

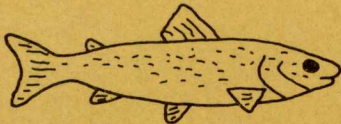
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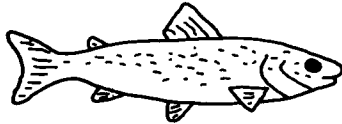
**ANNUAL REPORT
1972**

RESOURCE DEVELOPMENT BRANCH
NEWFOUNDLAND REGION
ST. JOHN'S



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 ENVIRONMENT CANADA
FISHERIES SERVICE



ANNUAL REPORT
1972

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ST. JOHN'S

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I N T R O D U C T I O N

INTRODUCTION

V.R. Taylor

Within the Region, and within the Branch, many changes took place in 1972. One of the most important of these was the transfer in April of the larger part of our former pollution control responsibilities, together with associated staff and equipment, to the newly-established Environmental Protection Service. This change required some reorganization within the Branch, including the addition of our remaining pollution responsibilities to the Environmental Protection Group - later renamed the Water Resources Group. At the same time, the former Lake Management Group was assigned somewhat wider responsibilities and renamed the Recreational Fisheries Group. Other existing Groups within the Branch remained as before.

Because of the continued emphasis on homewater exploitation of salmon stocks, as evidenced by the closure of the Port-aux-Basques drift-net fishery, a Commercial Fisheries Group was created. Its main function, at the outset, will be to determine how the Newfoundland and Labrador commercial salmon fishery can best be regulated so as to impinge as little as possible on other stocks (Maritimes and Quebec) migrating through Newfoundland fishing areas.

Notwithstanding these changes, it appears that, within the Branch, as with most other human activities today, "change" is about the only thing remaining constant. Thus it appears likely that, within the foreseeable future, further changes will take place, especially in the role that Branch staff may be expected to play in the management of marine resources. A copy of the Branch organization chart, as it exists at the date of writing, is attached as Appendix 1 to this Report.

As all Branch staff are aware, the Branch Chief requested, and was granted effective as of September 1, relief from his administrative duties for a period of one year. One of the things that he has done during this period has been evaluation of the need for "fish culture capability" as an additional "tool" for fish management in this province. A brief synopsis of the concept developed in this respect appears as Appendix 2 of this Report.

During the period of Mr. Taylor's "relief", R.E. Cutting has been performing the duties of Branch Chief. We express thanks to all staff members for the support they have provided in the year under review. Cooperation between staff of other Branches and Resource Development Branch staff, at Regional, District and Station Offices, has been particularly gratifying in ensuring that the tasks have been completed in the best possible manner.

DEVELOPMENT GROUP

DEVELOPMENT GROUP

J.D. Pratt, Group Leader (Development)

The 4,400 square miles of drainage area in the Exploits River watershed constitutes the largest single potential for development of Atlantic salmon on the island of Newfoundland. The objective of the Exploits River Development and Management Program is to maintain existing runs and to establish additional populations within the watershed. At present, only the area below Grand Falls is accessible to salmon (Fig. 1). However, salmon populations have been introduced into Noel Paul's Brook utilizing a controlled flow spawning channel. Fish passage facilities at Grand Falls are scheduled to be completed by the spring of 1973 for initial use by the returning Noel Paul fish. With the provision of fishways at other impassable locations and the further establishment of salmon populations in now unused rearing areas, an adult spawning escapement of approximately 30,000 fish with a commercial and recreational fishery of some 55,000 fish can be developed.

EXPLOITS RIVER DEVELOPMENT

M.K. Farwell
H.J. Rietveld
K.M. Mercer

Grand Falls Obstruction and Fishway

Construction of a fishway collection facility at Grand Falls (Fig. 2) began in September, 1972. It should be completed by early spring, 1973, and initially will be used by the returning Noel Paul's Brook salmon run. The collection facility is built on a 1 to 8 slope with provisions for a flow of 20 cfs through the collection area and fishway, and an additional 180 cfs provided as attraction water at the entrance. This facility, if circumstances warrant it, can later be extended to completely surmount the Grand Falls obstruction. Previous hydrographic surveys have revealed no physical or chemical barriers below that will inhibit salmon migration to this point. However, experiments conducted during the summer of 1972 showed that at certain low water levels pollution problems could inhibit or even prevent migration at the fishway entrance. The Environmental Protection Service is investigating this situation and negotiations with Price (Nfld.) Pulp and Paper Co. should result in the removal of this hazard prior to the 1973 salmon run to the area.

Hydroelectric Facilities

Investigations of forebay delay and of turbine mortality of

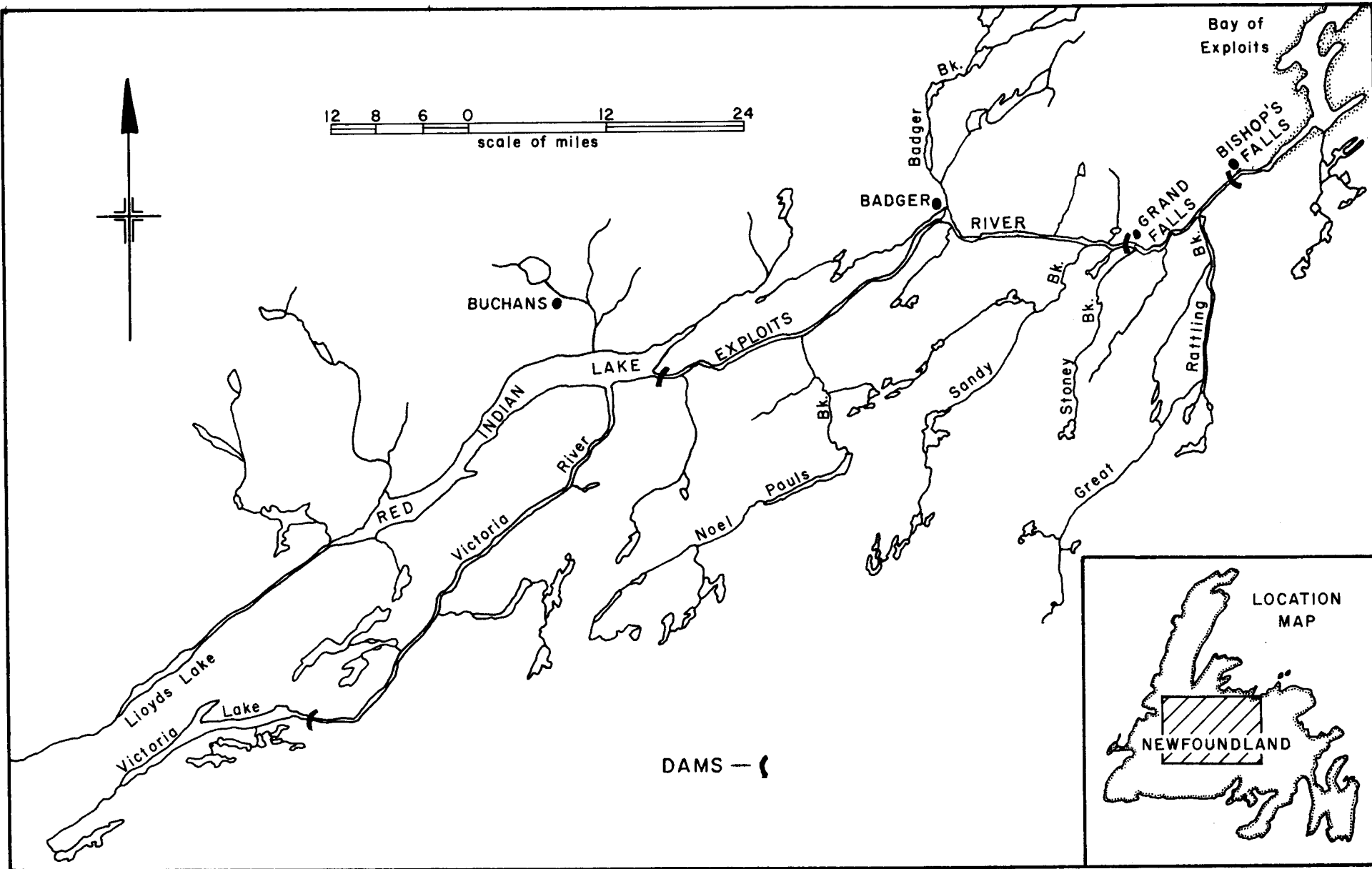


FIG. 1 THE EXPLOITS RIVER BASIN



Fig. 2. Grand Falls (photo)

downstream migrating smolts and kelts were carried out in 1972 at both the Grand Falls and the Bishop's Falls power facilities. Seventeen hundred smolts and five hundred kelts were tagged at Noel Paul's Brook to identify migration timing, delay, and migration in relation to the hydroelectric forebays. This tagging will also later provide data on the contribution to the sports and commercial fisheries of the fish involved.

These investigations and a literature review indicate that passage of fish through the turbines at the Grand Falls power plant could result in a mortality of up to 35%. However, a forebay surface spilling gate appears to allow fish an escape route so that they re-enter the main river successfully. During 1972, smolt and kelt migrations, this gate spilled water continuously, and no fish accumulated in the forebay. A guaranteed spill through this gate should prevent future excessive turbine mortalities. Moreover, water is also spilled over the dam during these migrations and this enables most emigrants to bypass the forebay entirely.

The forebay at the Bishop's Falls power plant has been a recurring problem for migrating smolts and kelts at that point. However, in 1972, first steps were taken to alleviate this situation. A surface spill opening, together with a counting trap, was placed in the forebay during the winter and began operation in late April (Fig. 3). Between April and July, 184 kelts and 9514 smolts passed through this trap. This demonstrated that this method of removing fish from the forebay is feasible. Modifications to be in effect during 1973 should allow this escape route to operate even more efficiently in the coming year. The success of this emigrant release facility indicates that formerly proposed diversion screens at the forebay may not be necessary.

Spawning Escapement Assessment

Adult salmon counts and spawning surveys were continued in 1972 to determine the size, distribution, and trends of salmon populations in the Exploits River and also to determine the suitability of other nearby streams as sources of future brood stock for developing those sections of the Exploits watershed between Grand Falls and Red Indian Lake (Fig. 1).

Adult salmon counts at Great Rattling Brook and Bishop's Falls were again done this year. The count at Bishop's Falls utilized a newly constructed counting facility. A total of 907 fish were passed through the trap. This is the lowest recorded count at this site since enumeration began in 1959 and is well below the average run of 1330 fish.

The Great Rattling Brook count, conducted at Camp One Falls Fishway, totalled 729 fish. This is also the lowest recorded count at that site since the effect of the adult transfer might have been expected to exhibit itself and is well below the average run of 1370 fish since 1965.



Fig. 3. Bishop's Falls forebay release facility (photo).

Stoney Brook, a tributary entering the Exploits at Grand Falls also was the site of a counting fence this year. As in the past, only a few fish were counted through, three grilse having gone upstream before the fence washed out in early October. No redds were located on this system during a spawning survey in early November.

Adult counts were also done in 1972 on three potential donor streams. Spawning escapements to Horwood River, Salmon Brook, and Middle Brook were enumerated, including 100 fish that were blood sampled for gene frequency analysis to determine suitability for Exploits stocking. The adult count at Horwood was 597 fish and at Middle Brook 848 fish. At Salmon Brook the count was 594 fish, well below the 1971 count of 1200. These investigations indicated that the three systems surveyed would not provide sufficient brood stock to materially assist the Exploits River development scheme.

Salmon runs to the Exploits, Salmon Brook, and other adjacent rivers were well down this year, even though the last year's smolt runs were of average size. This indicates that there was some factor or factors in the marine environment which adversely affected escapements. Even so, it is doubtful that even in an average year there would be a surplus of brood stock in these systems to contribute to the Exploits Development program.

Commercial and Recreational Fisheries

Development of the Exploits River is dependent upon adequate adult escapements from either existing or newly introduced populations. Though benefits will accrue to the commercial and recreational fisheries, proper control over these fisheries must be exercised to ensure adequate spawning escapements.

Investigations into the home water commercial fishery in the Bay of Exploits continued in 1972. "Home waters" have been designated as those areas within a radius of 25 miles of the mouth of the Exploits River. The survey revealed similar levels of fishing effort in 1971 and 1972. In 1972 there were 28 salmon nets fished in home waters. The 320 salmon taken in 1972 represent twenty percent of the total run to the river. Compared with the landings of past years, the 1972 commercial salmon fishery in this area was poor.

Size composition of the commercial landings from home waters closely correspond with that of salmon at the Bishop's Falls counting facility where the average weight was 4 pounds, and the grilse to salmon ratio being 9:1. Timing of the commercial landings also corresponds with timing at Bishop's Falls, the week of peak commercial landings occurring one week earlier than at the counting facility. The intent of this investigation is to define the relationship between home

water commercial catch and the escapement to the river, thus permitting effective regulation of the homewater fishery to enhance spawning escapement to the Exploits River.

The recreational fishery on the main Exploits River was investigated again in 1972. Information obtained was consistent with 1971 data. It is now evident, as a result, that the Bishop's Falls rapids and tailrace area accounts for nearly 50% of sports landings. Most landings occur within 100 yards of the existing sports fishing boundary at this obstruction. The number of fish angled in 1972 was 463 fish, slightly below the average since 1961 of 530 fish. It represented 34% of the run to the river. This is the highest percentage catch on record and is well above the average catch of 23 percent. Moving the fishing boundary downstream a few yards might allow more salmon to surmount this obstruction and contribute to spawning escapement.

Noel Paul's Brook Development

Noel Paul's Brook enters the Exploits River between Grand Falls and Red Indian Lake (Fig. 1). It has a drainage area of 410 square miles, or about one-tenth that of the Exploits River as a whole. If intensively stocked and managed, it is estimated to be able to produce 30,000 smolts annually. This "brook", in 1966, was chosen as the site of a controlled flow spawning channel for Atlantic salmon, the choice being based on experience gained in operating a similar facility at Indian River, Hall's Bay. The objective of the spawning channel was to provide, through intensive fry stocking, a population of anadromous Atlantic salmon in a formerly inaccessible stream habitat. Results to date, at least to the smolt stage, suggest that it is fulfilling this role quite well.

Adult Channel Escapement. Since 1967, Atlantic salmon spawners have been transferred by tank truck from Adies Stream on the Upper Humber River to the spawning channel on Upper Noel Paul's Brook. Table 1 summarizes the annual transfer information, as well as the spawning success and subsequent fry production at this site.

At the Noel Paul site, several spawner densities have been used, ranging from one female per twelve square yards of spawning area to one female per two square yards. In 1972, spawning density was at a ratio of one female per four square yards of spawning gravel.

Experiments conducted in 1972 indicate that at a density of less than two square yards per female, superimposition of redds may result in egg losses due to 100% of the spawning area being utilized. It appears that the optimum spawner density to use in such channels is about one female per 2-3 square yards.

Table I. Salmon spawning escapements and resultant egg deposition, Noel Paul's Brook Channel, 1967-1971.

Year	Channel escapement			Sex ratio - F:M		Total egg Deposition	Total No. Fry	Percent Survival
	Grilse	Salmon	Total	Grilse	Salmon			
1967	222	3	225	55:45	100:0	289,450	152,838	53
1968	358	7	365	43:57	57:43	296,822	162,409	60
1969	433	3	436	67:33	34:66	489,022	332,728	70
1970	392	2	294	66:34	0:100	502,446	302,769	63
1971	470	9	479	68:32	56:44	627,500	311,871	50
1972	505	4	509	61:39	100:0	598,192	-	-

Fry Production and Distribution. Egg deposition, fry productions, and egg to fry survival rates are summarized in Table 1. It will be noted that the egg to fry survival rate decreased to 50% in 1971-72, somewhat below the previous four year average of 62%. It is believed that this was due to movement to the spawning gravel surface of coarser substrate, unsuitable for spawning, and that this resulted in irregularities in spawning distribution and thus an associated egg loss. This movement of the coarser substrate has been attributed to annual cleaning to remove accumulated silt and detritus prior to spawning. To offset this deterioration in gravel quality, additional suitably sized spawning gravel was placed in the channel in 1972.

The 300,000 fry produced in 1972 were distributed to the main river and to tributary rearing areas, release points being located at one-quarter mile intervals along the stream. Rearing areas otherwise inaccessible were by helicopter. The proposed stocking density was planned at 45 fry per 100 square yard unit of rearing area. However, bad flying weather forced the release of some fry destined for inaccessible areas into areas accessible by road with a resultant density in some cases of up to 100 fry per unit.

Standing Crop Assessments. In 1966 and 1967, electrofishing assessments were conducted in stream rearing areas which were to receive the first channel fry in 1968. These sections usually contained small populations of ouananiche and brook trout. Fig. 4 summarizes populations occurring before and after fry stocking with Noel Paul's Brook. Population levels of 0⁺ salmon appear to have increased in 1970 but apparently decreased in 1971 and 1972. There are indications that this decrease may have been due to irregularities in the performance of the electrofishing gear. Efficiency tests based on mark-recapture techniques indicate that the gear used in 1972 was fishing at only about one-third normal efficiency in various types of habitats. When the population levels are adjusted to compensate for this factor, they still tend to underestimate ultimate known smolt productions. Indeed, it appears that egg deposition in the channel has been a more reliable predictor of smolt production than has electrofishing.

Smolt Assessment. The second smolt run from the channel occurred in 1972 and was enumerated at the Lower Noel Paul's Counting Fence (Fig. 5). Heavy ice in the river had damaged the fence platform so that only a partial count was possible. The actual count was 2928 with 1632 of these being Carlin tagged. The estimated total smolt run was 6500 fish. Aging analysis of the run has not been completed but, based on age composition in 1971, there should be approximately 4500 spawning channel produced smolts in the run. In 1971, at least 4,000 of the 6,200 migrants were of channel origin. The size similarity of these two runs is consistent with the similarity in numbers of fry produced in these

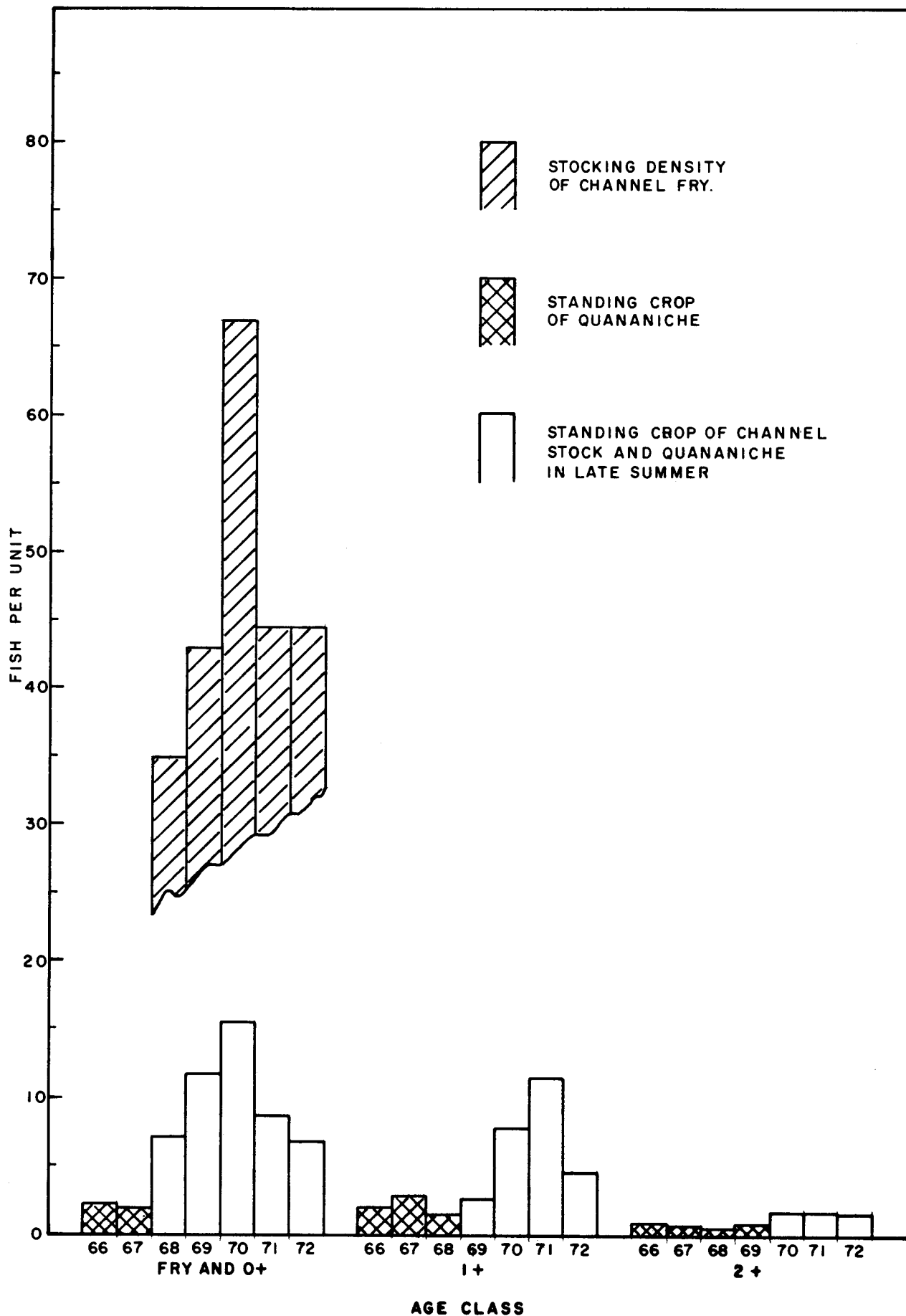


FIG.4 STANDING CROPS, 12 MILE STUDY AREA, NOEL PAUL'S BK.

two years of channel production (Table 1). Smolt run in 1973 should be double that of the first two years based on 1969 channel fry production. It is now evident that smolt production estimates based on parr standing crops as determined by electrofishing, tend to underestimate actual runs. This discrepancy may be partially attributed to standing water production of parr and smolt which is not included in present electrofishing assessments.

Although 1972 smolt data is not yet aged, the 3⁺ smolt production in 1971 and the 4⁺ smolt production of 1972, when related to the 1968 channel egg deposition, should yield an egg to smolt survival rate of 1.5 to 2.0 percent. This ranks above natural egg to smolt survival rates calculated for Maritime and Newfoundland waters of 1.0 to 1.4 percent.

Adult Returns. There were only two commercial fishery tag returns this year from the 2700 Carlin tagged Noel Paul's Brook fish emigrating in 1971. No tags were reported from the sports fishery or at any of our adult counting facilities. In 1971, there were two commercial returns from a release of 300 tags. This represents a nine fold difference in the rate of returns. It is suggested that the low complement of tags released accounts for the variation in rate of returns.

In 1973, a few returns are expected from the 1600 smolts tagged in 1972. If the rate of returns equals the 1971 rate, then valuable information on the utilization of this stock can be obtained. With the completion of the Grand Falls Collection Facility, 1973 will be the first year that untagged Noel Paul returns can be assessed provided that the pollution problems at this site do not become acute.

Proposed Activities in 1973. 1973 will see the continuance of escapement and exploitation monitoring on the Exploits. The Grand Falls collection facilities and fishway will be operated for the first time. Channel fry assessments and smolt enumeration will continue at Noel Paul's Brook. The rearing capacity of standing water areas of Noel Paul's Brook will also be investigated. The Bishop's Falls forebay release facility will also be operated and modifications assessed. Further potential sources of brood fish for stocking the Exploits watershed will be investigated. Major effort of the Exploits Program this year will be the assembling of a detailed plan for development and management of the watershed area below Red Indian Lake.

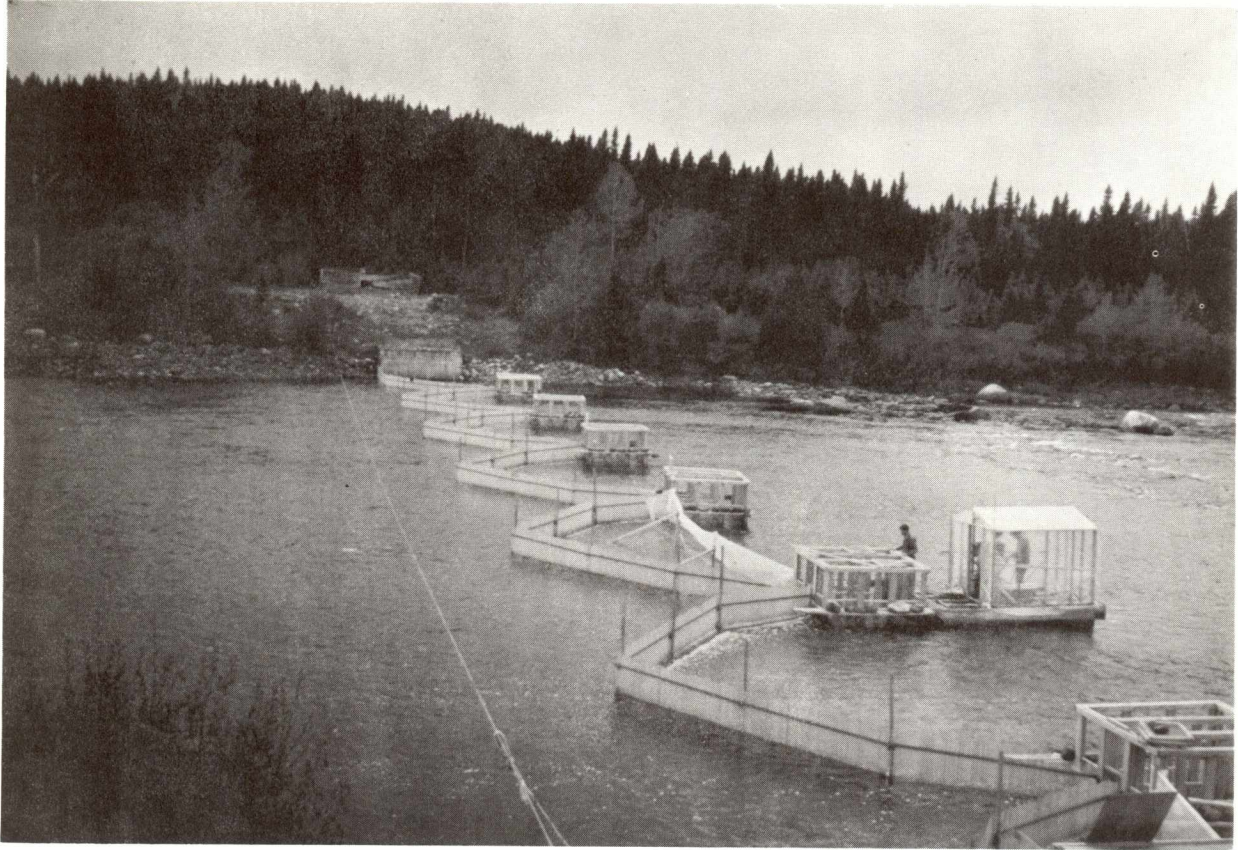


Fig. 5. Lower Noel Paul Counting Fence (photo).

OTHER DEVELOPMENT PROGRAMS

J.D. Pratt
Group Leader

The responsibilities of this Group also involve the development and management of rivers and streams for anadromous fish resources within Newfoundland and Labrador. Assessment of existing stocks and implementation of biological techniques for improving those stocks or promoting new ones are the prime activities. Group personnel frequently use adult transfers, spawning channels, and fishways to maintain or enhance searun salmonid populations. Another priority is the tagging of Atlantic salmon in Labrador as part of Canada's effort to assess the effects of the Greenland salmon fishery on home stocks.

Fishways and Stream Clearance. The activities of this unit include the planning and implementation of development and management programs for salmonids in insular Newfoundland, conduct of an Island stream inventory, compilation of an up-to-date stream catalogue, operation of existing fishways, and investigation of fish migration problems related to stream clearance and fish-pass facilities.

Fishway Counting Traps. In 1972, counts were obtained at 9 fishways, an increase of two over 1971. Counting was resumed at Middle Brook after 13 years and a permanent trap was installed in the fishway at Northeast River, Placentia.

Figure 6 summarizes counting trap results from 1963 for Indian River, Rattling Brook, Bishop's Falls, Upper and Lower Terra Nova and Torrent River Fishway. Figure 6 also summarizes counts at Middle Brook Fishway and Salmon Brook Fishway from 1956. In general, the numbers of fish counted decreased in 1972. However, Upper and Lower Terra Nova River counts showed a slight upward trend over 1971. Figure 7 is a view of the Upper Terra Nova River fishway.

The Torrent River count increased slightly with 60 fish passing through in 1972 compared to the 1971 count of 55 fish. Expected increased returns from the 1966 escapement through the fishway did not materialize and it has become obvious that an adult stocking program will be required to enhance utilization of the Upper Torrent watershed. In 1972, 56 fish were successfully transferred and distributed above the Torrent River Fishway. The program will be continued in 1973.

During 1972, it was planned to redistribute 60 Limond River salmon above the fishway. Data from several years of monitoring indicated few fish passed through the fishway. A counting trap was operated in 1972 and showed encouraging results with 42 salmon passing through the fishway. As a result, the transfer was not undertaken.

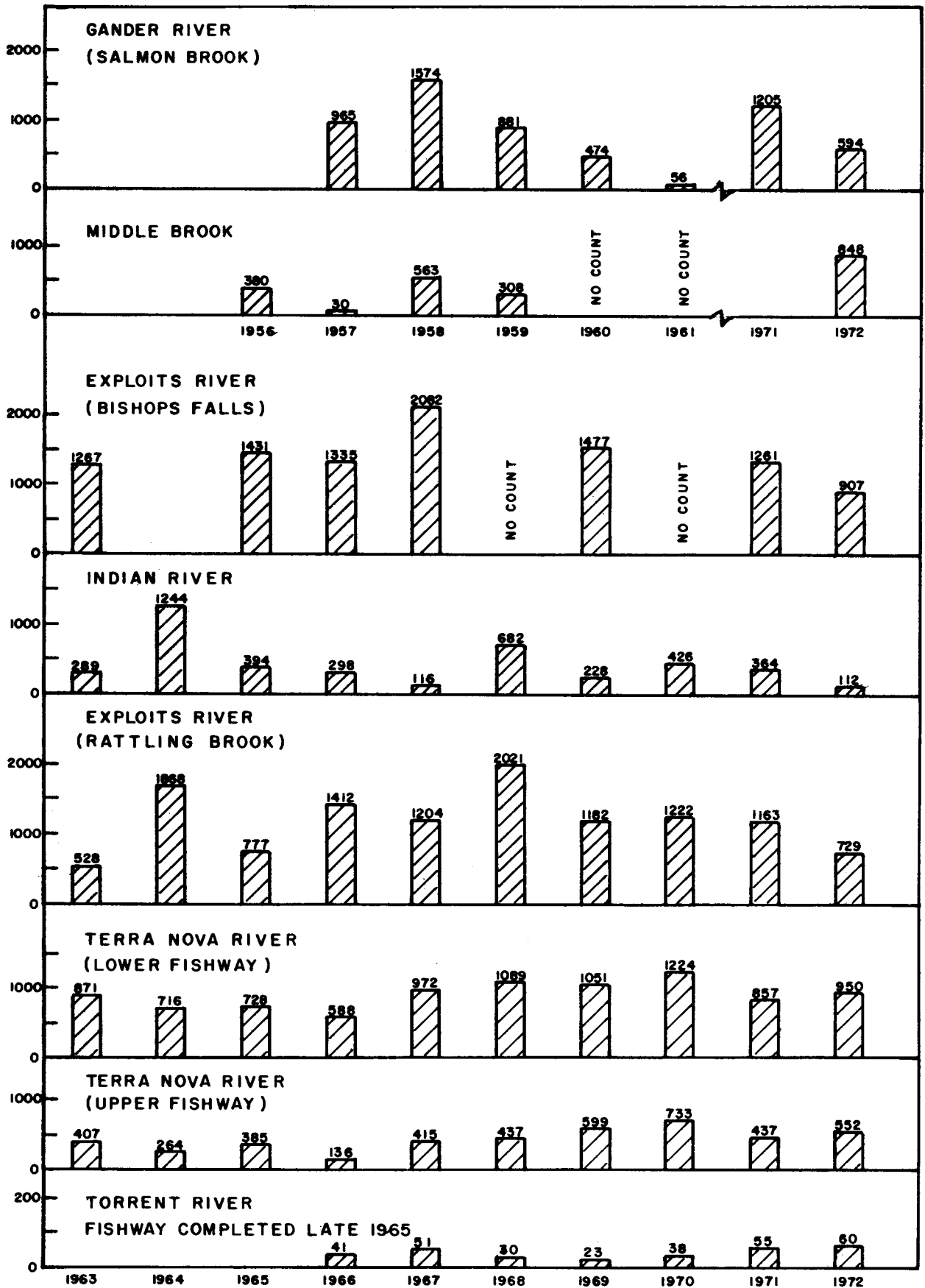


FIG.6 FISHWAY COUNTING TRAP DATA, SELECTED RIVERS, 1963-1972 AND 1956-1972.



Fig. 7. Upper Terra Nova river fishway.

If fishway passage of adults is low in 1973, movement of adults above the fishway will be reconsidered in order to establish a permanent run in the upper watershed as soon as possible.

A permanent counting trap was installed in the fishway at Northeast River, Placentia, in 1972 and 270 salmon were counted through during the season. A temporary trap was installed in 1968 which counted 68 fish during two weeks of operation before it washed out. A counting fence installed several miles downstream in 1971 counted 180 salmon. Monitoring of the salmon run will continue at Northeast River, and all fishways in 1973 to maintain an index of the runs.

Torrent River Development Program. Despite the completion of the Torrent River Fishway in 1965, the Atlantic Salmon population above the fishway has remained below 60 fish. In 1971, it was decided to transfer adult salmon into the upper watershed from a suitable source.

Following the 1971 assessment program, West River, St. Barbe was selected as the donor stream. The proposed program was designed to attain a total production goal of 1800 fish within the fisheries and escapement.

A portable metal counting fence was operated on West River in 1972 to monitor smolt and adult salmon runs and to collect adults for transfer to Torrent River. 11,906 smolts were counted through the fence in 1972 compared to 5,767 smolts in 1971. During the smolt run, 210 kelts were counted downstream.

Table II. Summary of salmon counts, West River 1971 and 1972.

Year	Grilse	Salmon	Total Fish	Total Angled	No. Trans.	Spawn Escap.
1971	427	305	732	205	-	590
1972	309	9	318	104	60	203

Table II summarizes the adult counts for West River during 1971 and 1972. Collection and holding of salmon for transfer to Torrent River began in early July. Plans called for holding 100-150 adult fish before beginning the transfer. However, several mortalities attributed to holding, forced cancellation of these plans and each day's catch was transferred immediately using a tank truck to Torrent River. They were then distributed to remote points in the watershed using a helicopter. Because of the low run at West River, only 60 fish (39 female) were transferred.

The stocking program of adult salmon from West River to Torrent River will be continued in 1973. From the 1971-72 smolt to river escapement survival rate of 7.2%, it is expected that approximately 850 fish will return to West River in 1973. If a run of this magnitude materializes, then approximately two hundred adults will be transferred to Torrent River.

Stream Inventory and Stream Clearance. An extensive stream inventory of the entire Gander River watershed was completed in 1972. This watershed is approximately 98% accessible to anadromous fish. No obstructions to migration exist on the main river except in one of the tributaries, Dead Wolf Brook. There are approximately 190,000 units of rearing area (1 unit = 100 yds.²) presently available on the system with an additional 5000 above the complete obstruction on Dead Wolf Brook.

Sixteen minor obstructions to upstream migration in various streams of the island were removed in 1972. Previous delays of adult salmon at these locations resulted in serious fish protection problems. The stream clearance program will continue in 1973, and remedial work carried out in 1971 and 1972 will be evaluated to measure the success of fish passage.

Stream Catalogue. A major updating of the stream catalogue commenced in late 1972 and is scheduled for completion in early 1973. This updated document will be invaluable as a source of information on all rivers throughout the island.

Indian River Project

H.J. Rietveld
A.P. Cowan

Indian River, which flows into Hall's Bay (Fig. 8), is the site of a controlled flow spawning channel, built to compensate for the loss of spawning area due to a diversion of the headwaters for hydroelectric purposes and to act as a prototype to explore the feasibility of using channels as an aid to Atlantic salmon management in Newfoundland. During the first eight years of operation, emphasis of the project was on operating within the existing accessible watershed area using natural escapements to supply the channel with adults and so maintain the existing run to the river. During 1971, steps were taken to broaden the scope of the project by also attempting to increase the production of salmon from Indian River. Planned expansion of the stocking program to the Black Brook tributary is expected to double the smolt production of the system by 1980.

Kelt tagging, commercial fishery sampling, and detailed stream surveys have increased the knowledge of stock utilization and stream production potentials. First application of this information occurred in 1972, when a restriction was placed on sports fishing at

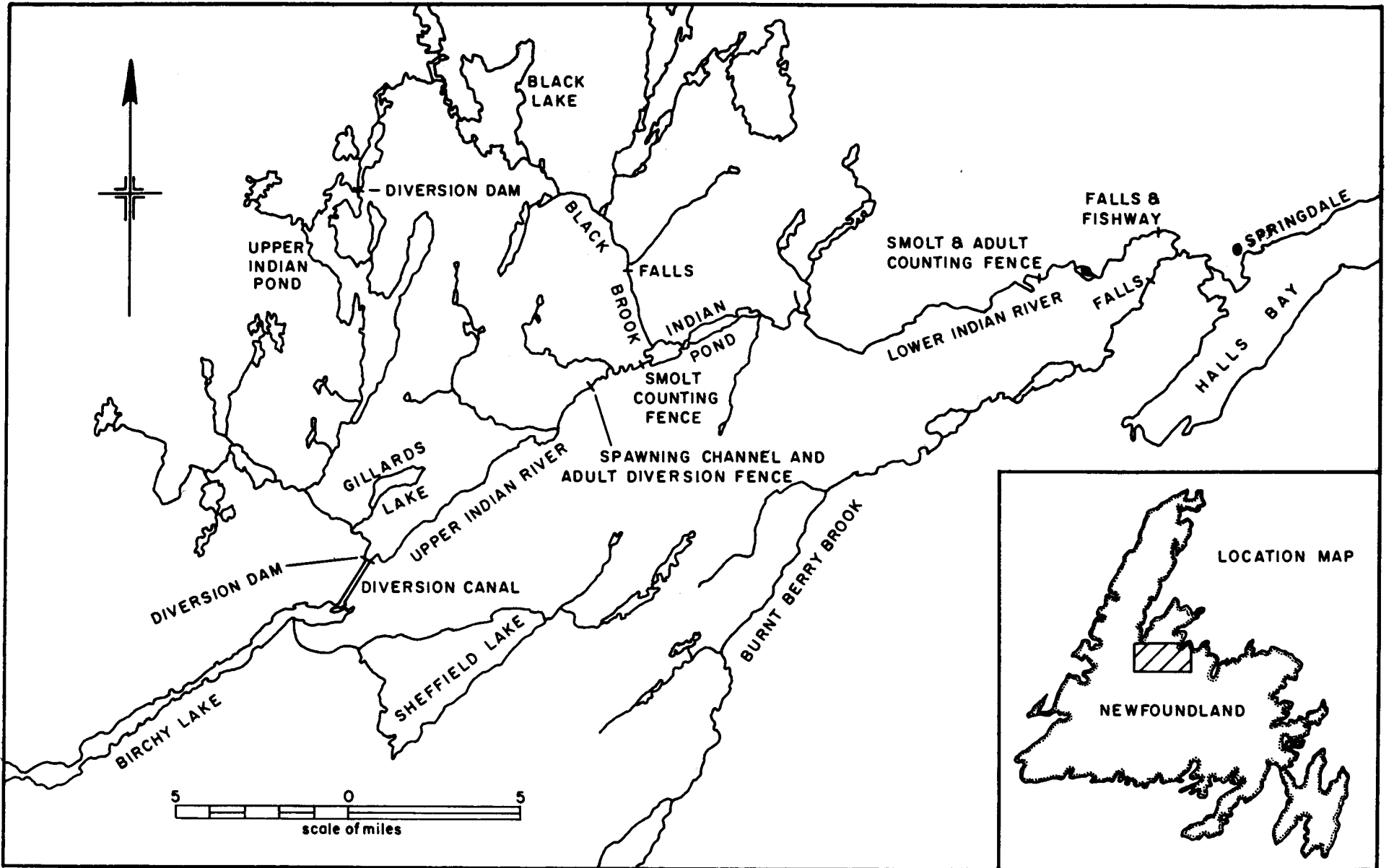


Fig. 8 Map of Indian River and its drainage area.

Indian Falls. The full effects of this restriction should be evident in 1973.

Channel Fry Assessments. In 1971, a channel escapement of 342 adults (258 females, 84 males) deposited an estimated 457,000 eggs. These eggs were expected to produce 275,000 fry for an egg to fry survival rate of 60%. However, abnormally low temperatures for an extended period of time during February and March, 1972, coupled with light snow cover, resulted in reductions in water flow and freezing of the channel gravel beds. As a result, total fry production was 56,000 and egg to fry survival only 12%. These fry were stocked below Indian Pond in areas where natural spawning was very light or non-existent.

Smolt Assessments. A record high smolt run of 13,481 fish was counted through the fence in 1972. This run was the result of the 1968 adult escapement of 693 fish, less than half of which spawned in the channel. From natural egg to fry survivals estimated for Indian River, and from known channel egg to fry survivals, it is estimated that channel produced stock made up 75% of the 1969 0+ class. On the assumption that there was no differential mortality between channel and natural progeny, this would mean that 75% of the 1972 smolts were produced from the channel. Further evidence of the contribution of the channel over the last five years is indicated by a positive correlation over the past five years between egg to smolt survival rate and the percentage of the escapement spawning in the channel.

Adult Assessments. Low water levels, partly attributable to the diversion of the headwaters, and high summer temperatures, contributed to a record low adult run in 1972. At the start of spawning, 100 fish had been angled, leaving an escapement of 102 fish, eighty percent of which spawned in the channel. This resulted in an estimated channel deposition of 102,600 eggs and should produce 60,000 - 70,000 fry in 1973.

Management Expansion. It became apparent in 1972 that any stock expansion program at Indian River would be contingent upon the availability of brood fish. An anticipated production of 300,000 fry did not materialize in 1972 because of freezing of the channel beds. During the summer, low water levels at Indian Falls delayed upstream migration to the extent that 50% of the escapement was angled as compared to an average of 35% angled in previous years.

Planned first stocking of Black Brook with channel fry was postponed because of a lack of fry in 1972. It is unlikely, because of the low adult escapement of 1972, that sufficient fry will be available for this stocking in 1973. It is anticipated however that Black Brook fry stocking will be possible in 1974 as a result of the expected run of 500-600 adults in 1973.

To avoid possible future stock deficiencies, certain steps have been taken to remedy the shortage of spawning adults at Indian River. An extension of the sports fishing boundary at Indian Falls in 1972 is expected to reduce the angling pressure on upstream migrating adults. Analyses are underway to determine whether changed regulation of the commercial fishery in Hall's Bay would help ensure sufficient spawning escapement for the management program. Discussions are also being held with Bowaters Power Company with a view to increasing the amount of water available in times of drought through the headwater diversion. All of these measures are expected to increase adult escapement and help ensure the success of further expansion of the present program.

Proposals for 1973. Egg to fry survival experiments will continue. Commercial and sports fishery monitoring will be continued in Hall's Bay and at Indian River, South Brook, and West Brook. As indicated, planned stocking of Black Brook has had to be postponed, but will now commence in 1974.

Labrador Management and Development

G.M. Hare
R.F. Peet
H.P. Murphy

Tagging of Atlantic salmon and stream reconnaissance surveys were continued in Labrador during 1972. The objectives of this program are to assess the impact of the West Greenland fishery on Labrador stocks of Atlantic salmon and to provide basic information on Labrador rivers for future development and management.

Smolts and adults have been tagged and enumerated at a counting fence (Fig. 10) operated on the Sand Hill River (Fig. 9), in southeastern coastal Labrador, since 1969. This river was chosen as the project site after evaluation of reconnaissance surveys of several rivers along coastal Labrador during 1966 and 1967. Based upon physical and ecological features, the Sand Hill is considered typical of most Labrador rivers.

Tag-recapture Studies. Compilation of total tag-recapture data (Table 3), for salmon produced by the Sand Hill, shows that (1) at least 47% of the population is composed of 2 sea-year virgin fish; (2) 95% of the potential or actual 2 sea-year fish are taken by the West Greenland and home-water commercial fisheries; (3) 35% of the grilse are taken by home-water commercial fisheries; (4) 7% of the recovered kelts enter the Greenland and home-water commercial fisheries.

The division of catches between 1⁺ sea-year salmon in West Greenland and 2 sea-year fish in homewater commercial fisheries varies. Assuming that all tag recaptures have been reported, catches within the



Fig. 9. The Sand Hill River counting-fence.

Table III. A summary of tag-recapture data for the Sand Hill River (1969-1972). Returns compiled to January 12, 1972.

Year	Tag type and series	Stage and no. released	Recaptures = Sea Years (Locality)						
			1 (Home) River/Comm. Fish.		1 ⁺ (Greenland)	2 (Home) River/Comm. Fish.		2 ⁺ (Greenland)	3 (Home) River/Comm. Fish.
1969	Green Carlin (L800-14643) (L14700-14915)	Smolt (6726)	32	15	4	4	34	2*	2
	Blue Atkins (L500-	Adult (399)		12	3	1	2		
1970	Green Carlin (L14644-14699) (L14916-22999)	Smolt (7974)	74	35	44	2	44	2	
	Blue Atkins (L165-199) (L902-1399)	Adult (516)		18	16	2	11	1	
1971	Green Carlin (L23000-33699)	Smolt (10342)	16	15	4				
	Blue Atkins (L1400-1799)	Adult (391)		5	4				
1972	Green Carlin (L34200-44199)	Smolt (8000)							
	Green Carlin (L33700-34060)	Adult (360)							

*One of these fish was counted through the Sand Hill fence in 1970

Greenland fishery accounted for 11% of the potential 2 sea-year salmon from the 1969 smolt tagging and for 42% from the 1970 tagging. The high exploitation (44 tag returns during autumn, 1971) of salmon in the Greenland fishery coincided with a record catch (47 tag returns) of 2 sea-year fish in the home-water commercial fisheries during 1972. However, tag returns from grilse in the home-water fisheries decreased by 52% from 1971. This reduction may be attributed to a poor survival at sea. The paucity of returns at the Sand Hill fence (16) and from Greenland (4 - to January 19, 1973) suggests a poor survival of the 1971 smolt class; a contrast to the apparently high survival of the 1970 smolts.

Tag recoveries (Fig. 11) from West Greenland are distributed from Cape Farewell in the south to Disco Bay in the north. The proportion of tag returns from the drift or set gillnet fisheries is unknown. Within home-water commercial fisheries, grilse returns are distributed from White Bay in eastern Newfoundland to Sandwich Bay, Labrador; and 2 sea-year salmon recoveries are distributed from Trinity Bay in eastern Newfoundland north to Cape Makkovik, Labrador (Fig. 12). In 1971, 13 of the 47 recoveries from 2 sea-year salmon were recorded along the east coast of Newfoundland. Considering the Maritime component in home-water catches, salmon of Labrador origin may make a substantial contribution to eastern Newfoundland commercial fisheries.

Enumeration. The 1972 enumeration at the Sand Hill counting fence showed considerable declines in smolt and adult counts from the two previous years (Table 4). Compared to 1971, smolt production declined by 15,600 fish (28%), while adult returns were reduced by 1708 fish (46%). Reasons for the decline in smolt production are unknown. The reduction (47%) in grilse returns is attributed to a poor survival of the 1971 smolt class, and the decline (37%) in returning 2 sea-year salmon presumably resulted from the heavy exploitation of the 1970 smolt class in the Greenland and homewater commercial fisheries.

Spawning Escapement. Tag recaptures (Table 3) in 1970 and 1971 showed that two-thirds of the grilse returned to the Sand Hill River with the remainder taken in home-water commercial fisheries. However, in 1972, records showed that only one-half of the grilse returned to the river with the home-water fishery harvesting a higher proportion. Also in 1972, tagging studies showed that only 2% of the 2 sea-year salmon returned to the river, a reduction from the 10% return in 1971.

As previous studies of the Sand Hill sport and commercial fisheries show that female fish comprise approximately 15% of the grilse and 80% of the 2 sea-year salmon entering the Sand Hill, this means that only 282 grilse and 135 salmon were available for a potential deposition of approximately 1,740,000 eggs in 623 square miles of river drainage. This is a considerable decline from a potential deposition of 2,978,000

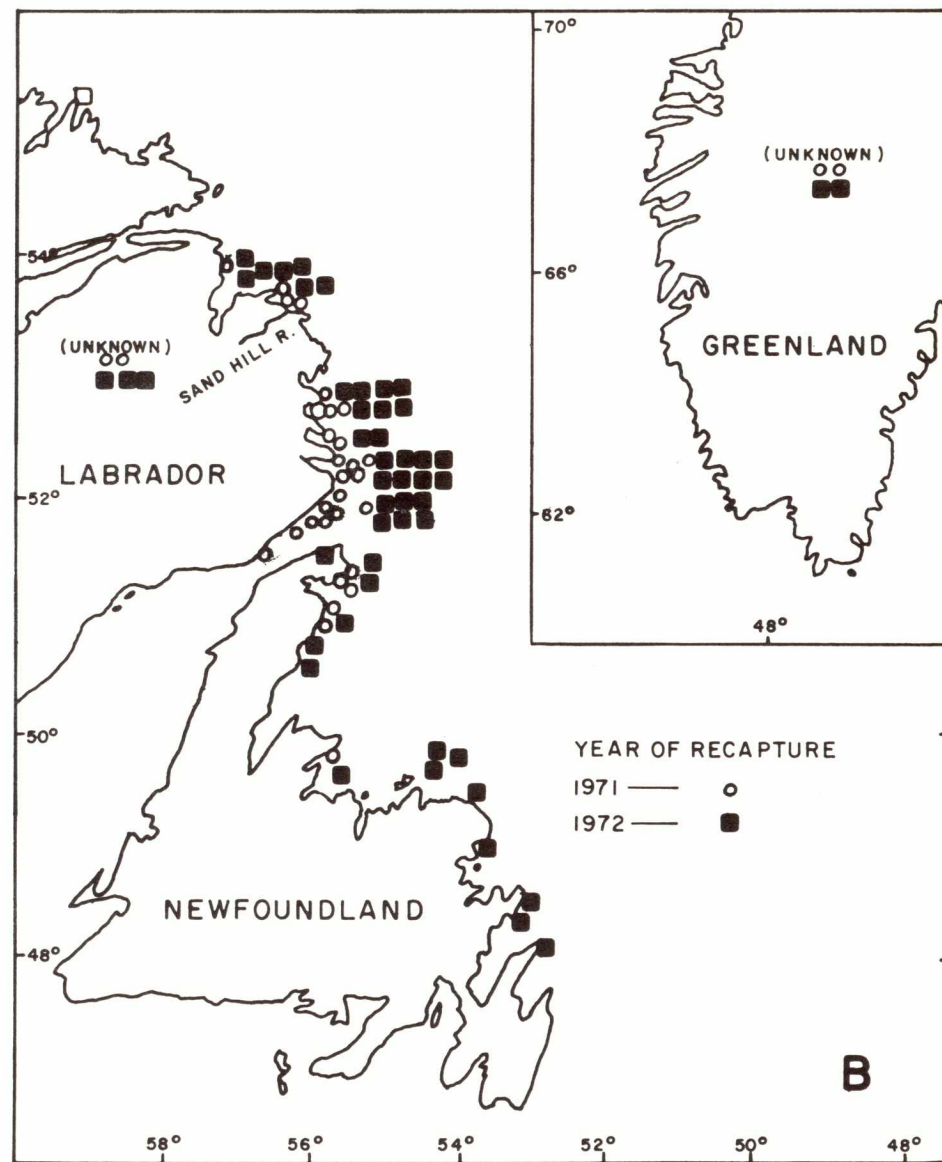
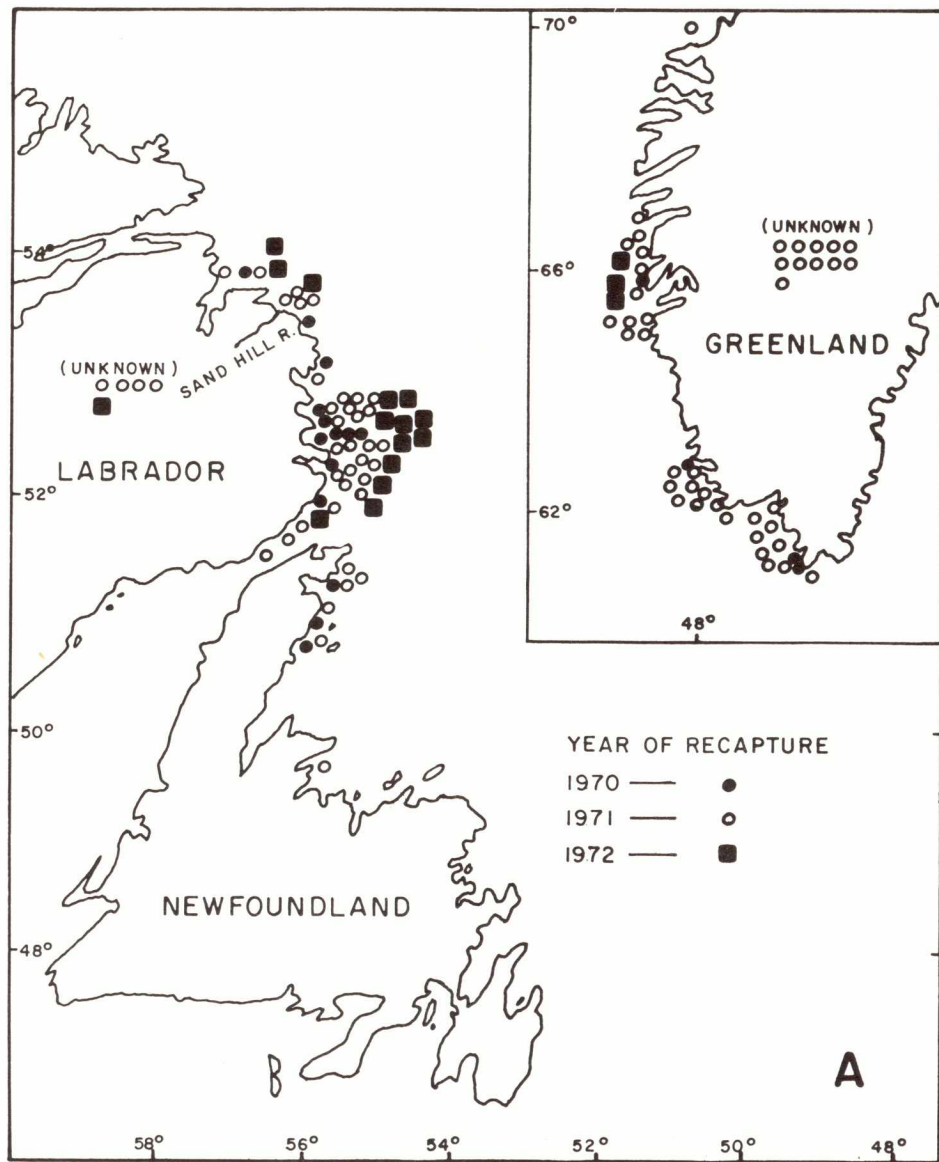


Fig.10 Distribution of tag recoveries from smolts tagged at the Sand Hill River counting-fence: (A), 1 and 1+ sea-year salmon; (B), 2, 2+ and 3 sea-year salmon. (Greenland recoveries are 1+ and 2+ sea-year fish.)

Table IV. A Summary of Atlantic salmon counts at the Sand Hill River counting fence, 1969-1972.

Year	Period of Count	Smolts	Adults		Total
			Grilse	Salmon	
1969	June 18-Aug. 28 (103 days)	8690*	897*	45*	942*
1970	June 8-Oct. 16 (131 days)	50494	3560	199	3759
1971	June 13-Oct. 3 (113 days)	52607	3487	267	3754
1972	June 22-Sept. 11 (82 days)	37007	1877	169	2046

*Partial Counts

eggs in 1971 and 2,063,000 eggs in 1970. Considering the grilse to salmon ratio, the fecundity, and the sex ratio of salmon entering the Sand Hill, the egg deposition of one 2 sea-year salmon approximates that of eleven grilse. If the high exploitation on 2 sea-year fish is maintained, a drastic reduction in the spawning escapement and depletion of the Sand Hill River salmon population can be expected.

Aerial Reconnaissance Surveys

During 1972, 18 coastal rivers from Lake Melville north to Hopedale were surveyed. Information was documented on spawning and rearing potential, accessibility to anadromous fish, and physical parameters of each stream. This completes basic inventory of 45 rivers which includes all major watersheds from the Gilbert River in southern Labrador to the Canairiktok River in the north (Fig.10).

1973 Operations

In 1973, smolt and adult tagging operations on the Sand Hill River will continue, and stream inventory will be extended northward to include other major Labrador watersheds. Tag-recapture data will be collected to monitor the West Greenland fishery and to verify or refute conclusions herein. Tentative plans include enumeration and sampling adult returns to determine potential egg depositions; electrofishing surveys to determine survival estimates; a biological study of the Sand Hill River smolts; and an assessment of various stream obstructions in cooperation with Engineering Services.

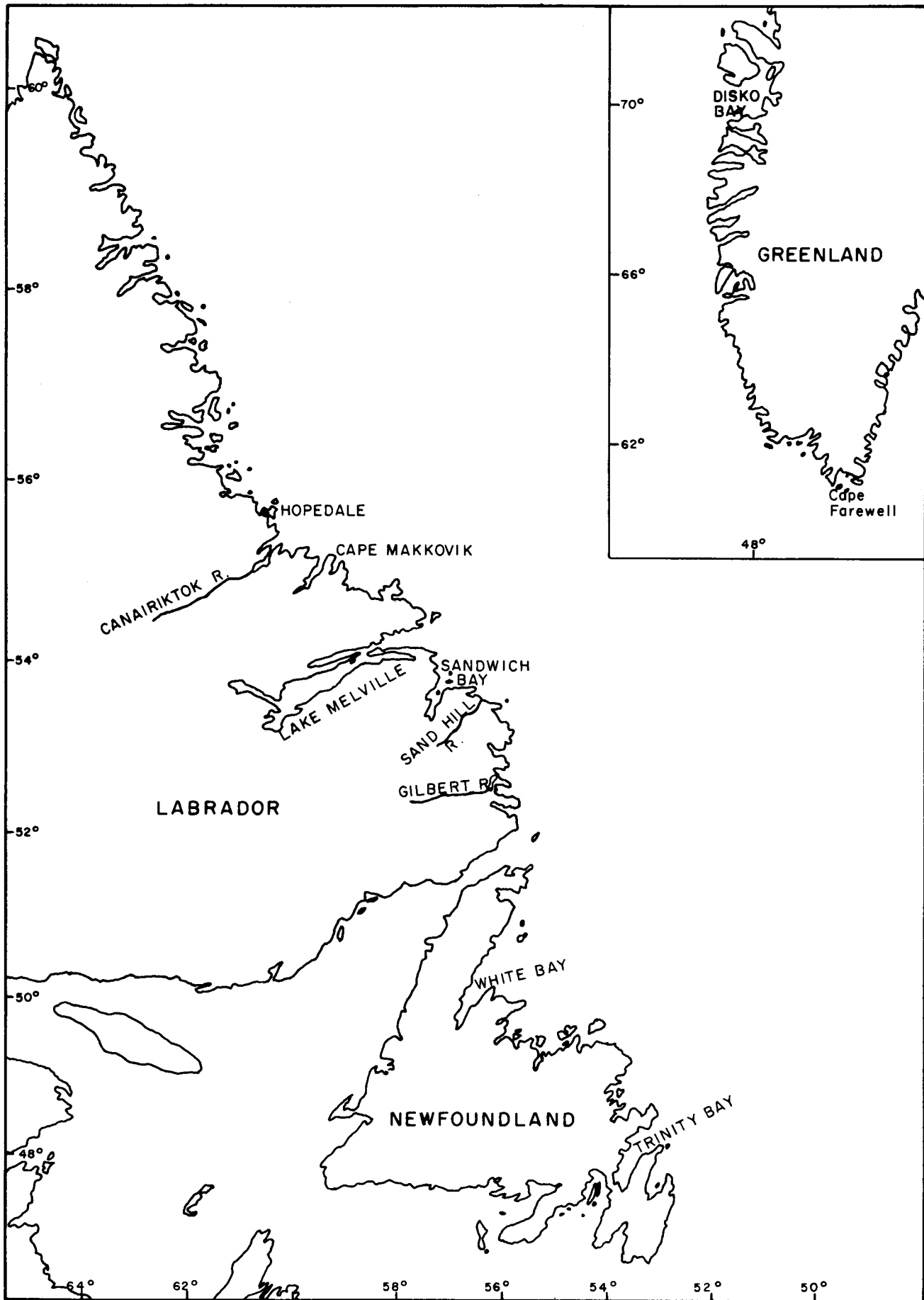


FIG. II LOCATIONS CITED IN THE TEXT

R E C R E A T I O N A L F I S H E R I E S G R O U P

RECREATIONAL FISHERIES GROUP

R.J. Wiseman,
Group Leader.

The Recreational Fisheries Group is responsible for inland sport fishery management and investigation in the Province of Newfoundland and Labrador. The Group's responsibility areas include:

Conducting scientific investigations into recreational fisheries.

Formulating recommendations for management, including protective regulations and other conservation measures.

Managing fish populations of standing waters, including impoundments.

Developing programs to enhance recreational fisheries and fishing.

Conducting limnological and resource inventories.

The major activities of the Group during 1972 included:

- (a) The problem of heavy exploitation of the sport fish resource in lakes near the Metropolitan area of St. John's, particularly lakes near the Trans Canada Highway.
- (b) Investigation and management of sport fish stocks in hydro-electric reservoirs.
- (c) Conduct of resource inventories and limnological descriptions of some of the major lakes in Insular Newfoundland.

METRO-AREA SPORT FISHERY INVESTIGATION AND MANAGEMENT

R.J. Wiseman
W.G. Whelan

The activities of this Unit are part of an on-going study set up to evaluate the status of the recreational fishery in heavily-fished lakes near the Metropolitan area of St. John's. The main objective of this study is to evaluate the sport fish harvest in relation to the existing resource and fishing pressure, and to implement

management techniques will enable the Department to maintain at existing levels, or to increase, stocks of resident sport fish. Study sub-objectives are (1) to inventory the existing resource, (2) to substantially increase growth and survival rates of sport fish by forage fish introductions, and (3) to distribute angling pressure and generate new fisheries through the construction of lake access developments.

Evaluation and management of the sport fishery conducted near an urban area continued during 1972 with intensive activity at Paddy's Pond and Thomas' Pond located near the Metropolitan area of St John's. During 1972, intensive management of these two lakes continued in the form of a forage fish introduction and evaluation program. In addition, the sport fish population monitoring program initiated at Paddy's Pond during 1969 was continued in 1972. The 1972 field season also saw surveys carried out at Five Mile Pond West, Grand Pond, Colliers Big Pond, Nine Island Pond, and Goose Pond as part of a limnological and resource inventory for the Avalon Peninsula designed to estimate the potential of these lakes for future sport fishery development. Considerable activity was also expended during the year in investigation of the potential of the landlocked smelt as a forage species for sport fish. This investigation centered around the smelt population in Nine Island Pond South, near Avondale.

Paddy's Pond Sport Fish Population Monitoring

This activity consisted of monitoring changes in the sport fish populations of Paddy's Pond, one of the heaviest fished lakes in Insular Newfoundland. The monitoring is made possible by the conduct of population estimate experiments. These twice-yearly experiments (Spring and Fall) are part of an on-going project begun in 1969.

Estimates of the standing population of brook trout, ouananiche (landlocked salmon), and brown trout were made during 1972. The Spring estimate was made during the period May 10-June 2, while the Fall estimate was made from September 25-October 13.

The Spring estimates indicated the population levels for all three species were comparable to those of the previous year despite the extremely high angler harvest during the 1971 season. Fall estimates indicated that above average numbers of spawners remained following season closure, perhaps the result of a relatively low harvest rate during the 1972 season. It is interesting to note that the stocks of Paddy's Pond fish have shown a general increase since monitoring was initiated during 1969.

Forage Fish Introduction and Evaluation

In an attempt to improve growth and survival rates of sport

fishes in Thomas' and Paddy's Ponds, a program of forage fish introduction was begun during 1971 with the release of approximately 22,000 three-spine sticklebacks, (Gasterosteus aculeatus) into Paddy's Pond and 9,500 into Thomas' Pond.

The stickleback introduction program was expanded significantly during 1972 when approximately 93,000 were stocked in Paddy's Pond and some 42,500 were released in Thomas' Pond. Evaluation of the contribution the forage species was making to the diet of the sport species was conducted by monitoring the food habits of brook trout, ouananiche, and brown trout in the two lakes over the open-water season. The results of the monitoring program are shown in Tables 5 and 6.

During the period May to September, sticklebacks were appearing frequently in the diet of both brook trout and ouananiche at Paddy's Pond.

Over the five month period under consideration, approximately 14 percent of the brook trout and 9 percent of the ouananiche which were sampled and had food in their stomachs, contained sticklebacks. None of the brown trout sampled were feeding on sticklebacks. The predation rate by Paddy's Pond sport species may have been so high, in fact, that further plantings may be necessary in 1973.

An additional aspect of the evaluation of the stocking program at Paddy's Pond is the yearly monitoring of the sport fish population structure. Table 7 shows the yearly estimates of the number of brook trout and ouananiche, nine inches or greater in length, present in Paddy's Pond over the period 1969-1972.

The marked increase in the number of "large" fish of both species present during 1971 and 1972 is readily noticeable. It is interesting to remember that stickleback introductions were undertaken during both of these years. At the present time, it is impossible to state with confidence that increased growth and survival rates, the result of foraging on sticklebacks, have been the cause of increases in the stocks of "large" sport fish as no age determination has been carried out. It is planned, however, to incorporate age determination into the 1973 monitoring program and at that time it will be possible to state emphatically whether increased stocks are due to the forage species or to natural fluctuations in the sport fish stocks.

A review of the data presented in Table 6 suggests that the "good luck" experienced with the introductions at Paddy's Pond does not appear to have occurred with the Thomas Pond management experiment. To date, sticklebacks have not been found to occur in the diet of sport fish in this lake. The adverse effects of the lake's limnology (low pH, highly colored water, low mineral content) combined with a summer drawdown of as much as 12 feet are blamed for the apparent failure of the experiment to date.

Table V. The food habits of Paddy's Pond brook trout, ouananiche, and brown trout expressed as frequency of occurrence (based on examination of fish collected monthly during the period May - September, 1972).

	Month	Sample Size	Length Range (cm.)	Empty	Invertebrates	Invertebrates & Sticklebacks	Sticklebacks
Brook trout	May	10	20.0-23.0	4	6	-	-
	June	10	20.5-23.9	-	9	1	1
	July	10	20.1-23.8	-	9	1	-
	August	10	20.2-23.0	2	6	1	1
	Sept.	10	20.2-26.9	7	2	-	1
	Total	50	20.0-26.9	13	32	3	3
Ouananiche	May	10	21.4-25.2	1	9	-	-
	June	10	20.5-23.2	5	5	-	-
	July	10	20.3-24.5	-	9	1	-
	August	10	20.5-25.2	6	3	-	1
	Sept.	10	23.7-26.4	4	5	1	-
	Total	50	20.3-26.4	16	31	2	1
Brown trout	June	9	21.9-28.2	1	8	-	-
	July	10	26.0-30.2	1	9	-	-
	August	10	22.4-31.6	4	6	-	-
	Sept.	10	27.4-33.8	7	1	-	-
	Total	39	21.9-33.8	13	24	-	-

Table VI. The food habits of Thomas' Pond brook trout, ouananiche, and brown trout expressed as frequency of occurrence (based on examination of fish collected monthly during the period May - September, 1972).

Species	Month	Sample Size	Length Range	Empty	Invertebrates	Invertebrates & Sticklebacks	Sticklebacks
Brook trout	May	10	20.4-25.7	1	9	-	-
	June	10	22.6-25.6	4	6	-	-
	July	10	22.5-25.6	4	6	-	-
	August	10	20.6-24.5	5	5	-	-
	September	10	22.4-26.2	5	5	-	-
	Total	50	20.4-26.2	19	31	-	-
Ouananiche	May	10	20.5-25.0	2	8	-	-
	June	10	21.1-26.7	4	6	-	-
	July	10	20.0-24.4	7	3	-	-
	August	10	20.0-25.8	9	1	-	-
	September	10	21.0-25.5	7	3	-	-
	Total	50	20.0-26.7	29	21	-	-
Brown trout	July	3	24.0-26.2	3	-	-	-
	August	1	29.9	-	1	-	-
	September	1	24.0	1	-	-	-
	Total	5	24.0-29.9	4	1	-	-

Table VII. Estimates of the total number of brook trout and ouananiche, with a fork length of nine inches or greater, in Paddy's Pond during the Falls of 1969, 1970, 1971, and 1972.

Species	Year			
	1969	1970	1971	1972
Brook trout	556	436	561	709
Ouananiche	1457	1293	2776	3048
Total	2013	1729	3337	3757

An additional aspect of forage fish studies was initiated during 1972 when a start was made on the investigation of the potential of the landlocked American smelt, Osmerus mordax, as a forage species for resident salmonid sport species. The population at Nine Island Pond South, near Avondale, was chosen for study this year and such aspects of smelt biology as growth rate, survival and mortality rate, age structure, food habits, reproductive success, exploitation rate, habitat utilization, and interspecific competition are under investigation. It is planned to extend this study to other populations during 1973.

Inventory of Avalon Peninsula Lakes and their Sport Fish Populations

As part of an on-going inventory study of Avalon Peninsula lakes with respect to their present sport fish populations and their potential for future development, five lakes were surveyed during 1972. The lakes investigated include Nine Island Pond, Goose Pond, Grand Pond, Colliers Big Pond, and Five Mile Pond West. Limnological and sport fish population data were obtained from each lake, and by combining morphometric and water chemistry data we arrive at a method of predicting potential fish yield. The potential fish yield data for 21 Avalon Peninsula lakes are presented in Table 8. Of the lakes investigated to date, potential annual yield generally ranges from approximately 2 to 4 pounds per acre per year, with an average of about 3. Therefore, given reasonable estimates of the total biomass of fish produced in each of a number of lakes per year, it becomes possible to set annual creel limits in terms of weight, for either individual lakes or a number of lakes in a geographic area.

Proposed Development of Boat Access

During the course of the recent "overfishing study" conducted on several lakes near the St. John's Metropolitan area it became obvious that a major contributor to this situation in recent years is the boat

Table VIII. Morphometric, edaphic, and potential fish production (yield) data for selected Avalon Peninsula lakes.

Lake	Mean depth (ft.)	T.D.S.	T.D.S. Mean depth	Potential Yield (lb/acre/yr.)	Lake Area (acres)	Potential Yield (lb/yr.)
Petty Hr. Long Pd.	21.3	33.8	1.59	2.52	428	1,079
Thomas Pond	13.3	27.0	2.03	2.85	255	727
Paddy's Pond	10.4	28.2	2.71	3.29	526	1,731
Gull Pond	14.0	38.8	2.77	3.33	140	466
Loon and Little Soldiers Pond	14.2	26.0	1.83	2.71	167	453
Soldiers Pond	8.8	22.6	2.57	3.21	334	1,072
Finnies Pond	12.5	23.7	1.90	2.76	384	1,060
Five Mile Pond West	7.6	26.4	3.47	3.73	213	795
Big Triangle Pond	9.1	32.7	3.59	3.79	119	451
Southern Peak Pond	13.6	32.4	2.38	3.09	193	596
Southwest Pond	14.8	31.6	2.14	2.93	353	1,034
Harbour Main Pond	10.8	30.8	2.85	3.38	500	1,688
Nine Island Pond South	11.1	29.1	2.62	3.24	203	658
Middle Gull Pond	33.8	25.2	0.75	1.73	757	1,310
Grand Pond	12.7	33.7	2.65	3.26	450	1,467
Snows Pond	9.9	27.5	2.78	3.33	1,251	4,166
Colliers Big Pond	8.5	37.0	4.35	4.17	157	655
Nine Island Pond	20.2	31.3	1.55	2.49	401	998
Goose Pond	9.6	35.2	3.67	3.83	318	1,218
Ocean Pond	15.0	31.6	2.04	2.86	815	2,331
Dildo Pond	32.7	29.1	0.89	1.87	970	1,814
Hogans Pond	16.0	37.3	2.32	3.05	147	448
Mean		30.5	2.43	3.07		

fisherman. With increased affluence and recreational opportunities many sport fishermen are switching their attention from shore fishing to boat fishing. This transition becomes all the more attractive in view of the fact that the boat fisherman is generally two to three times more efficient, in terms of yield, than the shore fisherman.

As a solution to this problem the Department proposed the development of boat access to lakes of significant size, near major highways, and close to metropolitan centres, which possess under-utilized, harvestable-size sport fish stocks. This development is expected to accomplish the following objectives:

- (1) Relieve pressure from heavily fished lakes by distributing the fishing effort.
- (2) Give the shore fisherman an opportunity to take a larger share of the sustainable sport fish harvest under conditions of reduced competition from the boat fisherman.
- (3) Encourage exploitation of sport fish populations which at present are underutilized.
- (4) Contribute to other aquatic recreational activities in addition to sport fishing, in the newly accessible areas.

Biological and engineering surveys were completed during 1972 and a number of sites near the St. John's Metropolitan area have been proposed for such development. It had been planned to commence this development during 1972 however unforeseen technicalities and legalities which surfaced during the course of negotiations with the Province over such matters as granting of Crown land, "breaking" of highways, responsibility for maintenance and operation of the development, and control of spur-road and cabin development prevented the development from getting off the ground this past year. Hopefully, these areas of concern may be cleared up in time to get off to an early start during 1973.

RESERVOIR AND LAKE INVENTORY STUDIES

G.D. Barbour
J.P. Davis

This Unit's major activities during 1972 were part of a long term study set up to evaluate and document the effects on resident sport fish species of hydroelectric reservoir formation in Newfoundland and Labrador, and to inventory the sport fish resources in these reservoirs as well as those of the Province's large, natural lakes. The main objectives of this study are to determine the immediate and long term

effects of reservoir formation on existing fish stocks, to determine the extent of the sport fishing resource in our reservoirs and large lakes, and to make management decisions which will enable the Department to effectively manage recreational fisheries in standing waters. Study sub-objectives are (1) to determine the magnitude of productivity changes in reservoirs, (2) to document changes in growth, reproductive and survival rates of reservoir fish stocks, (3) to inventory the sport fish resource in the larger standing waters of the Province, and (4) to formulate and implement sound fishery management techniques for reservoirs and large natural lakes.

Evaluation of hydroelectric reservoirs as sport fish habitat continued during 1972 with a comprehensive study of the Victoria Lake Reservoir, impounded in 1969 as part of the Bay D'Espoir Power Development. Inventory of the Province's larger lakes was also continued this past year with a study of the limnology and sport fish populations of Long Lake. Less intensive study was conducted at Long Gull Pond in the Stephenville area. This study was undertaken to determine the utilization of the lake and its outlet by migrating (anadromous and resident) salmonid fish in view of the proposal by the Harmon Corporation to use the lake water for the Stephenville Industrial Complex. During 1972, some effort was also expended in investigation of West Pond located at Halls Bay. This lake is being examined as a possible site for a proposed Fish Culture Establishment and, as such, information on the water chemistry, depth, thermal profile, fish populations, parasite and/or disease problems, if any, are required before decisions can be made to proceed with plans.

Victoria Lake Reservoir

Beginning in early summer 1972, a post impoundment study of Victoria Lake was carried out. Victoria Lake has been impounded as part of the Bay D'Espoir Hydroelectric Development. The purpose of this study was two-fold; the first objective was to compare the limnology and fish populations of Victoria Lake Reservoir with that of pre-impounded Victoria Lake. The baseline data on pre-flooding conditions were obtained during a 1965 study. The second objective of the study was to inventory the sport fish resource of one of the island's largest and deepest lakes.

Victoria Lake Reservoir is the uppermost lake in the chain of impoundments that retain water for the Bay D'Espoir Power Development. Impoundment in 1969 inundated Victoria Lake as well as a number of additional lakes. The new reservoir has a total drainage area of approximately 350 square miles and a surface area of 63 square miles. A comparison of the morphometry of the reservoir with that of the pre-flooded lake is shown in Table 9, and a bathymetric map of the reservoir is presented in Figure 12.

Table IX. A comparison of the morphometry of Victoria Lake and Victoria Lake Reservoir.

Morphometric Parameter	Victoria Lake	Victoria Lake Reservoir
Drainage area (sq. miles)	337	408
Area of the lake (sq. miles)	16.4	63
Maximum length (miles)	18.5	25.2
Mean width (miles)	0.9	2.4
Maximum depth recorded (feet)	384	462
Mean depth (feet)	-	91.3
Volume (billion cu. ft.)	-	158

Detailed water sampling and analysis was also conducted in 1972 on the reservoir as part of a water quality study. However, the only water quality parameters available from the 1965 study are pH and T.D.S. Table 10 compares these parameters for 1965 and 1972 on Victoria Lake water, together with comparable data from other reservoirs in the Bay D'Espoir Power Development, data from nearby Long Lake (a natural lake), and from selected Avalon Peninsula lakes.

It would appear that the level of dissolved nutrients has increased only slightly in the reservoir since impoundment and that present levels are comparable to levels in the other reservoirs and nearby natural lakes. The mineral content of Avalon Peninsula lakes studied is, however, significantly higher. It appears that, generally, the expected large scale increases in water fertility normally associated with reservoir formation in more southern latitudes has not occurred to date in reservoirs of the Bay D'Espoir Development.

Qualitative sampling of fish populations in Victoria reservoir was conducted in 1972 using fleets of gill nets (nylon stretched mesh size 1½", 2", 3", 4", and 5"). Samples of ouananiche, brook trout, and arctic char were obtained. Only a very small sample of brook trout was collected during 1965 and, to date, all 1972 arctic char data have not been analysed. Thus comparisons between the sport fish populations present in 1965 and 1972 are restricted to ouananiche only.

Table 11 presents growth data obtained from the 1965 and 1972 studies at Victoria Lake as well as that from some Avalon Peninsula waters.

Generally, the 1972 growth rate of both brook trout and ouananiche

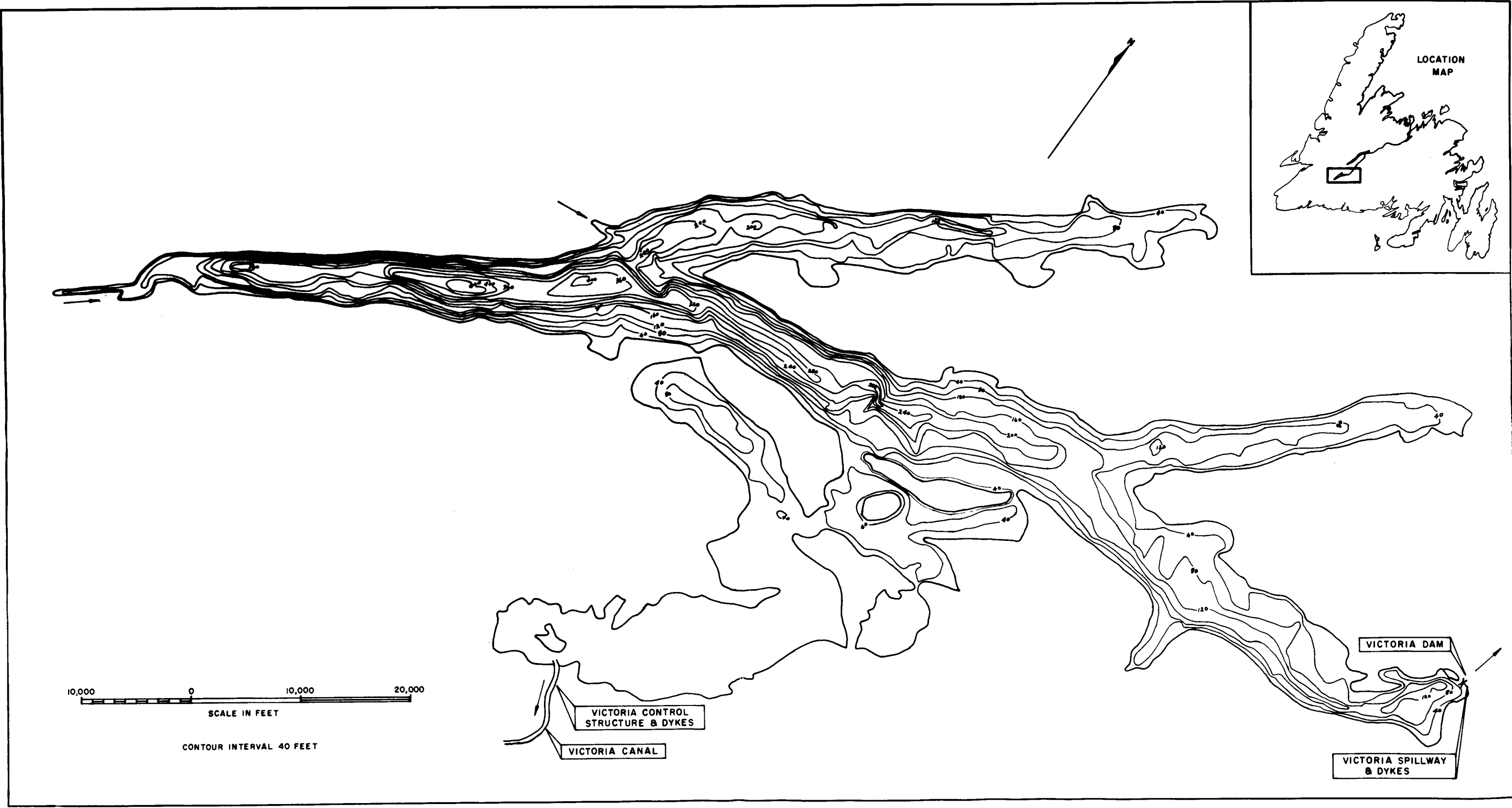


FIG. 12 BATHMETRIC MAP OF VICTORIA LAKE RESERVOIR

Table X. A comparison of water quality parameters for Victoria Lake and Victoria Lake Reservoir with other reservoirs in the Bay D'Espoir Power Development, Long Lake, and selected Avalon Peninsula lakes.

Lake (Year)	pH	Total dissolved solids
Victoria Lake (1965)	6.4	14.9 ppm.
Victoria Lake Reservoir (1972)	5.9	17.6 ppm.
Long Lake (1972)	6.3	19.0 ppm.
Long Pond (1971)	5.7	15.3 ppm.
Brazil Pond (1971)	5.5	18.7 ppm.
Soulis Pond (1971)	5.9	14.6 ppm.
Round Pond (1971)	5.5	15.4 ppm.
Little Burnt Pond (1971)	5.8	14.2 ppm.
Selected Avalon Peninsula lakes	6.2	30.5 ppm

Table XI. The growth rate (fork length in centimeters) of brook trout and ouananiche from Victoria Lake in 1965 and 1972, and from selected Avalon Peninsula lakes.

Lake	Year	Species	Annulus										
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Victoria	1965	Ouananiche	-	-	15.8	16.0	20.9	26.8	28.2	32.3	-	-	-
Victoria	1972	Ouananiche	2.8	6.2	11.4	18.4	25.0	29.3	34.6	39.0	41.2	41.4	46.1
Avalon Lakes		Ouananiche	4.9	8.9	13.4	17.3	20.7	24.6	28.4	34.6	42.6	43.0	44.9
Victoria	1965	Trout	NO DATA AVAILABLE										
Victoria	1972	Trout	5.8	11.5	16.7	21.4	26.8	-	-	-	-	-	-
Avalon Lakes		Trout	5.7	10.9	16.1	21.1	25.9	30.4	33.4	36.8	-	-	-

Table XII. A comparison of the growth rate and age composition of ouananiche in Victoria Lake during 1965 and 1972.

1965				1972			
Age	Mean Fork Length(cm.)	Mean Weight(gm.)	Sample Number	Age	Mean Fork Length(cm.)	Mean Weight(gm.)	Sample Number
3	15.8	41	2	3	23.0	136	1
4	16.0	56	20	4	29.2	282	9
5	20.9	108	36	5	35.1	495	29
6	26.8	225	35	6	36.8	573	24
7	28.2	296	26	7	43.3	940	20
8	32.3	394	2	8	45.2	1066	21
9	-	-	-	9	47.6	1247	12
10	-	-	-	10	49.6	1417	4
11	-	-	-	11	47.2	1128	5

Table XIII. A comparison of some important sample population parameters calculated for Victoria Lake ouananiche in 1965 and 1972.

Parameter	1965	1972
Mean fork length (cm.)	23.4	40.1
Maximum fork length (cm.)	36.7	57.9
Mean weight (gm.)	177	865
Maximum weight (gm.)	520	2094
Mean age (years)	5.6	6.7
Maximum age (years)	8	12
Sample size	121	125

in Victoria Lake is comparable to that exhibited by Avalon Peninsula populations, while the growth rate of ouananiche appears to have improved somewhat since 1965. A more detailed comparison of the growth rate and age structure of the 1965 and 1972 populations is presented in Tables 12 and 13.

It is immediately obvious from Tables 12 and 13 that the ouananiche population structure has changed significantly since 1965 with the present population characterized by a much faster growth rate and increased longevity. Generally then, it would appear that ouananiche have increased their growth and survival rates significantly during the 1965 and 1972 period. Since the water quality of the new reservoir has not increased appreciably, it must be assumed that increased growth and survival of ouananiche in the reservoir is unrelated to the slight increase in habitat area or of benthic invertebrates. The increased habitat for benthic invertebrates provided by many square miles of submerged and emerged deadwood is immense. This pattern of increased growth and survival of reservoir fishes is general elsewhere in the Bay D'Espoir system but in no case can it be attributed to increased water fertility.

Long Lake

While the study team was in the Victoria Lake area, they took the opportunity to investigate nearby Long Lake as part of an inventory of some of the island's larger lakes. Moreover, Long Lake had been rumoured to produce some of the largest ouananiche in insular Newfoundland. One of the objectives of this study was, therefore, to determine if indeed such large fish do inhabit Long Lake and, if so, the factors that contribute to this desirable situation.

The study included the investigation of the physical and chemical features of the lake together with sampling of its populations. Most of these data are yet to be analysed, except for the physical and chemical limnological data. A bathymetric map of Long Lake appears in Figure 13 and a partial water quality analysis is presented in Table 14. With respect to fish populations, the lake was found to contain arctic char, brook trout, and ouananiche, in that order of abundance. Although age and growth data analysis is incomplete, initial results indicate that the fish populations, though good, may be no better than populations inhabiting other lakes with comparable limnological features.

Long Gull Pond

The Long Gull Pond study conducted during the spring of 1972 was the completion of a survey begun during the fall of 1971, the purpose being to determine its utilization by migrating (anadromous and

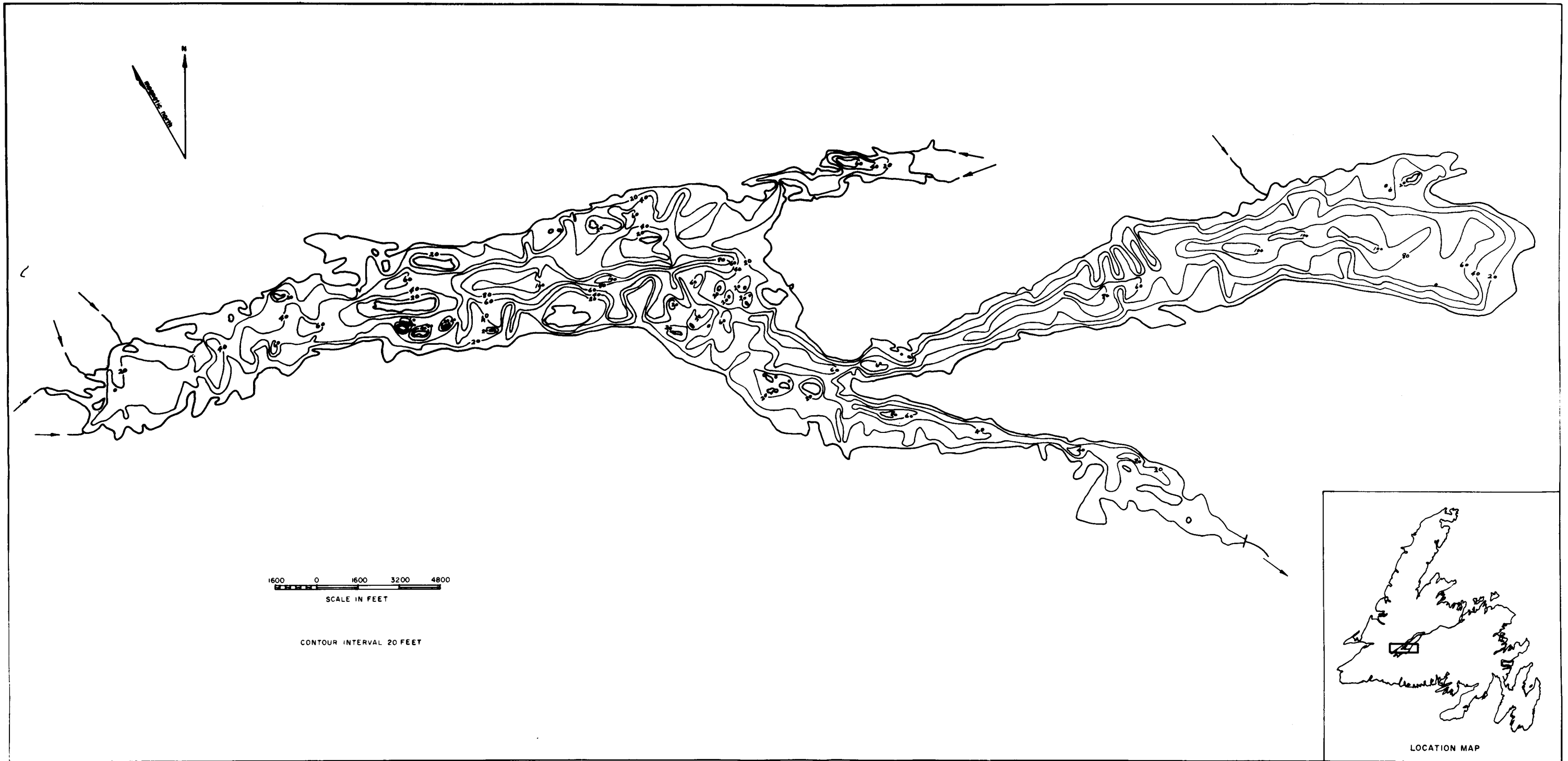


FIG. 13 BATHMETRIC MAP OF LONG LAKE

resident) salmonid fish. This information would, in view of a proposal by the Harmon Corporation to impound it as a reservoir for the Stephenville Industrial complex, enable intelligent decisions to be made as to remedial measures required if the proposal was proceeded with. The study also provided limnological and fish population data for a west coast lake to be incorporated into the lake inventory being compiled for the Province.

Limited gill netting conducted in Long Lake during October, 1971 demonstrated that anadromous salmon are utilizing the lake, and subsequently spawning in its outlet. Early 1972 study attempted to evaluate resident sport species in the lake, and to define to the extent that they may also utilize the outlet stream for spawning and rearing purposes. This part of the study, in addition to finding a moderately high population of resident brook trout and ouananiche in the lake, also indicated that a sizeable population of sea-run brook trout utilize the lake as an overwintering area. In view of these findings, there will undoubtedly be a requirement for fish passage facilities if the proposed impoundment scheme goes into effect.

West Pond

During late 1972, assisted by personnel of the Water Resource and Development Groups, a study was begun of the limnology and fish populations of West Pond, located at Halls Bay. West Pond is being examined as a possible site for a proposed fish hatchery and, as such, detailed information on its limnology and fish populations will assist in its evaluation in this respect. During the short period prior to lake freeze-up, water samples were collected, thermal and oxygen profiles taken, limited fish collections made, and a start made on mapping the underwater topography of the lake. This study should be completed in early 1973. Results to date indicate that West Pond is a deep, oligotrophic lake, thermally stratified in summer, low in nutrients (T.D.S. = 21.6 ppm.) and utilized by resident and anadromous brook trout and Atlantic salmon and by resident arctic char. No obvious parasite or disease problems came to light in the course of this study of West Lake.

Table XIV. A partial analysis of surface water quality for Long Lake (samples collected during 1972).

Parameter	Mean value
pH	6.3
Total hardness as CaCO_3	8.0 ppm.
Total alkalinity as CaCO_3	4.5 ppm.
Turbidity (Units)	3.2
Specific conductance, micromhos at 25°c	15.6
Total dissolved solids	19.0

WATER RESOURCES GROUP

████████████████████ WATER RESOURCES GROUP

C.A. Whalen,
Group Leader.

This newly created group was formed during the latter part of 1972, from amalgamation of the former environmental protection and pollution control groups. Maintaining fish habitat from detrimental changes in the aquatic environment and liaison with other services and governmental departments to ensure protection of fish stocks from pollution are primary responsibilities. Activity areas include:

(a) Monitoring of projects involving environmental manipulation such as hydroelectric developments, highway construction, municipal water supply schemes, logging operations and offshore oil and gas exploration. Field activity continued during 1972 at the Baie D'Espoir Hydroelectric Development and Come-by-Chance industrial project.

(b) Provision of branch services of an analytical laboratory at headquarters and a small bioassay facility at Bishop's Falls.

HABITAT ALTERATIONS

B.R. LeDrew
L.J. Cole
R.H. Hart

General Construction

Increases in requests for physical alterations to water courses associated with highway and causeway structures, stream diversions, gravel removal and other construction activities have required significant attention. Inspection, monitoring, and the recommending of remedial measures at such construction sites requires a cooperative bio-engineering approach in addition to field assistance by the Conservation and Protection Branch.

During the year in excess of 40 applications for stream crossings, diversions, and water supply systems were reviewed.

Logging Operations:

With the addition of the third paper mill, Labrador Liner-board Limited, increased pressures on the province's timber resources are inevitable. Coincident with this increase will be problems associated with environmental protection. Rigorous monitoring was



Fig. 14. Stream bank erosion from forestry operations.



Fig. 15. Wood transport and storage on the Exploits.

not possible in past years due to other staff commitments but will require further attention as forest harvesting increases.

Labrador Linerboard Limited's aim of harvesting 500,000 cords in Labrador have not materialized, indicating increased requirements will be placed on the island resource. An estimated 15,800,000 cords of wood are located on slopes too steep for conventional equipment and indications are that much of the future wood supply will come from such areas. Monitoring of new harvesting techniques will be required. Wood harvesting in Labrador represents a special case with the use of conventional harvesting methods and the unique characteristics of a northern environment.

Price Nfld. Limited and Bowaters Limited are still dependent on river transport for a large percentage of their annual wood production (65-70% and 40% respectively). Of particular significance is transportation on the Exploits system. The Company maintains that a significant cost differential exists in favour of river transport, even with an estimated 8% loss of river driven wood through sinking and stranding. In recent years loss of wood and bark to the watershed above the mill may have exceeded 30,000 tons annually.

Hydro-electric Development - Bay D'Espoir:

Construction of this complex has resulted in the moving of 16,000,000 cubic yards of material for channels and earth-fill dams. Part of this development has resulted in 58% of the headwater of White Bear River being diverted (Fig.16). As a consequence flows in the main river have been significantly reduced (Fig.17). This is of particular significance as the estimated run of 500-1500 Atlantic salmon must utilize the main river because most tributaries of the system are naturally obstructed at or near their mouths. It is estimated that as a result of flow reductions, a 40% loss of rearing area amounting to 6,700 units (1 unit = 100 square yards) has occurred in the 12 miles of main river accessible to Atlantic salmon.

Agreement between the Newfoundland and Labrador Power Commission and this department required maintenance of a minimum flow of 250 cfs at the mouth of the river during certain months and a maximum contribution of \$75,000 for compensatory rearing area lost as a result of flow reduction. Efforts began in 1972 towards this latter objective (see Engineering Services Group) by removing obstructions on the main river.

Stream surveys have indicated that an additional 26,600 rearing units will be available when fish passage can be accomplished in the main river. The electrofishing census program of 1972 indicated standing crop values in the order of three times higher in the one

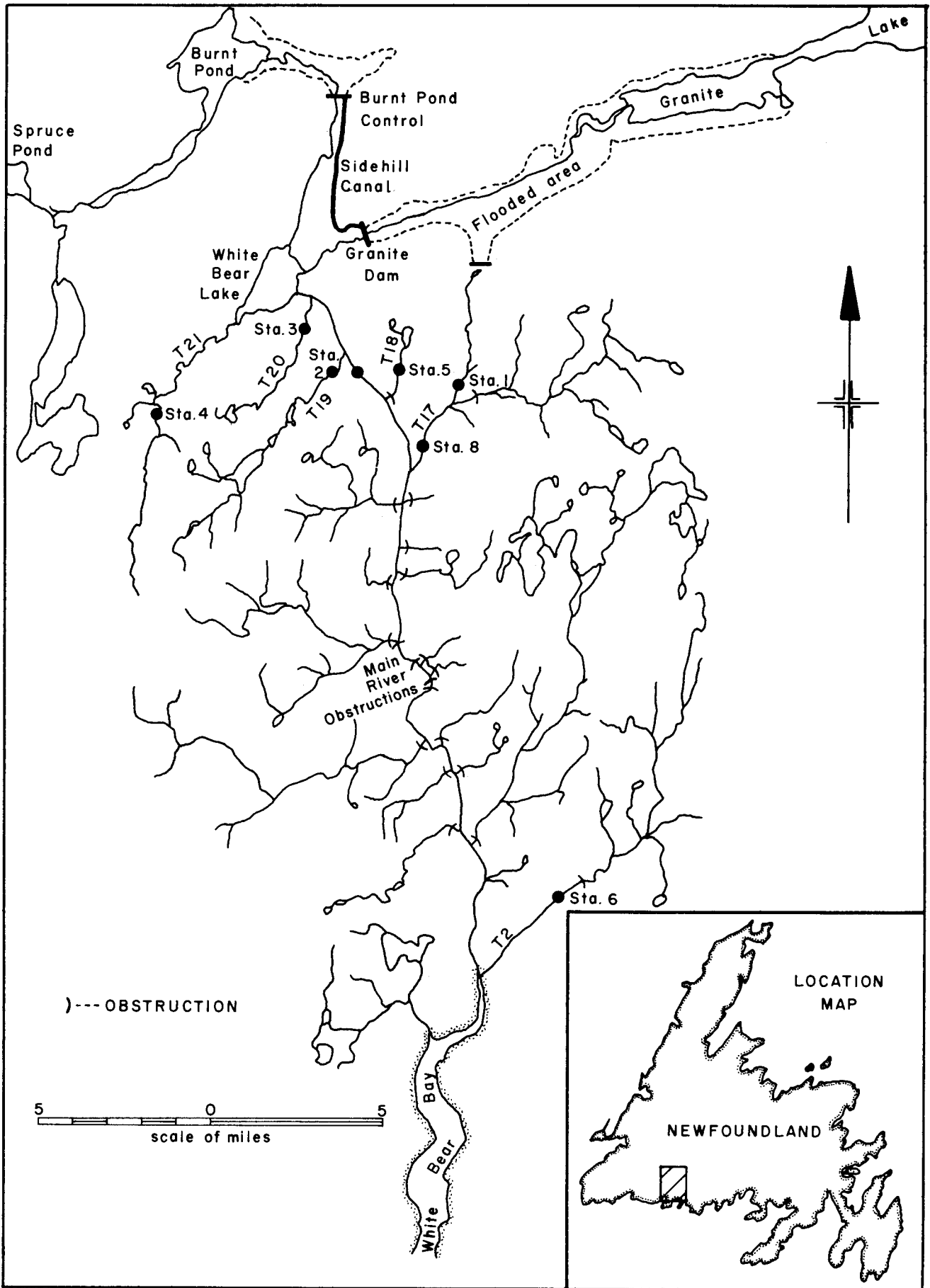


Fig. 16 White Bear River showing sites of 1972 electrofishing stations.

tributary accessible to Atlantic salmon as compared with values for tributary streams which are inaccessible. These results are indicative that previously inaccessible areas contain utilizable rearing space for anadromous salmon stocks.



Fig. 17. White Bear River, upstream of tributary No. 17.

Industrial Water Supplies - Come by Chance

The industrial development in the Come by Chance area includes plans for the integration of the Come by Chance river into a water supply system. In effect the river would become a controlled flow canal to deliver water toward the industrial site.

One of the major limiting factors to fish production in this system is believed to be its extremely low summer flows. To discharge our responsibility for protecting the environment as well as to monitor the effect of a controlled flow situation on fish populations in the system, a study program was initiated in 1969. In that year a detailed stream survey was carried out. The streambed comprises 3700 rearing units (1 unit = 100 sq. yds.) all of which are accessible to anadromous fish.

In July of each year from 1970 to 1972 an electrofishing census has been carried out. Figure 18 shows the location of sampling stations. In 1970, nine of the stations were completed (number 3 was omitted), representing 1.4% of the total river area. In 1971, and 1972 ten stations representing 1.9% of the river were fished.

The stream was divided into three sections (Churchills Station 1-3, Goobies Station 4-6 and Come by Chance Station 7-10). For each section stations were selected to represent type areas based on bottom composition and water velocity. From stream survey data the stream area corresponding to each of the ten type areas was determined and with these figures a weighed estimate of the total population could be derived from electrofishing results.

Total standing crop has remained stable over the past three years (salmon parr 120 gms per unit). Egg to smolt survival is estimated to be quite high (in the order of 10%).

In 1971-72 a portable conduit type counting fence was used to count downstream migrants (Figure 2). Washouts both years prevented a complete adult count, however, it is unlikely that the salmon run has exceeded 50 grilse in either year.

A total of 3542 smolts and 3379 sea trout (Salvelinus fontinalis) were passed downstream in 1971. In 1972 the count was 8374 and 2354 respectively. Thus the stream has produced between 1.0 and 2.3 smolt and between 0.6 and 0.9 sea trout per unit.

In 1973 a smolt count will be conducted to complete the baseline study of this system.

WATER QUALITY

C.A. Whalen
A. Jamieson

Laboratory Services

The division of material and personnel between Resource Development Branch and Environmental Protection Service became official during 1972. The laboratory was retained by the Water Resources Group to maintain a branch analytical laboratory capability. Environmental Protection Service have not as yet moved into their new laboratory and are presently the major users of the laboratory trailer.

The Laboratory Services Unit has the capacity and facility

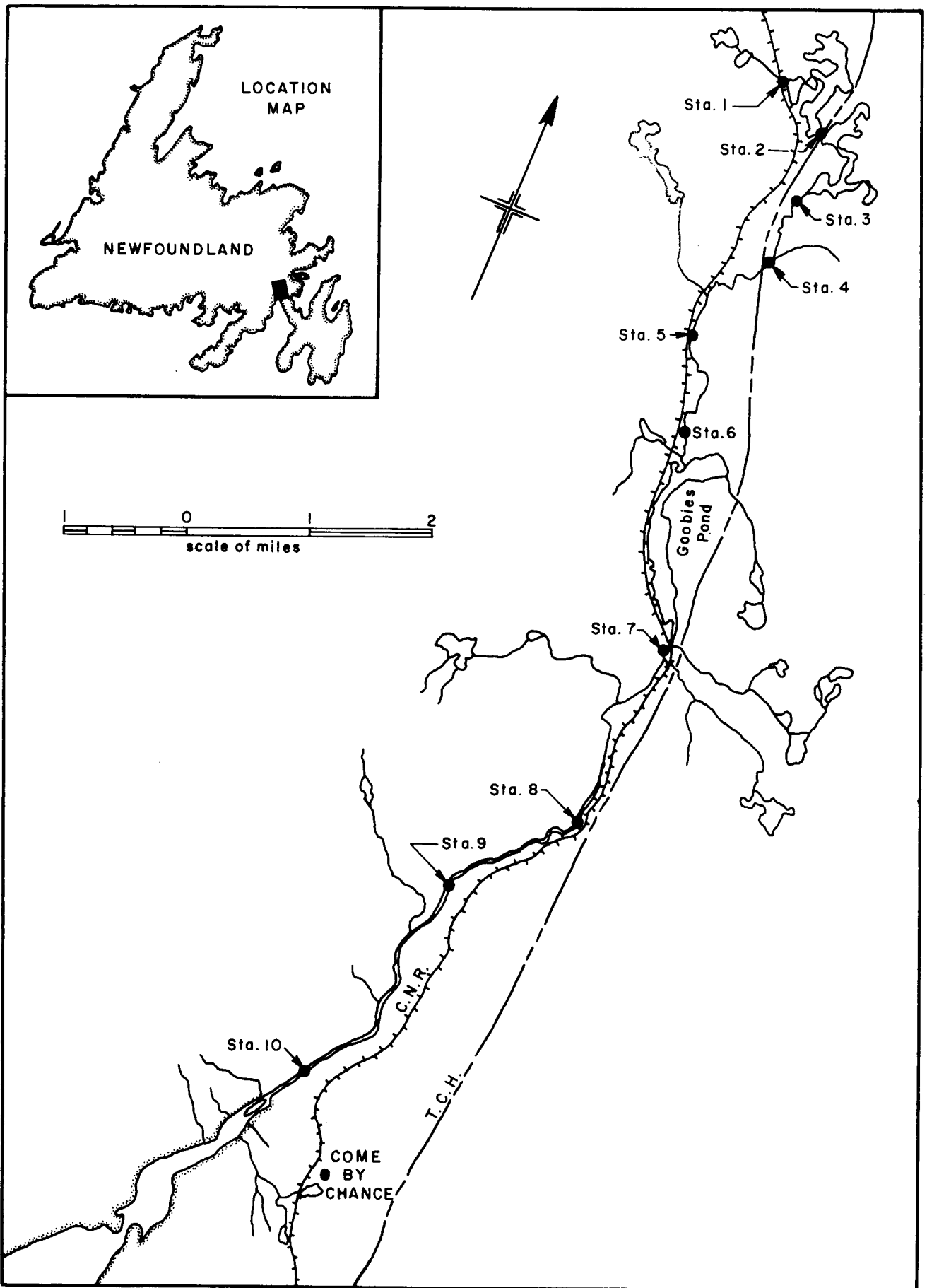


Fig.18 Come-By-Chance River showing sites of electrofishing stations.

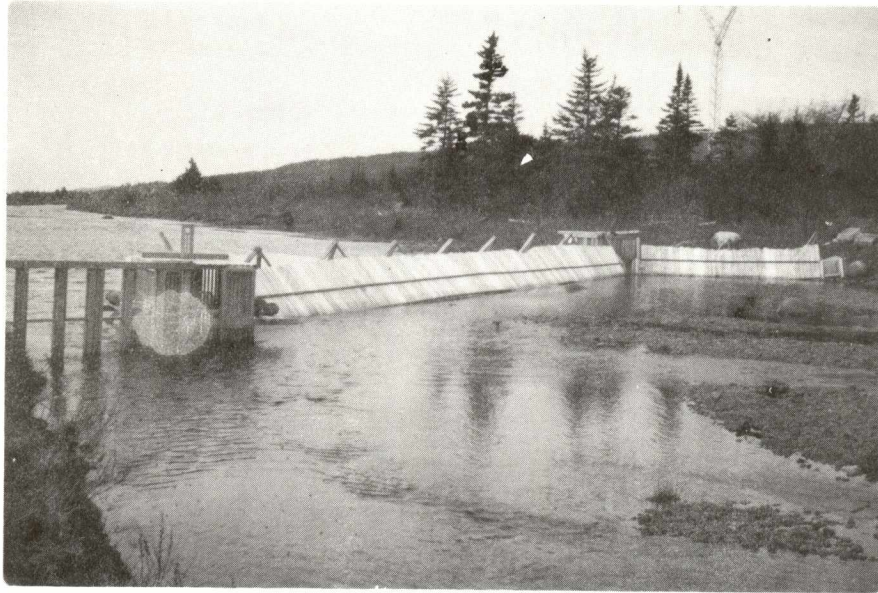


Fig. 19. Conduit-type counting fence, Come-by-Chance River, 1972.

to perform the following analyses, alkalinity, pH, hardness, specific conductance, copper, zinc, lead, iron, calcium, chloride, B.O.D. test, dissolved oxygen test, total solids, suspended solids, dissolved solids, elemental phosphorus, magnesium, sodium, turbidity, phosphates, salinity, silica, plus other tests that, by prior arrangement, could be set up.

During the year, as part of our new area of responsibility, a water quality inventory was initiated. Involved in the program was the sampling of several hundred rivers and lakes on the island and a smaller number from Labrador. The analysis of all samples have been completed and the data made available to the editors of the stream catalogue.

Pollution - Exploits River

Efforts continued during 1972 to resolve water resource conflicts on this system. This work has been undertaken by the Environmental Protection Service from which this review is abridged. See also the Development and Engineering Sections of this report .

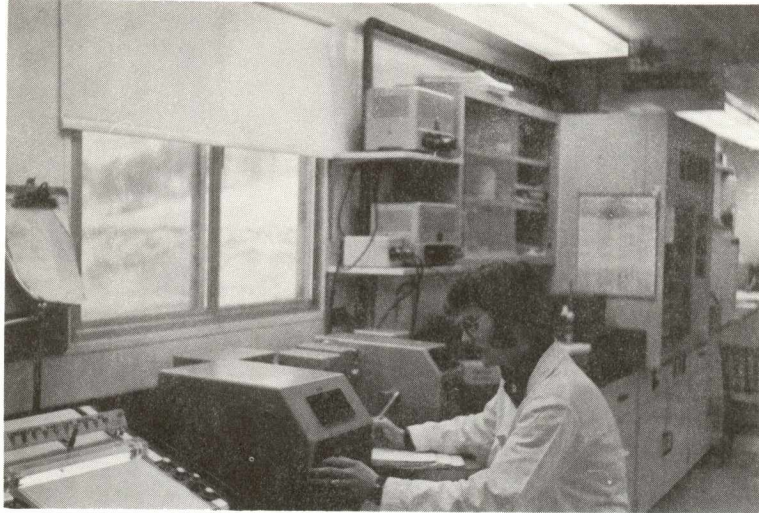


Fig. 20. Analysis by Spectrophotometry



Fig. 21. Some laboratory instrumentation, pH, conductivity, and turbidity meters.

Table XV. Summary of analyses done during 1972 by the Laboratory Services Unit, Water Resources Group.

Tests	No. of Samples	Method
pH	320	Glass electrode
Total Hardness	313	Hach Man Ver Hardness Test
Alkalinity	312	Titrametric Determination
Turbidity	315	Nephelometry
Specific Conductance	314	Conductimetry
Copper	30	Atomic Absorption
Zinc	10	Atomic Absorption
Iron	25	Atomic Absorption
Calcium	296	Atomic Absorption
Chloride	298	Mercuric Nitrate Method
Dissolved Oxygen	50	Winkler Method
Suspended Solids	12	Gravimetric Determination
Elemental Phosphorus ("phossy" water, mud, fish extracts, etc.)	516	Gas Chromatography

The pollution load entering the Exploits system is comprised of base metal mine and concentrator wastes (American Smelting and Refining Company), mixed sulfite - groundwood paper mill waste (Price Newfoundland Company, Grand Falls), and untreated domestic sewage from the towns of Bishop's Falls, Windsor and Grand Falls, population 18,454.

Sampling during 1972 was restricted to heavy metal analysis as reported in Table XVI. Sampling station locations are illustrated in Figure 22. Results of the 1972 analyses indicate higher relative concentrations to those of 1971. These data may reflect the mine shut-down which occurred during the summer and fall of 1971.

Price (Nfld.) Company Limited effluent discharge via four

Table XVI. Heavy metal concentrations, Exploits system, 1972.*

	UBB	#2	#6	STATIONS #7	#8	AGF	#12	RBB
cu(ug/l) \bar{x}	7(5)	26(15)	12(23)	7(8)	10(7)	7(7)	7(18)	8(6)
r	t-20 (4-15)	15-36 (4-44)	8-18 (4-300)	4-15 (4-56)	6-20 (4-42)	4-22 (4-66)	1-28 (4-51)	5-20 (4-23)
Zn(ug/l) \bar{x}	70(33)	572(720)	171(116)	117(67)	87(45)	94(44)	119(75)	108(45)
r	34-650 (10-106)	84-1200 (4-2000)	t-578 (54-1050)	26-250 (33-200)	18-190 (60-106)	17-416 (30-129)	20-140 (33-138)	30-509 (8-115)
Hardness \bar{x}	9(6)	18(17)	12(9)	9(9)	8(9)	10(8)	11(9)	9(9)
mg/l r	5-18 (4-14)	8-60 (6-32)	8-24 (4-18)	4-10 (7-22)	6-16 (7-18)	4-20 (6-18)	6-22 (6-18)	4-14 (4-14)

* Bracket numbers indicate 1971 concentrations

Data from EPS Interim Report on the Exploits

\bar{x} - mean

r - range

t - trace

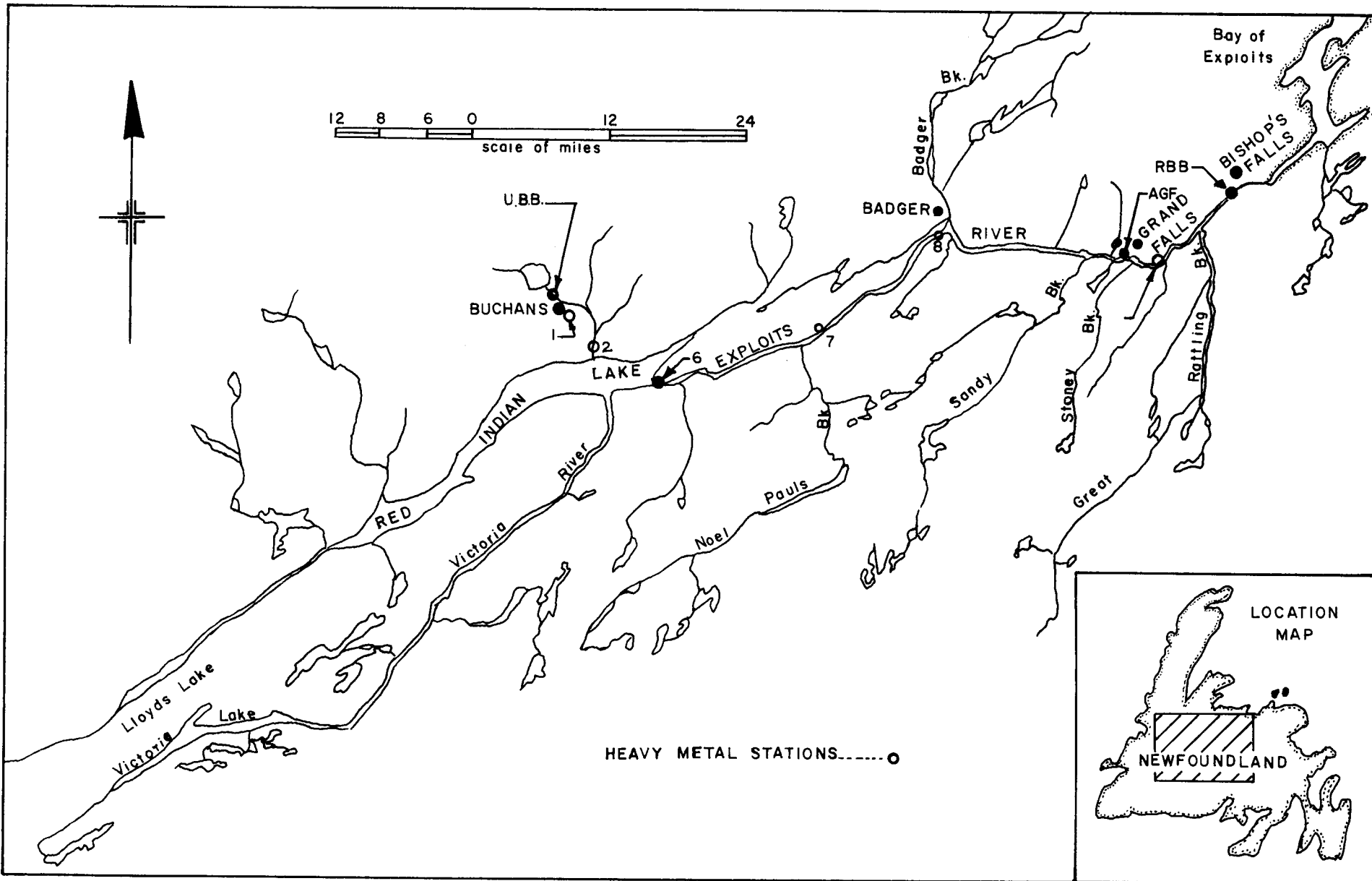


Fig. 22 The Exploits river Basin showing Pollution sampling stations , 1972.

sewers all of which are toxic to fish. Results of a single static bioassay using 65% effluent and Atlantic salmon parr indicated 100% mortality in 96 hours in three of the four sewers. Caged adult salmon held in the vicinity of the woodroom sewer and fishway have been killed. The major toxic component of the woodroom sewer is resin acid, a single analysis of this effluent contained 14.2 ppm. The LC₅₀ is reported as 0.7 ppm.

Progress with the various companies located on the Exploits system include modifications of in-plant systems at Price to improve fibre losses. ASARCO has constructed a new and enlarged tailings system. The new ASARCO treatment system will utilize a decant tower and an area designated for chemical treatment, primarily pH control. Initial retention time for the system is 40-54 days with an end retention of 13-18 days at the known life of the mine.

C O M M E R C I A L F I S H E R I E S G R O U P .

COMMERCIAL FISHERIES GROUP

L.G. Riche,
Group Leader.

Introduction

The major responsibility allocated to this group is the development and implementation of information for determining proper management of the Newfoundland and Labrador Atlantic salmon resource. Despite the urgent need for immediate work in the area, full time staff or financial assistance were not available until late 1972. It is anticipated that a full team of biologists and technicians can be functional in the field in 1973.

Commercial Salmon Fishery Statistics

In 1970, mainly through the effort of the Economics Branch of this Region, a computer program was developed. That program provides the landings by month, by statistical area (15), by statistical district (53), by type of gear, and by two size-classes. In 1971, the program was expanded to provide an annual printout of the monthly landings by settlement (about 682).

The present system has two areas of inadequacy. Input data for size-class is not complete because all fish buyers are not using 6 pounds round weight as a separating line between large and small. Fortunately, the proportion of buyers using this criterion is increasing. Secondly, the landings by settlement are available only on an annual basis when availability on a monthly basis early in the following month is a requirement under intensive management. Realization of a system for providing "current" landings monthly by settlement appears attainable for 1973.

Establishment of a program to describe fishing gear quantities and utilization is also necessary. Quantities of gear licensed are now known, but it is impossible to quantify units of effort with present knowledge. Hopefully, catch-effort figures can be developed after some refinement of the present system of tabulating gear used in the salmon fishery.

Biological Sampling of Salmon Catch

In recent years, sampling effort has been expended on landings from the Port-aux-Basques drift net fishery, from Packs Harbour, Labrador and St. Georges Bay. A stepped up sampling program is planned to encompass as many areas in Newfoundland and Labrador as

staff permits. Other groups will be asked to assist in this program.

Identification of Salmon Stocks

The separation of mixed stocks can be achieved only by identification and quantification of the individual components. Three techniques, at least, seem available in the immediate future: smolt tagging; tagging of adults, particularly before the fishery commences; and biochemical methods involving serum and/or electrophoretic techniques. All these approaches will be utilized as soon as resources can be mobilized and cooperative programs established.

Arctic char, Labrador

The arctic char fishery is a stable economic factor for the native people of northern Labrador. Based on limited statistics this fishery has been harvested at an annual rate of 200,000 to 300,000 pounds annually. The decline of the inshore cod fishery will no doubt put additional pressure on this stock, in addition a growing market and better prices will increase fishing effort. To establish a sound management policy a program study of this fishery will be a high priority in 1973.

Marine Fisheries Management

There is a growing demand from all involved in the marine fishery to establish management programs for the total resource. Involvement will be a multi-disciplined approach utilizing all expertise available within the Fisheries Service to achieve this goal. In late 1972 Resource Development Branch and particularly the Commercial Fisheries Group provided work input into management of Redfish, Herring and the new Capelin fishery. It is expected that additional demands will be placed on this group in 1973-1974 with regard to marine management.

E N G I N E E R I N G S E R V I C E S G R O U P

ENGINEERING SERVICES GROUP

B.R. Bauld,
Chief Engineer.

CONSTRUCTION

K. Powell
D.B. Stone
R. Fitzpatrick
L. Goulding

Facilities for Greenland Salmon Fishery Investigations

The construction unit provided the services of a supervisor to the Development Group to assist in the installation of the smolt-adult counting fence at Sand Hill River, Labrador. Installation of the fence was completed in June with very little trouble as the underwater platform had withstood the effects of spring runoff very well and little maintenance work was required.

The Development Group has indicated that the operations at the fence went very well and that no problems were encountered. This type of design has proven successful and it is expected that any such permanent facilities constructed in the future would incorporate modifications indicated by experience gained in past operations.

Exploits River Development Program

Grand Falls. A decision was made, in 1971, by the Exploits River Development Committee to proceed with the design of collection and transfer facilities at Grand Falls on the Exploits River. The consulting engineering firm of ShawMont Nfld. Ltd. was engaged in late 1971 to carry out the design and prepare plans of the required facilities. Our own personnel proceeded with the design of an access road to the site during the same period. (Fig. 23).

The tender call for the access road was issued in early June. Tenders were opened on June 27 and a contract awarded to Chaulk Transportation Co. Ltd. They commenced construction immediately and the project was completed by early September.

A tender call for construction of collection and transfer facilities was issued in June with the closing date set for July 12, 1972. Tenders were opened on that date but as only one bid was received, no contract was awarded as the one bid received was considered too high. After discussing the problem, it was decided to reissue

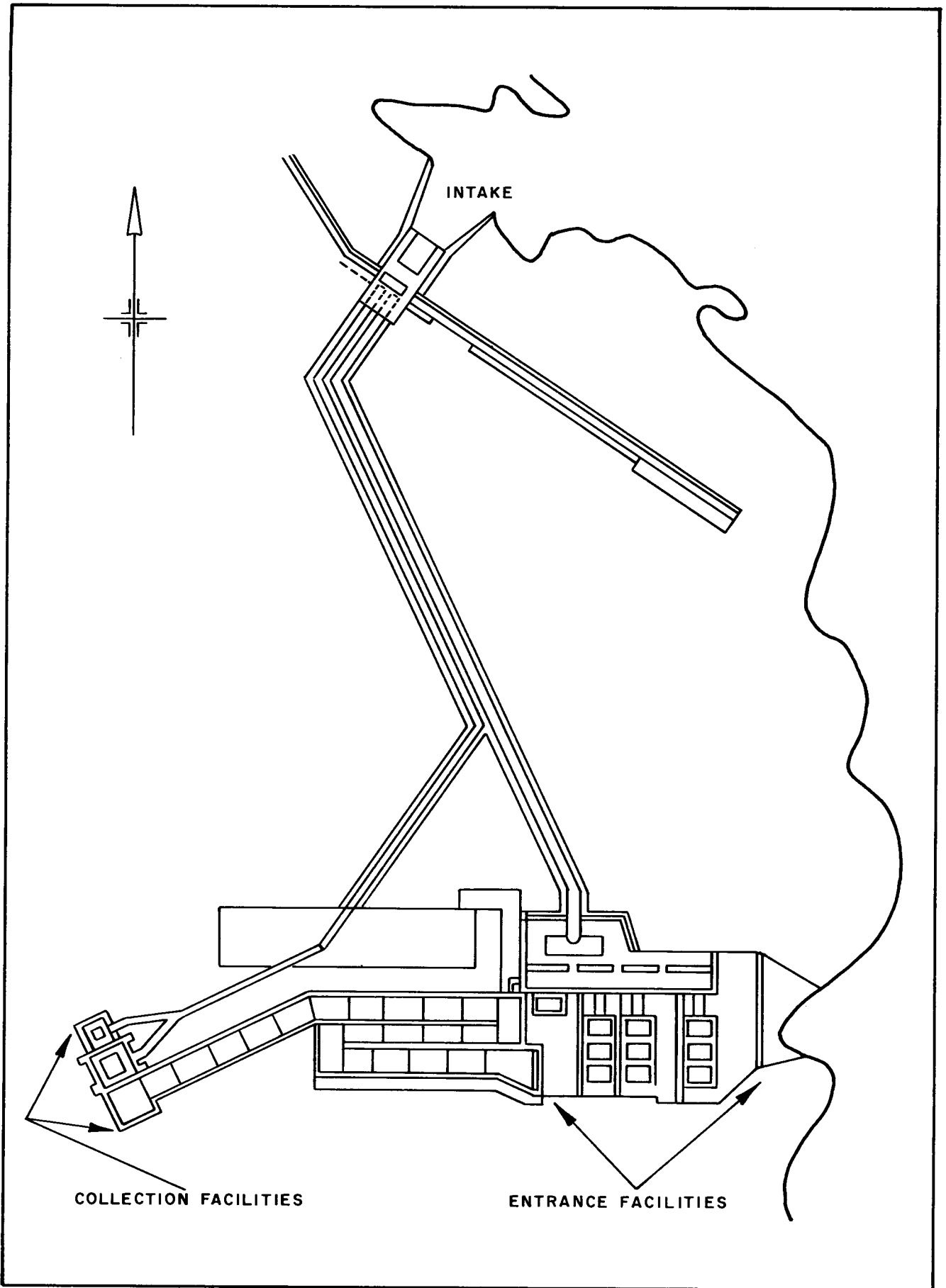


FIG.23 STAGE I OF GRAND FALLS FISHWAY—COLLECTION AND TRANSFER FACILITIES.

the tender call with a closing date of August 2. Bids were opened on August 2 and the contract awarded to the lower bidder, Corinthian Enterprises Ltd.

The contractor commenced work at the site in early September. Excavation of the rock was commenced and proceeded quite well until weather and water levels interfered to slow progress. However, by the end of the year most excavation had been completed. The contractor will continue work on the project in 1973 with the estimated completion date set for mid-March. It is anticipated that the facilities will be fully operational for adult salmon returning in 1973 (Figs. 24 and 25).

Bishop's Falls. Fishway and counting facilities at the south end of the dam located at Bishop's Falls were completed and put into operation in 1972. The steel gratings which cover the fishway were installed toward the end of the year. Flashboards, used to control flow of water in the area of the fishway, were constructed in our workshop and installed when water levels receded. The fishway appeared to operate satisfactorily during 1972.

Bishop's Falls Forebay. A project, under the Winter's Works Program, to ensure that down stream migrants, both smolt and kelts, are by-passed through the Bishop's Falls powerhouse forebay was carried out for the Development Group. The project consisted of enlarging and deepening an existing opening in the end wall of the forebay to ensure a sufficient flow of water to attract the fish through the opening and out of the forebay. Trapping facilities were installed on the downstream face of the forebay structure to measure degree of success of the program. It was necessary to make adjustments to the facilities during the period of operation and further alterations may be necessary in 1973. The number of smolts and kelts counted through the facilities indicated its successful operation.

Noel Paul's Brook Spawning Channel. Routine maintenance work was carried out during the year. The road leading to the channel site was upgraded by the installation of culverts, ditching, and ballasting as required. A contract was awarded for this work.

Additional gravel for the channel was also obtained under contract. Most of the gravel was placed in the channel in 1972. However, some gravel was stocked-piled for use during 1973.

Noel Paul's Brook Smolt Counting Fence. The timber crib platform was damaged during the spring runoff, a section of the platform being ripped out by ice moving downstream. Temporary measures were used to enable the Development Group to carry out a smolt count. Permanent repairs were carried out at low water levels experienced during the summer.

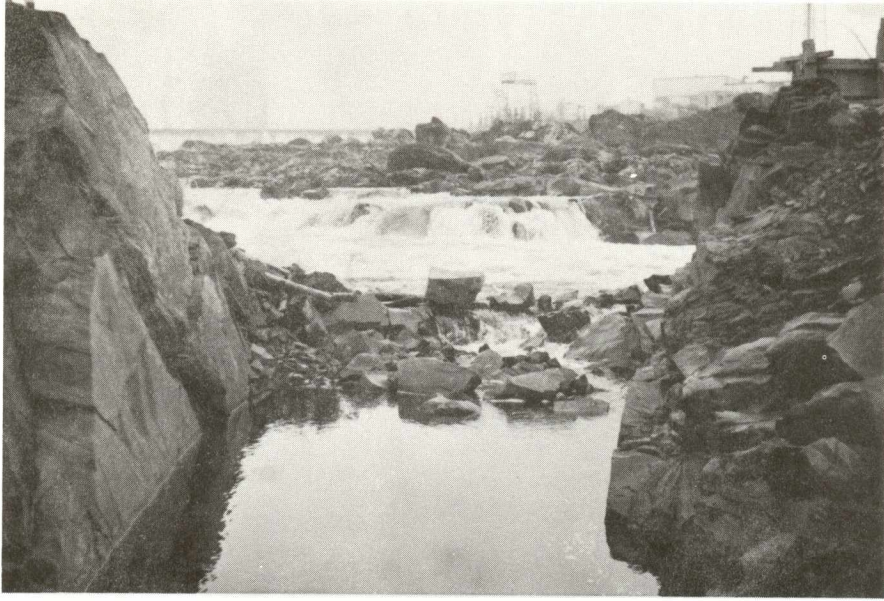


Fig. No. 24. Construction site, Grand Falls.



Fig. No. 25. Construction site, Grand Falls.

Camp One Dam Fishway. The logging dam at this fishway site has deteriorated to the point where it endangers the section of fishway passing through it. It was decided to carry out alterations to the fishway and remove the dam completely. The Branch construction crew commenced this work at the site in September but were hindered by high water levels, even though efforts were made to divert flow around the construction site. Blasting for a new section of the fishway required as part of the modifications, was completed before freeze up ice conditions further made work impossible. The project will be completed during 1973.

Bay D'Espoir Power Development

An agreement was reached with the Newfoundland and Labrador Power Commission in 1971 on measures to protect the salmon stocks of White Bear River. Part of the agreement included making several obstructions on the main stem of the river passable for fish so that spawning and rearing area above the obstructions would be accessible to migrating fish. This would offset spawning and rearing areas lost in the lower river. The Department agreed to supervise and carry out the necessary stream remedial work and a construction crew moved to the site in early July and carried out remedial work at three locations (Figs. 26 and 27). Work done included blasting at the lower site to confine flow to one channel; at the middle site blasting to remove boulders and confine flow; and, at the upper site, more extensive work at a falls to blast a passable fish channel and remove boulders. The work required approximately two months to complete, following which the Engineering Group assisted the Water Resources Group to install a portable counting fence upstream of the last obstruction to determine if the remedial work was having the required effect.

STREAM REMEDIAL AND FISHWAY MAINTENANCE

E.L. Tulk
R. Lundrigan

Stream Remedial Work. Again this year a small construction crew carried out remedial work at a number of river obstructions on the Island of Newfoundland. This consisted of drilling and blasting rock to form pools and channels over obstructions so that passage for upstream migrants was eased. The following is a list of the rivers and work done at each location.

N.E. Placentia River. Work at this site was carried out during the period January to May under the Winter Works Program. It consisted of constructing a diversion dam and platform to control flow over existing baffles to better enable migrating fish to surmount the obstruction. A platform for the installation of a fish counting trap was



Fig. 26. White Bear river Construction site.

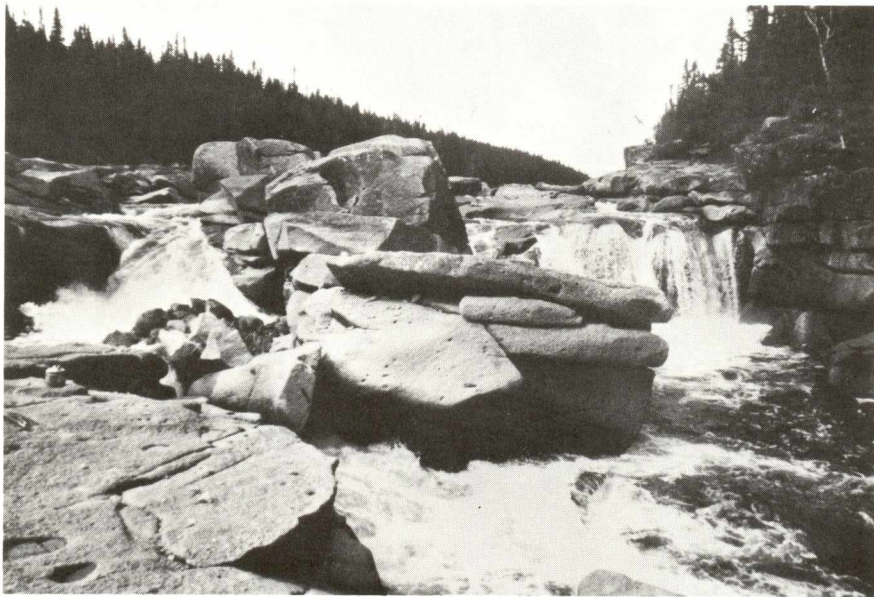


Fig. 27. White Bear river Construction

constructed to enable evaluation of the remedial work. The arrangements proved successful during the 1972 period of operation.

Lockston Brook. Work done at this obstruction consisted of blasting a large boulder and bedrock at a small falls located 2 miles above the tail race of a powerhouse.

North Harbour River, Placentia Bay (Gull Pond Brook). Work consisted of blasting rock at several rapid sections to confine flow to a single channel at low flow periods.

Shoal Harbour River. Rock and boulders were removed at a falls located one-half mile above Shoal Harbour Pond.

Conne River. Blasted wider passage at entrance to Brin Bag Hole in order that salmon could bypass the hole at higher water levels. This work, a follow-up of work carried out in 1971, consisted mainly of widening the fish passage at "Brin Bag Hole" to ease fish passage at high water levels.

Twillick Brook. Two locations were worked on, Camp #4 Falls and Pike's Pool Falls. It consisted of blasting channels to confine water at low flows.

Northern Arm River (Holyrood). A falls and rapids located 200 yards from mouth were blasted to ease passage of fish.

Salmon River (Port Blandford). Some minor work was carried out at a falls just above highway. An old logging dam, which had become blocked with debris, was also opened up.

N.W. Brook (Port Blandford). A diversion dam at a previously constructed fish passage was modified to ensure flow in the migration channel at low water levels.

Sandy Harbour River. Some blasting was done to ensure water was confined to single channel at a falls located near the mouth of brook.

Nonsuch River. Blasted falls at mouth of river. A notch was also blasted in the lip of the falls to confine low water flows and thus aid fish to surmount the obstruction.

Garnish River. Four locations were worked on between the pond and a gorge on Black River tributary. It consisted of blasting and removing boulders from the river bed at these locales.

Middle Brook. A small amount of rock at the falls below the diversion dam was removed as a follow up to work carried out in 1971.

Red Harbour River. A channel was blasted through a falls to confine flow to single channel at low water. The falls was located one mile above the river mouth.

Taylor's Bay Brook. Blasting was conducted at a rock outcrop to confine flow to a single channel.

Humber River (Big Falls). A large boulder which had fallen into the channel previously blasted through the falls was removed so as to ease fish passage.

Harry's River. The construction crew installed a cable at the gauging station located on this river. This will enable Water Survey personnel, who operate the station, to obtain better flow measurements in the river.

Counting Fences

The Engineering Group provided assistance, as requested by the various Groups, with installation of counting fences operated during 1972.

Fishway Maintenance

The usual maintenance program was carried out during May and June to ensure that all fishways and counting fences were in good operating condition when needed.

DEVELOPMENT

G. Scott
B. Flynn

Access Roads

The program of surveying for access roads into inaccessible lakes along the Trans Canada Highway on the Avalon Peninsula was continued and it had been expected that one or two roads could have been constructed in 1972. However, problems arose mainly with provincial regulatory bodies, which prevented any construction being carried out. The program will be pursued further in 1973.

Humber River Fishway

Engineering investigations continued for the proposed fishway at Main Falls, Upper Humber River. Further field data were collected during the year and preliminary designs were investigated. Plans and specifications will be worked on during 1973 on the premise that it may be possible to schedule construction for 1974.

General

The Engineering Service's Group provided advice to the Water Resources Group in reviewing plans submitted by various agencies. Again it was necessary to spend considerable time and effort on activities of the provincial Department of Highways. Various problems such as bridge construction and culvert installation were reviewed and meetings held with officials in an effort to protect the fish populations utilizing the waters involved.

Numerous plans for the installation of water and sewerage facilities were reviewed, including the carrying out of on-site inspections. Considerable time was spent on Northern Arm Brook, which is being developed as a water supply for Bishop's Falls and, possibly, Grand Falls and Windsor. The main problem encountered here was that of trying to keep the contractor from destroying the river bed during installation of the pipe line.

A new water supply reservoir has also been proposed for the Town of Grand Bank, Burin Peninsula. The Engineering Group worked closely with the consulting engineers in designing the fishway facilities which the Department required to be incorporated into the storage system. The water supply development is scheduled for construction in 1973.

Workshop and Storeroom, Bishop's Falls

A contract was awarded for paving of the parking and work area around this building during the year. A second contract, for landscaping our frontage on the highway was carried out during the summer. These two activities have greatly improved the utility and appearance of the area.

1973 Engineering Program

The Development Program for the Exploits River will be continued with the operation of the new collection and transfer facilities at Grand Falls coming into operation. Further engineering investigations will be carried out on the design of other facilities which may be required to support this development program in the future.

Alterations at Camp One Dam Fishway will be completed during 1973 including the installation of new trapping and transfer facilities at that site.

Engineering investigations will be carried out in conjunction with other concerned Branch Groups on the proposed fish culture establishment.

It is planned that a suitable site will be located in 1973 so that preliminary design work can be started.

The stream remedial program will be continued with main emphasis being placed on the Avalon and Burin Peninsula's rivers. The usual maintenance program on fishways, counting fences, spawning channels, and other facilities will be carried out as required.

S U M M A R Y

EXPLOITS RIVER DEVELOPMENT

Grand Falls Obstruction and Fishway

Construction of salmon enumeration and collection facilities were begun in 1972 and will be operating during the 1973 adult salmon run. These facilities will, if returns from the development program justify it, form an integral part of a fishway to completely bypass the Grand Falls and its associated hydroelectric dam. In the interim, the facilities will be used to transfer such adult fish as enter them beyond the obstructions referred to.

Hydroelectric Facilities

Investigation revealed that adverse effects on the downstream smolt migration at the Grand Falls forebay may be of minor magnitude due to an escape route created by a surface spilling gate.

The problem of the Bishop's Falls forebay as an obstacle to migrant smolts, and kelts has been at least partially remedied by construction of a surface spill facility at this structure. This will be further investigated in 1973 and, it is hoped that additional modifications may negate the need for previously considered forebay diversion screens.

Spawning Escapements

The adult spawning escapement to the Exploits River in 1972 (907 fish) was the lowest recorded count at that site since enumeration began in 1959.

Assessments of adult runs on three potential donor streams for Exploits stocking did not indicate adult escapements in the rivers examined adequate to provide excess brood stock for the Exploits.

Commercial and Recreational Fisheries

Investigation of the "home water" commercial fishery for the Exploits, and of the Exploits sport fishery, continued in 1972. That portion of the commercial fishery take attributed to Exploits stocks represented 20 percent of the total Exploits run to the river.

Angling success on the Exploits River in 1972 (463 fish) was slightly below the average of 503 fish since 1961.

Noel Paul's Brook Development

The spawning channel in this tributary of the Exploits River was operated as in previous years. Experiments in 1972 indicated an optimum spawning density in the channel to be about one female per two to three square yards of spawning gravel. Fry survival in the channel from 1971 egg deposition was about 50 percent somewhat less than that the previous four year average egg to fry survival of 62 percent.

Standing crop assessments were continued in 1972.

The 1972 smolt count from the spawning channel was hindered by ice damage to the smolt fence. However a partial count was made which, together with an estimate for non-counted, gave an estimated run in 1972 of 6500 smolts.

Two tags, from smolts tagged in 1971, were recovered from the 1972 commercial fishery. No other returns were reported from our traps or from the recreational fishery.

Activities on the Exploits in 1973 will be mainly a continuation of those in 1972, with the added advantage of adult enumeration facilities at the Grand Falls obstruction.

OTHER DEVELOPMENT PROGRAMS

This unit continued its activity in assessing stream obstructions on salmon rivers, recommending remedial work where necessary, and supervising the operation of a number of counting traps on "index" rivers around the island.

An attempt was made to provide impetus to salmon population, establishment on the Torrent River (above the fishway) by a small adult transfer to the area. Similar planned activity on Lomond River was not carried out since an appreciable number of adults moved upstream through the fishway in 1972.

An extensive reconnaissance of the Gander River was carried out in 1972.

Work continues on updating the "stream catalogue" of all island rivers.

Indian River Project

Operations at Indian River spawning channel continued.

This included fry, smolt and adult enumeration. Some restrictions on sport fishing near the river mouth were implemented to attempt to increase the 1972 spawning escapement.

Due to a severe winter, and low water levels, fry survival from 1971 egg deposition was only 12 percent. This low survival was due to freezing of the spawning beds during the winter.

A record high smolt count of 13,481 fish was recorded in 1972.

The 1972 adult spawning run to Indian River, 102 fish, was the lowest on record.

Plans are being made to provide wider distribution in Indian River of channel fry produced by transferring some of them to tributaries not now productive due to natural barriers.

Labrador Management and Development

Smolt and adult tagging continued at Sand Hill River in 1972. It has been established that significant numbers of Sand Hill River adults are taken in the Greenland fishery.

Both smolt counts and adult counts at the Sand Hill River fence declined in 1972 (smolts - 37007 fish, adults - 2046 fish).

General reconnaissance surveys were conducted on 18 coastal rivers in Labrador.

It is planned that 1973 operations at Sand Hill river will be, in the main, a continuation of 1972 work.

METRO-AREA SPORT FISHERY INVEST. AND MGT.

Activity was mainly a continuation of work begun in earlier years and concerned mainly with the status of recreational fisheries in heavily fished lakes and ponds.

Two heavily fished ponds near St. John's, Paddys Pond and Thomas' Pond have been intensively studied. It has been established that the fish populations of these ponds are being exploited to the fullest. In an effort to provide additional food for their trout populations, sticklebacks were introduced as additional forage. It has been established, as a result, that this species has become a significant item of diet in Paddy's Pond, while little evidence of this appears to have occurred in Thomas' Pond. This may be related to

the limnological features, and water management practices in this pond. It appears that in Paddy's Pond the forage fish introduction has had a marked increase in trout growth.

The "inventory" of Avalon peninsula lakes was continued in 1972. An additional five lakes were surveyed.

A proposed program to provide public boat access to some underutilized lakes and their fish populations, was not implemented in 1972 due to inter-governmental difficulties relating to access road construction and control.

RESERVOIR AND LAKE INVENTORY STUDIES

Fish populations and related limnological studies were carried out at the Victoria Lake reservoir. Due to pre-impoundment studies previously carried out, it was possible to compare "before and after" fish population parameters. It appears that water quality has changed little since impoundment but that there has been increased growth and survival in ouananiche populations. The small pre-impoundment sample of brook trout in Victoria Lake makes a similar comparison for this species impossible.

Long Lake, a natural body of water near Victoria Lake, was also surveyed in 1972. Initial data indicates the lake to have good populations of arctic char, ouananiche and brook trout, in that order of abundance. Though the lake has had a reputation for "big" fish, it appears that, in this respect, it only compares with other Newfoundland lakes with similar limnological features.

A brief survey was also conducted on Long Gull Lake on the West coast, a possible source of water supply for industrialization in that area, to determine the effects on its fish populations, and remedial measures required, if the lake were impounded. The study determined that, if the lake were developed for water supply, measures would be required to protect its fish populations.

Some limnological data were collected at West Pond, Hall's Bay, to evaluate it as a possible source of water supply for a fish culture station.

WATER RESOURCES GROUP

This is a Group, newly created in early 1972 to handle Branch pollution control responsibilities still remaining after the creation of the Environmental Protection Service. It also includes the responsibilities of the Branch's former Environmental Protection Group.

Habitat Alterations

More than 40 applications in such areas as stream crossings, road construction, gravel removal, etc., were reviewed, and recommendations made, relating to their impact on fish populations.

Considerable attention was also devoted to the activities of forest based industries and the effect of their operations on water courses and their fish populations.

Hydroelectric Development - Bay D'Espoir. This large hydro development resulted in the diversion of about 58 percent of the White Bear River headwaters. To protect the White Bear salmon run, it was required of the developer that a minimum flow be guaranteed in the main river below the diversion and that, in addition, they contribute funds, to a maximum of \$75,000, to make accessible compensatory rearing area that had previously been unutilized due to natural obstructions. Engineering work to accomplish this was conducted in 1972.

Industrial Water Supplies - Come-By-Chance. A study has been continuing on this small river since 1969 to determine the effects on its fish population if it were developed as a water supply and, further, remedial measures that would be required if adverse effects were foreseeable. Work during 1972 including operation of smolt and adult counting fences, and of electrofishing to determine existing standing crop.

Water Quality

Laboratory Services

Following the division of work and materials between Resource Development and E.P.S., it was decided that the analytical laboratory would remain with this Branch. However, since E.P.S. people have not yet acquired their own laboratory, that Service is still the major user of our laboratory. This is expected to be remedied soon.

Pollution-Exploits River

Efforts continued to resolve water resource conflicts on this system. Actual pollution control activity is, of course, now a function of E.P.S. This Group, however, works very closely with E.P.S. to ensure that water quality remains adequate for our fish programs on that river. Improvement is anticipated in both major pollution areas in 1973, since the paper mill plans in-plant modifications to reduce its fibre losses, and the mining company should have its new and enlarged tailings system in operation.

COMMERCIAL FISHERIES

This newly formed Group has as its major responsibility the development of information necessary to manage the Newfoundland commercial salmon fisheries for optimum exploitation of its own stocks with minimum effect on salmon stocks from other provinces migrating through our fishing areas.

Emphasis will be placed on refining statistics necessary to properly describe the fishery and the salmon population being exploited.

It is hoped that limited work will be possible on the commercial char fishery of Labrador. It seems probable, too, that some significant effort will have to be devoted to the several facets of the major marine fisheries for cod, flounder, herring, etc.

ENGINEERING SERVICES

Construction

Assistance was provided the Development Group in installation of the two-way counting fence at Sand Hill River.

At Grand Falls, a collection and transfer facility was designed (by consultants) and a contract let for construction about mid-year. An access road to the construction site was designed by our own personnel. The construction contract for construction and transfer facilities should be completed in early 1973.

A new fishway, with counting facilities, began operations at Bishop's Falls in 1972. An escape route for adult and smolt migrants from the Bishop's Falls forebay was also designed and constructed in time to be operative during the 1972 smolt run.

Maintenance engineering work was carried out at a number of locations, including Noel Paul's spawning channel and smolt fence.

The fishway at Camp No. 1, Great Rattling Brook, due to deterioration of the logging dams, has been largely redesigned and construction modifications are underway.

Our engineering crew carried out stream remedial work at White Bear River in accordance with an agreement with the Power Commission. Costs of this work are borne by the Commission.

Stream Remedial and Fishway Maintenance

A small construction crew under supervision of one of our technicians carried out miscellaneous stream improvements at some 17 sites. Assistance was also provided other groups with the installation and removal of several counting fences.

Development

Surveys of access road routes to recreational fishing waters were conducted for the Recreational Fisheries Group.

Investigations were continued to collect further engineering data for a possible fishway at Main Falls on the Upper Humber River.

In cooperation with other Groups, numerous plans for road developments, water and sewerage facilities, and such like were examined and recommendations made.

The surroundings of our field headquarters at Bishop's Falls were considerably improved in 1972 by paving of parking areas and some general landscaping of the site.

A P P E N D I C E S

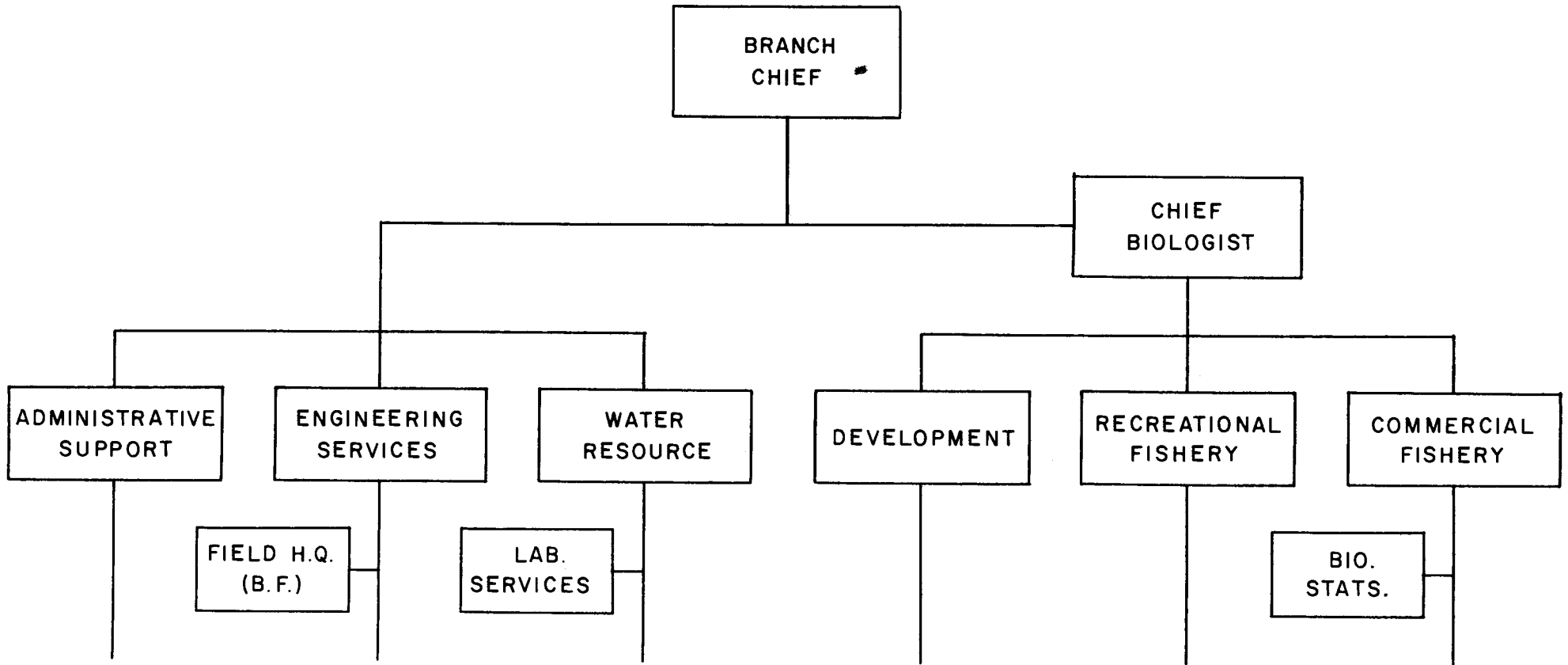
APPENDICES

- Appendix 1. Branch Organization Chart

- Appendix 2. Basic Concept - Multi-Purpose
Fish Culture Establishment (Nfld.)

- Appendix 3. Reports and Publications, 1972.

APPENDIX I
BASIC ORGANIZATION CHART



(Effective April 1st. 1972)

APPENDIX 2

Basic Concept - Multi-Purpose Fish Culture Establishment (Nfld.)

Until recent years it was considered that populations of salmonid fishes in Newfoundland's marine and fresh waters were, within natural variations, adequate to maintain themselves at existing exploitation levels. Aside from increased population and industrialization, two other events suggest that this is no longer the case, and will be even less so in future years. The first of these events is the policy, evidenced by closure of the Port-aux-Basques commercial fishery, that the Newfoundland commercial salmon fishery must be managed, insofar as possible, so as to exploit only its own stocks. This means, when fully operative, that the average take of the Newfoundland fishery must inevitably decline. The second event is the rapid increase in demand for recreational trout fishing opportunity which has already meant, near metropolitan areas (where most of the pressure originates), that some waters are being overfished and others are heading in that direction.

The proposed fish culture establishment has two main objectives. These are (1) to bring large new unutilized freshwater areas into salmon production so as to increase Newfoundland's homewater stocks for both the commercial and recreational fisheries, and (2) to provide management support for the recreational trout fisheries which, except for regulation, is now almost totally lacking.

The establishment, if built, would have an additional significant objective, that being to provide base stock for a marine aquaculture "pilot-plant" experiment using indigenous salmonid species. Some areas of the South coast, in particular, show potential in this regard, but it requires testing.

In summary, the main features of the proposal are:

- (1) To bring into new production, at five year intervals, an estimated 50,000 salmon rearing units (a "unit" equals 100 sq. yds.) - mostly self perpetuating. A rough Benefit: Cost ratio for each such "block" of new production, including stream improvements that would be necessary in some cases, indicates a B:C ratio varying from 1.5:1 to about 3:1 (each "block" of new production would have a different B:C ratio depending on the stream remedial work required to ensure self perpetuating runs when established).
- (2) In the case of self perpetuating runs established, most costs would cease at the end of the five year period but benefits would continue to accrue. In some cases, where

the stream improvement capital has already been invested, but runs are inadequate to populate the newly opened areas, no additional capital investment would be necessary.

- (3) The establishment would provide much needed flexibility in the areas of salmon management and the recreational trout fisheries.
- (4) It would provide, at minimal cost, base stock of one year salmonids for a marine aquaculture "pilot plant".
- (5) Since no such facility now exists in the province, it would provide management diversity and flexibility in a number of areas which cannot be readily provided otherwise.
- (6) The establishment would provide some experimental capacity in salmonid management, as well as contributing significantly to a public information and educational role by way of exhibits on site and stock for temporary exhibitions held annually throughout the province.
- (7) Capital costs of all components of the establishment are estimated (believed generously) at 2.4 million dollars to be expended over a three year period.
- (8) Annual operating costs, including the aquaculture component, are estimated at \$125,000. per annum.
- (9) Even if it were possible to begin operation of the proposed establishment in late 1975, the end product for salmon would not be realized until 1979, by which time it is anticipated that the required need will be much more urgent than at present.
- (10) Initial design of the station, which plans only for relatively small initial output levels, will be such that, if expectations are met, these levels can be doubled or trebled with relatively small additional investment in capital.

APPENDIX 3

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