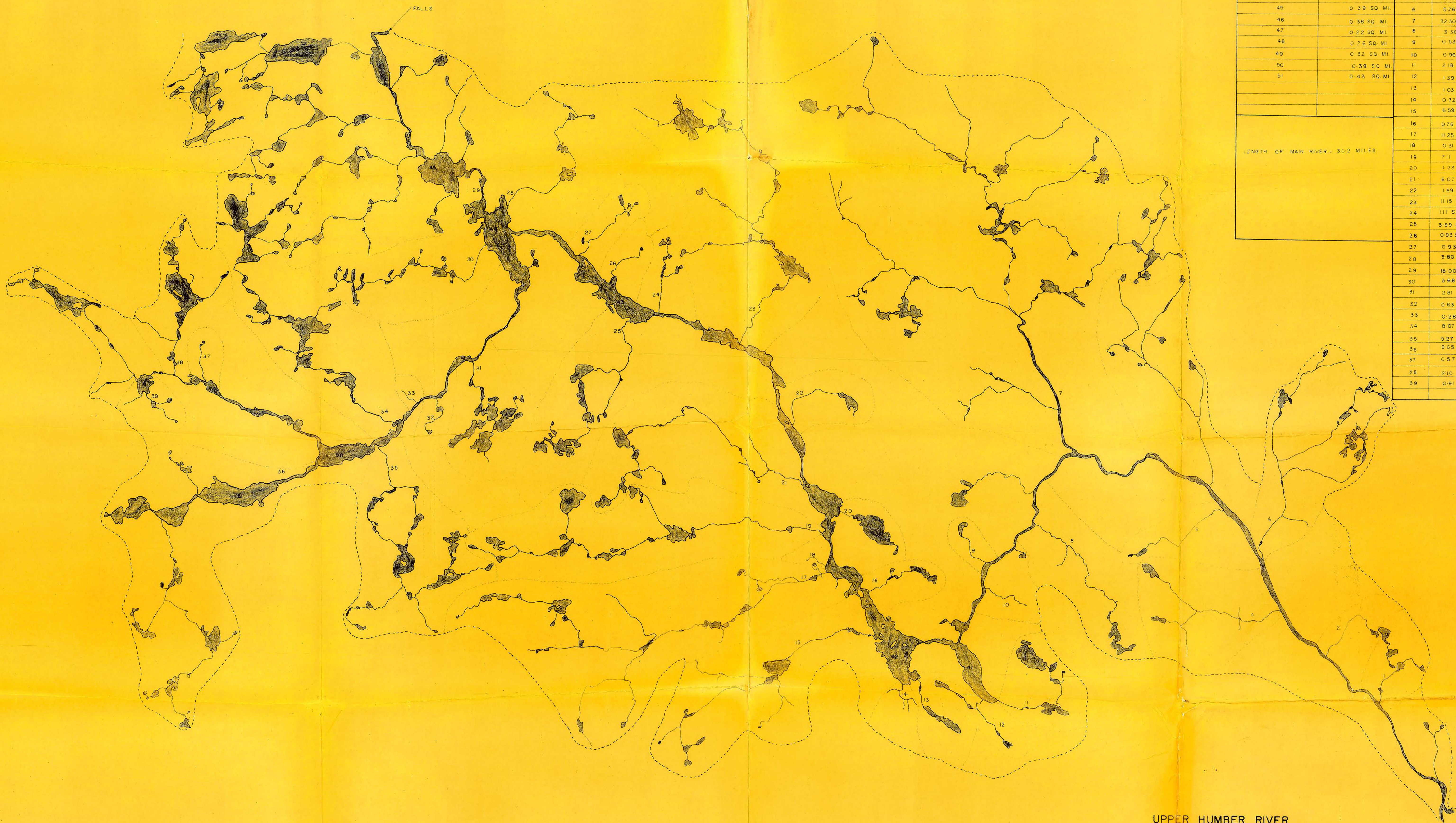
Table IV outlines the costs for fish passage and the approximate cost per fish, assuming maximum production, for the Fishels Brook falls and Main Falls, Humber.

Table IV: Fish Passage Costs, Fishels Brook and Humber River.

	<u>Estimated fishway cost</u>	<u>Cost of access</u>	<u>Cost/Potential Fish</u>
Fishels	\$ 75,000	\$ 25,000	\$ 28
Humber	100,000	Nil	5

Based on this analysis, construction of a fishway over Main Falls on the Upper Humber is the best use of funds. However, to realize this potential production, additional management techniques will be needed.

The uneven distribution of spawning gravel will allow the realization of maximum production. To offset this effect, it is recommended that spawning channels, preferably two, be built to accommodate down river spawners, or a small hatchery be built, to produce salmon to the fry stage. It is recommended that, at least, one of these techniques be used. Regardless of which is employed, it is strongly suggested that stocking the upper reaches with fry begin with fishway construction. Known 1967 escapement to the falls was 160 adult salmon - a figure much too low to properly stock the available rearing area.



LAKE NUMBER	LAKE AREA	TRIBUTARY NUMBER	DRAINAGE AREA	LENGTH
40	0.13 SQ. MI.	1	1.40 SQ. MI.	1.60 MI.
41	0.41 SQ. MI.	2	1.15 SQ. MI.	1.36 MI.
42	0.75 SQ. MI.	3	3.79 SQ. MI.	2.88 MI.
43	0.52 SQ. MI.	4	4.92 SQ. MI.	4.24 MI.
44	0.64 SQ. MI.	5	1.75 SQ. MI.	2.08 MI.
45	0.39 SQ. MI.	6	5.76 SQ. MI.	4.32 MI.
46	0.36 SQ. MI.	7	32.30 SQ. MI.	9.12 MI.
47	0.22 SQ. MI.	8	3.36 SQ. MI.	3.28 MI.
48	0.26 SQ. MI.	9	0.53 SQ. MI.	1.04 MI.
49	0.32 SQ. MI.	10	0.96 SQ. MI.	0.80 MI.
50	0.39 SQ. MI.	11	2.16 SQ. MI.	2.48 MI.
51	0.43 SQ. MI.	12	1.39 SQ. MI.	1.60 MI.
		13	1.03 SQ. MI.	1.28 MI.
		14	0.72 SQ. MI.	0.48 MI.
		15	6.59 SQ. MI.	5.04 MI.
LENGTH OF MAIN RIVER = 30.2 MILES		16	0.76 SQ. MI.	1.56 MI.
		17	11.25 SQ. MI.	7.36 MI.
		18	0.31 SQ. MI.	0.32 MI.
		19	7.11 SQ. MI.	6.40 MI.
		20	1.23 SQ. MI.	1.44 MI.
		21	6.07 SQ. MI.	6.08 MI.
		22	1.69 SQ. MI.	1.84 MI.
		23	11.15 SQ. MI.	7.00 MI.
		24	1.11 SQ. MI.	1.28 MI.
		25	3.99 SQ. MI.	3.84 MI.
		26	0.93 SQ. MI.	0.96 MI.
		27	0.93 SQ. MI.	1.52 MI.
		28	3.80 SQ. MI.	3.44 MI.
		29	18.00 SQ. MI.	9.12 MI.
		30	3.68 SQ. MI.	3.60 MI.
		31	2.81 SQ. MI.	1.92 MI.
		32	0.63 SQ. MI.	0.88 MI.
		33	0.28 SQ. MI.	0.40 MI.
		34	8.07 SQ. MI.	5.60 MI.
		35	5.27 SQ. MI.	4.56 MI.
		36	8.65 SQ. MI.	7.52 MI.
		37	0.57 SQ. MI.	0.72 MI.
		38	2.10 SQ. MI.	2.78 MI.
		39	0.91 SQ. MI.	1.12 MI.

UPPER HUMBER RIVER
DRAINAGE AREA = 197.2 SQ. MI.
SCALE: 1" = 0.8 MI.



TRIBUTARY NUMBER	DRAINAGE AREA	LENGTH	LAKE NUMBER	LAKE AREA
1	1.55 MI. ²	1.76 MI.	11	0.89 MI. ²
2	3.39 MI. ²	3.04 MI.	12	1.52 MI. ²
3	6.40 MI. ²	4.08 MI.	13	0.33 MI. ²
4	1.07 MI. ²	1.52 MI.	14	0.69 MI. ²
5	0.29 MI. ²	0.56 MI.	15	0.60 MI. ²
6	1.12 MI. ²	1.84 MI.		
7	5.52 MI. ²	5.52 MI.		
8	2.58 MI. ²	2.64 MI.		
9	6.30 MI. ²	3.28 MI.		
10	8.52 MI. ²	5.20 MI.		

STREAM DRAINAGE AREA ABOVE FALLS = 54.5 MI.²

LENGTH OF MAIN RIVER (SECTION SHOWN) = 19.60 MI.

LENGTH OF MAIN RIVER (ABOVE FALLS) = 17.04

FISCHELLS BROOK

SCALE: 1" = 0.8 MI.