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Limnological Investigation of
Fundy (New Brunswick) National Park,
1948.

by

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TABLE OF CONTENTS

PAGE

LAKES

Bennett Lake	1
Lake View	5
Headquarters Lake	10
Tabor Lake	12
Tracy Lake	13
Bruin Lake	14
Flagnar Lake	15

STREAMS

Drummond Stream	16
Point Wolf River	17
Forty Five River	19
Upper Salmon River	20

GENERAL CONSIDERATIONS

21

MAPS

Fundy National Park	35
Bennett Lake	36
Lake View	37
Headquarters Lake	38

PHOTOGRAPHS

LAKES

Bennett Lake	39
Lake View	39-40
Headquarters Lake	42
Tabor Lake	41
Tracy Lake	40
Bruin Lake	41
Flagnar Lake	41

STREAMS

Drummond Stream	44-45
Point Wolf River	45-48
Forty Five River	43-44
Upper Salmon River	42-43

Limnological Investigation of
Fundy (New Brunswick) National Park,
1948.

In order to obtain data upon which to base a policy for the wise use of the limnological resources of Fundy (New Brunswick) National Park a study was conducted during the period May 15 to 27 inclusive.

In view of the short time available for the study it was decided that efforts should be made to obtain as much information as possible in regard to the fish populations and other biological, physical and chemical conditions in the two larger lakes in the park and to supplement this by less intensive studies on five of the smaller lakes and portions of three of the larger river systems in the park. The locations of the more important water areas are indicated on the map on page 35.

BENNETT LAKE

This lake, with a surface area of approximately 48 acres lies adjacent to highway 14 in the northwest portion of the park at an altitude of 863 feet above sea level. Because of its accessibility the lake is very popular with anglers.

The lake was investigated on May 19 and 20. It was thoroughly sounded on May 19, and the contour map on page 36 was prepared on the basis of 61 soundings. It will be noted from the map that much of the lake is less than four metres deep and the maximum depth of over nine metres occupies only a very limited area. On page 39 are two photographs of the lake.

Physical and chemical observations made at 3.30 p.m. on May 19 are summarized below.

<u>Depth</u>	<u>Temperature</u>	<u>Dissolved oxygen</u>	<u>Dissolved Carbon dioxide</u>	<u>pH</u>
0 Metres	6.2°C	9.6 cc. per litre		6.3
5 "	6.2°C			
9.5 "	6.2°C	9.4 cc. per litre	Less than 1.5 parts per million	6.2

Transparency (Secchi's disc) 2.5 metres, cloudy, light wind, water brown in colour.

The temperature data indicate that the spring overturn of the lake had occurred only a short time prior to the observations. The abundance of oxygen at all levels is explained by this condition. It is probable that samples taken later in the summer or during the winter would indicate some degree of stagnation in the deeper water, in view of the small area covered by deep water. This stagnation is evidently not often of serious consequence to the fish population but under conditions associated with a prolonged ice cover a part of the fish population might be destroyed.

The bottom fauna of the lake was sampled by three dredgings each covering 1/4 sq. foot of bottom. Complete details regarding these dredgings and the analyses of the bottom fauna contained in them are given in Table 1 on page 24. The information in this table is summarized below.

<u>Dredging Number</u>	<u>Depth of water</u>	<u>Number of animals per dredging</u>	<u>Number of Animals per Square metre</u>	<u>Dry weight of animal organic matter</u>
4	10 Metres	12	518	2.27 pounds per acre
5	3 "	105	4,530	" " "
6	1.5 "	<u>134</u>	<u>5,780</u>	<u>11.95</u> " " "
	Average	84	3,609	22.80

The plankton population of the lake was sampled by a total vertical haul of 10 metres and a horizontal surface tow of 50 yards. In each case a 25 cm. "Wisconsin" type plankton net was used. Details of the plankton organisms secured in these samples are given in Table 2 on page 25 . The total vertical haul secured a volume of 0.2 cc. of plankton. This limited plankton volume was probably correlated with the fact that the water temperature was still low and the growing season had only just begun.

Two gill net series were set in the lake and a total of 57 Eastern Brook Trout were secured for examination. The trout varied from 6 to 12 inches in length and from 1 ounce to 14 ounces in weight. The trout were uniformly fat and in good condition and had fed on a variety of foods. The food items which could be identified are summarized in the following table.

<u>Item</u>	<u>Number of Stomachs</u>	<u>Percent of Stomachs</u>
Molluscs	11	19.7
Insect remains	6	10.7
Damselfly and Dragonfly nymphs	19	33.9
Amphipods	16	28.6
Fish	1	1.8
Amphibians (Spotted salamanders)	1	1.8
Leeches	<u>2</u>	3.5
	56	

Complete details regarding the gill net sets are given in Table 3 on page 26 . Individual details of Eastern Brook Trout examined are given in Table 4 on page 26 . In the second gill net series, in addition to several complete trout, the head only of one Eastern Brook Trout was found. A considerable quantity of slime was present on the net near the fish head. The remainder of the fish had apparently been eaten. The condition of the fish head and the slime on the net suggest the presence of eels in the lake. No other indication of the presence or activity of eels was observed but in view of the short distance of the lake from the sea it seems probable that eels would be present in the lake and also in all other water areas in the park.

Creel census operations were begun in June, and, in spite of the fact that anglers were unfamiliar with this work, data regarding the capture of 148 trout, by anglers, were secured. Of the 148 trout reported taken 69 or 46.6 percent were reported released, presumably because they were less than the length desired by anglers.

Bennett Lake is a productive, slightly acid speckled trout lake rather characteristic of the highland portion of New Brunswick. Several boats were available on the lake for rental in former years. At the time of observation three boats in good condition were available on the lake and the remains of at least seven others were noticed. The lake has been heavily fished for many years and since daily catch limits have apparently not been enforced upon anglers, individual

catches of 40 to 70 fish per day were reported as common during the early part of the season. As an example of the intensity of angling to which the lake was exposed it was noted that 12 cars containing about 30 anglers visited the lake on May 24 before noon. Six additional cars were observed to be parked at the lake during the afternoon. It seems probable that several hundred fish were taken on this occasion. Much of the angling on the lake was carried on during the first three weeks in May and it is probable that the quality of the angling deteriorated to some extent during the latter part of the summer.

With the organization of a warden service in the park area and the enforcement of park regulations regarding fishing it seems probable that even with the increasing popularity of the area as a recreation center the intensity of fishing on Bennett Lake will be decreased somewhat in future years. It is not known at this time whether a decrease in fishing intensity will bring about an increase in the average size of fish in the lake, but experience in other areas has indicated the probability of this result.

LAKE VIEW

This lake with approximately the same surface area as Bennett Lake (48 acres) lies in a differently shaped basin. A considerable portion of the lake has a depth exceeding 5 metres although the area exceeding 9 metres in depth is approximately the same size as that in Bennett Lake. The lake lies in the extreme northwest corner of the park at an altitude of approximately 960 feet above sea level. The lake is easily accessible from highway 14 and has apparently been more of a summer resort than Bennett Lake since several well-constructed

cottages are to be found on its northwest shore. Several boats were present on the lake at the time of observation. These probably belonged, in at least some cases to the owners of the cottages. Photographs of the lake appear on pages 39 and 40.

Physical and chemical observations made at 3.00 p.m. on May 21 are summarized below.

<u>Depth</u>	<u>Temperature</u>	<u>Dissolved Oxygen</u>	<u>Dissolved Carbon dioxide</u>	<u>pH</u>
0 Metres	9.2°C	9.2 cc. per litre	Nil	6.5
3 "	9.0°C			
4 "	8.6°C			
5 "	8.0°C			
8.5 "	7.8°C	9.0 cc. per litre	Nil	6.5

The temperature data indicate that this lake warms up somewhat earlier than Bennett Lake. The abundance of dissolved oxygen at all depths suggest that stagnation of the deeper water is unlikely except under extreme winter conditions.

The lake was sounded on May 21 and the contour map on page 37 was prepared on the basis of the 62 soundings taken.

The bottom fauna of the lake was sampled by three dredgings each covering 1/4 sq. foot of bottom. Complete details regarding these dredgings and the analyses of the bottom fauna contained in them are given in Table 5 on page 29. The information in this table is summarized below.

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Private cottages will not be available now that the park is established.

<u>Dredging Number</u>	<u>Depth of Water</u>	<u>Number of Animals per dredging</u>	<u>Number of Animals per square metre</u>	<u>Dry weight of animal organic matter</u>
7	7.5 metres	44	1,895	7.60 pounds per acre
8	3.0 "	146	6,300	10.58 " " "
9	1.5 "	<u>100</u>	<u>4,314</u>	<u>6.31</u> " " "
	Average	97	4,169	8.16

The plankton population of the lake was sampled by a total vertical haul of 9 metres and a horizontal surface tow of 50 yards. In each case a 25 cm. "Wisconsin" type plankton net was used. Details of the plankton organisms secured in these samples are given in Table 6 on page 30. The total vertical haul secured a volume of 0.5 cc. of plankton. This limited plankton volume was probably related to the fact that the growing season for these organisms had just begun.

A gill net series comprising 25 yards of each of $1\frac{1}{2}$ ", 2" and 3" mesh was set in the lake at 5.00 p.m. on May 22 in water depths ranging from 1 to 5 metres. The net series was lifted at 9.30 a.m. May 23, following a night of heavy rain and strong wind. The net contained 39 Eastern Brook Trout ranging in length from $5\frac{3}{4}$ inches to $9\frac{3}{4}$ inches and in weight from 1 oz. to 5 oz. Complete details of the trout are recorded in Table 7 on page 31. All the trout secured were fat and in good condition. All the female fish contained seed eggs and it would appear that the larger specimens had spawned during the previous autumn. Food items were identifiable in the stomach contents of many of the trout as indicated in the following table.

<u>Item</u>	<u>Number of Stomachs</u>	<u>Percent of Stomachs</u>
Dragonfly Nymphs	40	84
Amphipods	4	8
Earthworms	<u>4</u>	8
	48	

The earthworms probably found their way into the trout stomachs as a result of angling. Several anglers fished the lake on May 21, 1948 and reported losing fish which may have carried away part of the bait. The bait used consisted, in all cases, of earthworms.

It will be noted that the percentage of dragonfly nymphs in the food of the trout of Lake View was considerably higher than was observed in Bennett Lake. No large population of dragonfly nymphs was observed in the bottom samples taken by dredgings although numerous nymphs were observed living among vegetation in extremely shallow water. It appears probable that the trout had fed extensively in shallow water during the night. One fish taken in the gill net had been partly eaten by some animal. Near the partly eaten trout a quantity of mucous was found adhering to the net. As in the case of Bennett Lake these observations were considered to indicate the presence of eels in the lake. Spotted salamanders were observed near the south end of the lake but none were found in trout stomachs. Many small trout approximately $1\frac{1}{2}$ inches long were observed near the outlet of the lake. The lake was stocked with 600 No. 4 fingerling Eastern Brook Trout in 1945 by the Department of Fisheries. The presence of small trout in the lake in the spring of

1948 indicates the occurrence of natural reproduction. The considerable population of trout, as shown by gill net catches and angling records from the lake, suggest that natural reproduction is capable of maintaining a balanced population in the lake.

Creel census operations were begun on May 25 at the lake, and, in spite of the fact that the park operating routine was not fully effective until much later in the season, data regarding the capture of 174 trout by anglers were secured. Of the 174 trout reported taken 58 or 31.5 percent were reported released presumably since they were less than the length desired by anglers.

Of the 39 trout secured in the gill netting operation 67 percent were shorter than the minimum legal length for trout as set forth in the regulations governing fishing in the national parks.

Lake View, like Bennett Lake, has been heavily fished for many years, and, as in Bennett Lake, individual catches have been large. Since some of the cottages have been located on the lake for many years it is probable that the lake has been fished on a more continuous basis, but possibly by a smaller number of anglers, than Bennett Lake.

HEADQUARTERS LAKE

This small lake lies in the area which is being developed as a park townsite. Its surface area is approximately 1.75 acres. It is surrounded on all sides by a typical bog. As would be expected the ring of vegetation appears to be advancing over the open waters of the lake, the free edge of the vegetation mass floating on the surface of the water. The lake was investigated on May 18 and 19. It was thoroughly sounded and the contour map on page 38 was prepared on the basis of 21 soundings. It will be noted from the contour map that the lake is deep in relation to its size. Much of the bottom area is below the 10 metre contour.

Physical and chemical observations made at 4:00 p.m. on May 18 are summarized below.

<u>Depth</u>	<u>Temperature</u>	<u>Dissolved Oxygen</u>	<u>Dissolved Carbon dioxide</u>	<u>pH</u>
0 metres	10°C	9.2 cc. per litre	Nil	6.2
2 "	8°C			
3 "	5.5°C			
4 "	5.0°C			
5 "	4.8°C			
7 "		0.7 cc. per litre	13 parts per million	
10 "	4.5°C			
11.5 "	4.5°C	0.4 cc. per litre	22 parts per million	6.0

Transparency (Secchi's disc) 1 metre, broken clouds, light wind, water brown in colour.

The lake has no continuous surface inlet, but receives runoff water from a small drainage area to the northeast, following heavy rains. The lake drains by a narrow channel to the sea although no flow was occurring in the channel at the time of the investigation. A photograph of the lake is on page 42.

As will be seen from the above table the amount of dissolved oxygen present in the lower levels of the lake was insufficient to support trout. The fact that this degree of stagnation was present in the early spring suggests that complete stagnation of the lake would probably occur during the winter. This would appear to preclude the possibility of successfully maintaining trout in the lake although it might be possible to maintain a population of fish of other species which could tolerate very low oxygen concentrations.

The bottom fauna of the lake was sampled by three dredgings each covering 1/4 sq. foot of bottom. Complete details regarding these dredgings and the analyses of the bottom fauna contained in them are given in Table 8 on page 33. The information contained in this table is summarized below.

<u>Dredging Number</u>	<u>Depth of Water</u>	<u>Number of animals per dredging</u>	<u>Number of Animals per square metre</u>	<u>Dry weight of animal organic matter</u>
1	11.5 metres	2	86	0.08 pounds per acre.
2	5 "	3	129	2.00 " " "
3	3.5 "	5	215	2.23 " " "
	Average	3.3	143	1.44 " " "

The plankton population of the lake was sampled by a total vertical haul of 12 metres and a horizontal surface tow of 50 yards, in each case using a 25 cm. "Wisconsin" type plankton net. Details of the

plankton organisms secured in these samples are given in Table 9 on page 34. The total vertical haul secured a volume of 0.6 cc. of plankton. This limited plankton volume was composed largely of the larvae of Corethra sp.

A gill net series consisting of 25 yards of each $1\frac{1}{2}$ ", 2" and 3" mesh net was set at 7:00 p.m. May 18 in water ranging in depth from 4 to 10 metres. The gill net series was lifted at 9:00 a.m. May 19, and contained no fish. Reports by local residents suggested that fish had been seen in the lake on few occasions. It seems probable that salamanders may have been observed and reported as fish. This has occurred in other water areas in other parks on several occasions.

FAVOR LAKE

This small lake of approximately 10.5 acres surface area was visited on May 23. The lake is reached by travelling over a series of old wood roads beginning near the road bridge across the Point Wolf River. The actual distance from the Point Wolf River to the lake is approximately $4\frac{1}{2}$ miles, but in view of the fact that the wood roads are not marked in any way, considerable difficulty was encountered in selecting the right roads and finally reaching the lake. As seen in the photograph on page 41 the forest cover extends almost to the water's edge all the way around the lake. The lake drains by way of a small stream to the Goose River. At the time of the visit this stream was carrying between 15 and 25 cubic feet of water per second. At 6:00 p.m. the surface temperature was 11°C . The bottom of the lake appeared to

be composed mainly of soft deposits although some stones were observed. Stones and gravel were present in the outlet stream and conditions in that area appeared suitable for the spawning of Eastern Brook Trout. Several rafts were available on the lake and although an examination of the eastern half of the lake was made from one of these, no trout were observed. The eastern end of the lake had an average depth of approximately 4 feet, the western end appearing somewhat deeper. Creel census data secured from the lake record the capture of 67 Eastern Brook Trout, with an average fishing effort of 0.6 hours per fish. The size range of the fish reported taken extended from 8 to 15 inches, the 15 inch fish being the largest reported taken anywhere in the Park. Fishing in the lake is reported as erratic by residents of the area who have had several years experience on the lake.

In view of the fact that angling in the lake involves a walk of at least 10 miles over unmarked trails and wood roads, it is not considered that the angling intensity will be great. The trout population of the lake has apparently maintained itself naturally and since large fish have been reported taken from the lake in each of the past several years no fish cultural action seems necessary at present. If the development of the park area renders the lake more easily accessible to anglers, the management of the fish population will require further consideration.

TRACY LAKE

This lake is one of the headwaters of the drainage system of which Bennett Lake and Bennett Brook are lower components. The

lake has an area of approximately 14.5 acres. Much of the lake is shallow although a water depth of at least 2.5 metres was observed. Boats were formerly available on the lake for rental to anglers although according to reports the lake was never very popular because of its relative inaccessibility. One boat was present on the lake at the time of the investigation and this was found to be in sufficiently good repair to permit an examination of much of the lake. The bottom of the lake was largely composed of soft material covered in many places with submerged rooted vegetation. The bottom of the lake near the outlet stream and the bottom of the outlet stream itself were covered with gravel which appeared to offer suitable conditions for spawning of Eastern Brook Trout. The lake is reported to contain large Eastern Brook Trout although none were observed during the investigation. No creel census data were secured from the lake. Many salamanders were observed lying on the bottom of the lake in shallow water apparently in preparation for mating. The lake is accessible by proceeding up-stream from Bennett Lake or by traveling approximately one mile through the forest from the north end of Bennett Lake. No trail was found in this area. The lake is also accessible from Bruin Lake which is in turn reported to be accessible by trail from the Shepody road. A photograph of the lake is on page 40.

BRUIN LAKE

This small lake which forms one of the headwaters of Laverty Brook which in turn empties in the upper Salmon River is accessible over a trail approximately 300 yards in length extending north from

the north end of Tracy Lake. The lake has an area of approximately 4.5 acres and much of the water appears shallow. No boat or raft was available in the lake so only a shore examination was possible. As in the case of Tracy Lake many salamanders were observed in shallow water. Splashes on the surface of the lake some distance from shore appeared to indicate the presence of large numbers of fish although no individuals were seen clearly enough to be positively identified as fish. As in the case of the other small lakes in the park the forest cover extended to within a few yards of the water's edge on all sides. A photograph of the lake is on page 41.

This lake has been reported to contain a small number of moderate-sized trout and apparently has not been heavily fished in the past because of its inaccessibility and its small size. As in the case of the other small lakes, increased ease of access through development of a system of trails in the park may necessitate management of the fish population at some future time.

FLAGNAR LAKE

This lake, of approximately 6 acres surface area, is approximately 1/2 mile northeast of ~~Tabor~~ Lake and drains by way of a small stream into the Point Wolf River. The outlet stream at the time of observation was flowing at the rate of 10 to 20 cubic feet per second. The surface temperature of the lake at 4.30 p.m. on May 23 was 14°C. The pH at the same time was 6.5.

Like ~~Tabor~~ Lake the forest cover extends almost to the water's edge in Flagnar Lake. The lake margin itself is largely swampy and several small inflowing streams are present. The lake

bottom is soft near shore and the lake appears to be relatively shallow. As in the case of Tabor Lake stones and gravel occur in the bottom near and in the outlet stream and presumably provide suitable conditions for the spawning of Eastern Brook Trout. No trout were observed in the lake although anglers have reported good catches of trout from the lake on a few occasions. No creel census cards were received for this lake. Evidence of muskrat activity was present on the lake margins and a muskrat was observed in the outlet stream. The water in the lake was clear with a faint brown colour. A photograph of the lake is on page 41.

DRUMMOND STREAM

This stream, which drains Lake View and is a tributary of the Point Wolf River, has been used extensively during past years for the transport of logs cut in the area south of Lake View to the mill near the mouth of the Point Wolf River. In order to facilitate log-driving² a timber dam has been constructed at a point approximately $1\frac{1}{2}$ miles south of Lake View. The construction of this dam has created a pond area approximately $\frac{3}{4}$ mile long extending up-stream from the dam. The dam is approximately 500 feet long and 20 feet high at the centre and is well shown in the photographs on pages 44 and 45. The dam is fitted with large gates which may be opened quickly and which will permit the rapid flow of water required for log-driving in the lower reaches of the stream.

The stream was visited on May 24, which was approximately 10 days after the last log-driving operations had been conducted. The effects of the sudden release of a large volume of water for log-driving purposes were easily observed below the dam and the scouring action of

²This operation ceased with the establishment of the park.

this rapid flow appeared to have been quite great. Twenty hand-sized stones which were examined in the stream bed below the dam and which would have been expected to be populated by insect larvae in fair numbers were completely bare as the result of the scouring action. The stream below the dam contained several deep pools and might be capable of supporting a moderate population of Eastern Brook Trout provided that the use of the dam for log driving is discontinued. The pond above the dam is largely filled with alders and since it is shallow over most of its area it would probably become too warm to be a suitable habitat for Eastern Brook Trout during the summer. At 3:00 p.m. on May 24 the surface temperature of the water in the pond was 9.°C and the pH was 6.0. The surface pH in Lake View on May 21 was 6.5. The lower value obtained in the pool on the Drummond Stream was considered to be due to the large mass of decaying wood in the pond.

Now that logging operations are terminated the dam will fall into disrepair and can be expected to collapse within a few years. After that time the stream will return to its original condition and since its flow is stabilized to some extent by Lake View it should provide a limited amount of good angling for Eastern Brook Trout in its numerous pools.

POINT WOLF RIVER

The lower reaches of this river lie in a gorge of considerable depth and are similar in some respects to those of the Cheticamp River in Cape Breton Highlands National Park. At the present time a dam near the mouth of the river prevents the up-stream

migration of salmon and consequently the only sport fish found in the river is the Eastern Brook Trout. The lower three miles of river contain many attractive pools and it seems probable that if salmon could ascend the river conditions would be suitable for the provision of good-quality salmon angling in some of the pool areas. Several photographs showing various features of the river are on pages 45, 46 and 47. At present there are no adequate trails either in the bottom of the river gorge or along the top of the banks on either side. In view of the picturesque nature of the gorge, it seems probable that trails will be constructed at least along the banks of the river. Such trails would render accessible the pools along the river and would make it easier for anglers to reach these areas. The dam, which is situated near the mouth of the river, is not provided with a fishway and consequently is a complete barrier to up-stream migration of fish. At present the pond above the dam is reported to contain a small population of Eastern Brook Trout of good size. Creel census data concerning 14 trout taken from this pond record a size range of 8" to 13".

Eastern Brook Trout fingerlings, in the following numbers, were released in the river by the Fisheries Department.

<u>Year</u>	<u>Number</u>
1935	10,000
1936	5,000
1937	10,000
1938	5,000

A former resident of the area near the dam has reported that approximately 12 years ago the dam fell into disrepair and was carried away during the spring freshet. Salmon in considerable numbers were

reported, to have passed up the river during the late summer following the removal of the dam. The dam was subsequently replaced and at a later date large numbers of young salmon were observed passing over the dam on their way to the sea.

If a suitable fishway was provided or if the dam was removed it is probable that an annual salmon run capable of providing angling in the lower reaches of the river would result. The dam at present is a picturesque addition to the river and if it is to be maintained in its present condition the construction of a suitable fishway would permit the up-stream migration of salmon. If routine maintenance of the dam is neglected for a few years the dam will be carried away and salmon migration will be possible. The dam could also be removed in the near future by explosives or other means if such a course is deemed desirable.

FORTY FIVE RIVER

This river, which is one of the tributaries of the Upper Salmon River, bears much the same relation to that river as does Drummend Stream to the Point Wolf River. The large dam which controls the flow of water for log driving on this river is located outside the park boundary, but the effect on the river bed of its operation is of a similar nature to that of the dam on Drummend Stream. This river has a gorge similar to the Point Wolf River with steep tree-covered slopes rising to heights of from 200 to 300 feet in many places. In some places bare rock walls from 50 to 75 feet high are present although usually only on one side of the river at any one point. Photographs of this river are on pages 43-44. On May 25, at

3.20 p.m. the temperature of the river was 7°C. and the pH 6.8. Below the junction of the north and south forks of the Forty Five River, the river was approximately 40 feet wide, about 1 foot deep, and was flowing at the rate of about 5 feet per second. A small collection of bottom fauna was made at this point from stones in the river bed. This collection contained mayfly nymphs of several sizes.

Since this river is subject to artificially controlled spring freshets its fish-holding capacity is greatly reduced at the present time. If the log driving operations cease the river could support a moderate population of small trout and would provide angling in its pool areas.

THE UPPER SALMON RIVER

This river, which enters the Bay of Fundy adjacent to the town of Alma, is blocked by a dam about 18 feet high approximately 3/4 mile from its mouth. The west bank of the river forms the park boundary. At the west end the dam is equipped with a fishway as shown in the photographs on pages 42 & 43. The fishway has long been inoperative and its design leaves much to be desired. At the present time this river, like the Point Wolf River, is inaccessible to upstream migrating salmon. The salmon are reported to enter the mouth of the river in late August and early September of each year although their up-stream migration is necessarily terminated below the dam. The pond immediately above the dam, which was filled with logs at the time of the writer's visit to the park, is reported to contain a considerable number of large-sized Eastern Brook Trout. The water in the river was quite clear in spite of the presence of large numbers of logs which had come down the river

during the week. An examination of the bottom fauna of the river above the head of the pond indicated that the disturbance of the bottom due to log driving was much less severe in this portion of the river than in the Forty Five River or Drummond Stream.

If the fishway at the dam were restored it seems probable that an autumn run of salmon would occur in spite of the use of the river for logging operations in the spring of each year.

GENERAL CONSIDERATIONS

It will be seen from the foregoing remarks regarding some of the lakes and streams lying within the boundaries of Fundy (New Brunswick) National Park, that the native, freshwater game fish is the Eastern Brook Trout. This fish provides a considerable amount of angling under a wide variety of conditions and has apparently been able to maintain its populations in spite of heavy and continuous angling during past years.

The possibility of offering salmon angling in the area has been discussed and it would seem probable that an excellent run of salmon would occur in each in the large rivers in the park if provisions were made whereby the salmon could proceed without obstruction up these rivers.

In connection with the production of salmon angling it should be realized that salmon will not enter a river from salt water unless the volume of inflowing freshwater is great enough to form a strong attraction. Precipitation conditions in August and early September will have a considerable effect on the numbers of salmon which may ascend the rivers in the park during this period just as

the amount of precipitation in June affects the number of salmon which enter the Cheticamp River in Cape Breton. In order that salmon may be available for angling it is necessary that sufficient numbers of them have ascended the river. It should be noted, however, that for reasons not well understood it is sometimes impossible to take salmon, by angling, from areas in which numbers are present.

In European areas, where salmon runs are equally influenced by precipitation, recourse has sometimes been made, with success, to the production of artificial freshets as a means of attracting salmon from the sea into the rivers, especially during times of drought when natural freshets were lacking.

The log-driving dams on the Drummond Stream and Forty Five River are designed to produce artificial freshets and could be used, if necessary, as a means of creating suitably-timed freshets to attract salmon to enter the Point Wolf and Upper Salmon Rivers.

While the writer was investigating the limnological conditions in the area it was pointed out by members of the staff of the Department of Fisheries that introductions of Rainbow Trout had been made with considerable success to river systems both east and west of the park area. Since physical and chemical conditions in these rivers were reported to be quite similar to those present in the Upper Salmon River, the Point Wolf River and some of their tributaries it seems probable that Rainbow Trout could be expected to survive and reproduce in the large river systems in the park. In the rivers outside the park where the Rainbow Trout have been introduced this species has established itself in portions of the drainage areas which were not regularly frequented by Eastern Brook Trout.

Creel census operations in the park have been conducted on a limited scale during 1948. The information so obtained is useful in connection with the studies made in the area during 1948.

Large piles of sawdust, resulting from the operations of sawmills during many years, are present at many points in the park, as seen in the photographs on page 47. Fortunately, most of this sawdust has been piled on land and little damage to limnological interests has occurred.

The piles of sawdust present a considerable fire hazard, as well as detracting from the esthetic beauty of many parts of the park. The disposal of the sawdust will presumably be carried out as soon as possible, probably by burning or burying.

Table 1

() Length in millimetres.

Bottom Fauna - Bennett Lake.

Dredging number	4	5	6
Area covered (Square feet)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Depth of water (metres)	10	3	1.5
Type of bottom	Soft brown organic material	Soft brown material with many plants	Soft brown material with plants.

Fauna

Mollusca				
		1(2.5)		
			1(5)	
Annelida				
	6(10-25)			
Crustacea				
	1(2.5)	39(2-4)	39(2-4)	
	common			
			1(1)	
Insecta				
Odonata				
		8(7-22)	4(10-16)	
		5(10-20)		
Diptera				
	5(3-7)	51(2-24)	70(3-9)	
			6(7-10)	
		<u>1(6)</u>	<u>13(7-15)</u>	<u>Average</u>
Total animals per dredging	12	105	134	84
Total animals per sq. metre	518	4530	5780	3609
Dry weight, animals, gms.	0.0058	0.1383	0.0305	
Animal organic matter,				
Dry weight, pounds per acre	2.27	54.20	11.95	22.80

Table 2

A - Abundant
 C - Common
 R - Rare

Plankton - Bennett Lake.

	<u>Horizontal surface tow, 50 yards (0.2 cc.)</u>	<u>Total vertical haul 10.5 metres (0.2 cc.)</u>
<u>Phytoplankton</u>		
Bacillariae		
<u>Tabellaria</u> sp.	C	C
<u>Pinnularia</u> sp.		R
Volvocaceae		
<u>Volvox</u> sp.	R	
Myxophyceae		
<u>Lyngbya</u> sp.	R	R
<u>Zooplankton</u>		
Rotifera		
<u>Anuraea</u> sp.	R	R
Cladocera		
<u>Bosmina</u> sp.	R	C
<u>Daphnia longispina</u>	R	
Copepoda		
<u>Diaptomus</u> sp. (Young & adult)	R	R
<u>Canthocamptus</u> sp.	R	
Mastigophora		
<u>Ceratium hirudinella</u>	R	C
<u>Miscellaneous Material</u>		
Pollen Grains	A	A
Detritus	50%	60%

Table 3Gill Net Sets - Bennett Lake

<u>Set Number</u>	<u>Meshes</u>	<u>Lengths</u>	<u>Depth of water</u>	<u>Time in</u>	<u>Time out</u>	<u>Type of bottom</u>
2	1½", 2", 3"	25 yds. of each	1-4 metres	1:00 p.m. 19/5/48	6:00 p.m. 19/5/48	Sand & soft mud
3	1½", 2", 3"	25 yds. of each	1-4 metres	6:00 p.m. 19/5/48	9:00 a.m. 20/5/48	Sand & soft mud

Appendix Table 4Gill Net Catch - Bennett Lake.Eastern Brook Trout

<u>Number</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>Stomach contents</u>
<u>Set Number 2.</u>				
1	12"	12 oz.	F	seed eggs Clams - one 6½", 1 oz. trout
2	10½"	6½ oz.	F	6 cc. Clams.
3	8"	2¾ oz.	M	imm. 2 cc. Clams.
4	7¼"	2 oz.	M	imm. 2 cc. Clams and damselfly nymphs. Black spots on skin.
5	6½"	1½ oz.	M	imm. 1½ cc. insect remains.
6	6¾"	2 oz.	M	imm. 2 cc. insect remains.
7	6"	1½ oz.	F	imm. 2 damselfly nymphs, 4 dragonfly nymphs.
8	6¾"	1½ oz.	F	seed eggs 1 leech. Tapeworm in intestine
9	6¼"	1½ oz.	F	imm. 2 cc. insect remains. Tapeworm
10	6½"	1½ oz.	F	imm. 4 dragonfly nymphs.
11	6¾"	1½ oz.	M	imm. Insect remains. Tapeworm
<u>Set Number 3.</u>				
12	12"	14 oz.	F	old eggs present Beetle larvae, dragonfly nymphs clam. One 6½" and one 6¾" spotted salamanders. Tapeworm.
13	8¾"	4 oz.	M	1 dragonfly nymph. 2 cc. shrimp several tapeworms.
14	11"	9 oz.	M	6 cc. clams (full stomach) damselfly nymph.

<u>Number</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>Stomach contents</u>
<u>Set Number 3 (continued).</u>				
15	8 $\frac{5}{4}$ "	4 oz.	M	Empty
16	8 $\frac{5}{4}$ "	3 $\frac{1}{4}$ oz.	M	3 cc. Snails. Large tapeworm.
17	8 $\frac{5}{4}$ "	4 oz.	F seed eggs.	3-4 cc. clams. Tapeworm in posterior part of stomach.
18	6 $\frac{3}{4}$ "	1 $\frac{1}{2}$ oz.	M imm.	Snails, digested matter.
19	6 $\frac{1}{2}$ "	1 oz.	F spawning this year.	Dragonfly nymph.
20	6 $\frac{5}{4}$ "	1 $\frac{1}{2}$ oz.	M	Small amount digested matter. Tapeworms.
21	6 $\frac{1}{4}$ "	1 oz.	M	Small amount digested matter.
22	6 $\frac{1}{2}$ "	1 $\frac{1}{4}$ oz.	M	2 cc. digested matter. Tapeworms.
23	6 $\frac{5}{4}$ "	1 $\frac{1}{2}$ oz.	F has spawned, old eggs present.	Shrimps.
24	6 $\frac{1}{2}$ "	1 $\frac{1}{4}$ oz.	F	Empty.
25	6 $\frac{1}{2}$ "	1 oz.	F	1 cc. Shrimps.
26	7 $\frac{1}{2}$ "	2 $\frac{1}{2}$ oz.	M	Leech, dragonfly nymphs, shrimps.
27	6"	1 oz.	M	Empty.
28	6"	1 oz.	M	2 large dragonfly nymphs.
29	6 $\frac{5}{4}$ "	1 $\frac{1}{2}$ oz.	F	1 dragonfly nymph.
30	6 $\frac{1}{2}$ "	1 $\frac{1}{2}$ oz.	F	2 dragonfly nymphs, shrimps.
31	6 $\frac{5}{4}$ "	1 $\frac{1}{2}$ oz.	F	Dragonfly nymphs remains.
32	6"	1 oz.	M	Shrimp remains.
33	6 $\frac{5}{4}$ "	1 $\frac{1}{2}$ oz.	F	Tapeworms, empty.
34	6 $\frac{1}{4}$ "	1 oz.	F	Tapeworms, 1 dragonfly nymph, 2 damselfly nymphs.
35	6 $\frac{5}{4}$ "	1 $\frac{1}{2}$ oz.	M	Empty.
36	6 $\frac{1}{2}$ "	1 $\frac{1}{2}$ oz.	F	3 dragonfly nymphs.
37	6 $\frac{1}{2}$ "	1 $\frac{1}{2}$ oz.	M	2 damselfly nymphs.

<u>Number</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>Stomach contents</u>
<u>Set Number 3 (continued)</u>				
38	6"	1 oz.	F	1 cc. shrimps, 1 clam.
39	6 $\frac{1}{2}$ "	1 $\frac{1}{2}$ oz.	F	2 cc. shrimps.
40	6 $\frac{1}{2}$ "	1 $\frac{1}{2}$ oz.	F	2 cc. digested matter.
41	6"	1 $\frac{1}{2}$ oz.	F	1 beetle larva, small amount digested matter.
42	6"	1 oz.	F	Empty.
43	6 $\frac{1}{4}$ "	1 oz.	F	2 cc. digested matter including shrimps.
44	6 $\frac{3}{4}$ "	1 $\frac{1}{2}$ oz.	F	Tapeworms, some digested matter.
45	6 $\frac{1}{4}$ "	1 $\frac{1}{4}$ oz.	F	Digested matter.
46	6 $\frac{3}{4}$ "	1 $\frac{1}{2}$ oz.	F	Tapeworms, small amount digested matter.
47	6"	1 oz.	M	2 cc. damselfly nymphs.
48	6 $\frac{1}{4}$ "	1 oz.	F	3 cc. digested matter, mostly shrimps.
49	6 $\frac{1}{4}$ "	1 oz.	F	1 $\frac{1}{2}$ cc. shrimps.
50	6 $\frac{1}{4}$ "	1 $\frac{1}{2}$ oz.	M	Clams, shrimps 2 cc.
51	6"	1 $\frac{1}{4}$ oz.	F	1 $\frac{1}{2}$ cc. shrimps.
52	6"	1 oz.	M	Damselfly nymphs, $\frac{1}{2}$ cc. shrimps.
53	6"	1 oz.	M	Dragonfly nymph, shrimps, digested matter.
54	6 $\frac{1}{4}$ "	1 oz.	F	1 cc. shrimps.
55	6 $\frac{3}{4}$ "	1 $\frac{1}{2}$ oz.	F	Small clams.
56	6"	1 oz.	F	1 large dragonfly nymph.
57	6 $\frac{1}{2}$ "	1 oz.	M	Dragonfly nymph.

Table 5.

() Length in millimetres.

Bottom Fauna - Lake View

Dredging number	7	8	9
Area covered (Square feet)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Depth of water (metres)	7.5	3	1.5
Type of bottom	Soft brown ooze, many fish drop-pings.	Soft brown ooze, some plants	Brown sandy material, some rooted plants.

Fauna

Mollusca				
<u>Pisidium</u> sp.	2(2)			
Annellida				
Oligochaeta		2(10-15)		
Hydracarina	1(1.5)	1(2)	3(2.5)	
Crustacea				
Amphipoda (<u>Hyaella</u> sp.)	18(2-4)	51(1.5-4.5)	61(3-4)	
Insecta				
Coleoptera				
Hydrophyllidae larvae		2(6-11)		
Ephemeroptera nymph		1(3.5)		
Diptera				
<u>Chironomid</u> larvae	22(4-9)	81(2-9)	32(3-7)	
<u>Ceratopogonid</u> larvae		1(10)	1(7)	
Trichoptera				
<u>Psilotreta</u> sp.		3(8-11)		
Odonata				
Anisoptera nymph	1(22)	2(8-10)	2(8)	
Zygoptera nymph		<u>2(15-23)</u>		<u>Average</u>
Total animals per dredging	44	146	100	97
Total animals per sq. metre	1895	6300	4314	4169
Dry weight, animals, grams.	0.0194	0.0270	0.0161	
Animal organic matter, dry weight, pounds per acre	7.60	10.58	6.31	8.16

Table 6.

A - Abundant
 C - Common
 R - Rare

Plankton - Lake View

Horizontal surface tow,
50 yards (1.9 cc.)

Total vertical haul
9 metres (0.5 cc.)

Phytoplankton

Desmidiaceae

Staurastrum sp. R

Bacillariae

Pinnularia sp. R

Zooplankton

Cladocera

Holopedium gibberum R R

Bosmina sp. C C

Daphnia pulex R R

Copepoda

Diaptomus sp. A A
 (adults & young)

Cyclops sp. R R

Rotifera

Conochilus sp. R R

Notholca sp. C

Mastigophora

Dinobryon sp. R

Table 7.

Gill Net Catch - Lake View.

Eastern Brook Trout.

<u>Number</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>Stomach contents</u>
				<u>Set Number 4.</u>
58	9 $\frac{3}{4}$ "	4 $\frac{3}{4}$ oz.	F	6 Dragonfly nymphs.
59	9"	4 oz.	M	5-6 cc. Dragonfly nymphs, tapeworms.
60	9 $\frac{3}{4}$ "	5 oz.	F	7-8 cc. Dragonfly nymphs (Stomach full).
61	8 $\frac{1}{2}$ "	3 $\frac{1}{2}$ oz.	F	5-6 cc. Dragonfly nymphs and shrimps.
62	8 $\frac{3}{4}$ "	4 $\frac{1}{2}$ oz.	F	5-6 cc. Dragonfly nymphs.
63	9 $\frac{1}{4}$ "	4 $\frac{1}{4}$ oz.	F	5-6 cc. Dragonfly nymphs.
64	8 $\frac{1}{2}$ "	3 $\frac{1}{2}$ oz.	M	4 cc. Dragonfly nymphs.
65	7 $\frac{1}{2}$ "	2 $\frac{1}{2}$ oz.	F	2 Dragonfly nymphs.
66	7"	1 $\frac{3}{4}$ oz.	M	4 cc. Dragonfly nymphs.
67	7"	2 oz.	F	5 cc. Dragonfly nymphs.
68	9"	4 oz.	M	6 cc. Dragonfly nymphs.
69	7 $\frac{3}{4}$ "	3 oz.	F	6 cc. Dragonfly nymphs, earthworms and shrimps.
70	8 $\frac{1}{4}$ "	3 oz.	F	5 cc. Dragonfly nymphs.
71	7 $\frac{1}{4}$ "	2 $\frac{1}{2}$ oz.	F	5 cc. Dragonfly nymphs.
72	8 $\frac{3}{4}$ "	5 oz.	F	10 cc. Dragonfly nymphs, shrimps.
73	7"	2 $\frac{1}{2}$ oz.	F	3 Dragonfly nymphs.
74	7"	2 oz.	F	4 cc. Dragonfly nymphs.
75	9"	5 oz.	M	30 Dragonfly nymphs.
76	7"	2 $\frac{1}{2}$ oz.	M	4 cc. Dragonfly nymphs.
77	7"	2 $\frac{1}{2}$ oz.	F	4 Dragonfly nymphs.
78	6 $\frac{3}{4}$ "	2 oz.	M	5 Dragonfly nymphs.
79	6 $\frac{3}{4}$ "	2 oz.	F	4-5 cc. Dragonfly nymphs, earthworms.
80	7"	2 oz.	M	4 cc. Dragonfly nymphs.

<u>Number</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>Stomach contents</u>
<u>Set Number 4 (Continued).</u>				
81	8"	3 oz.	F	6 cc. Dragonfly nymphs.
82	7"	2 oz.	F	6 Dragonfly nymphs.
83	7 $\frac{1}{2}$ "	3 oz.	F	6-8 cc. Dragonfly nymphs, earthworms.
84	5 $\frac{3}{4}$ "	1 $\frac{1}{2}$ oz.	M	Dragonfly nymphs, earthworms.
85	6 $\frac{3}{4}$ "	2 oz.	F	2 cc. Dragonfly nymphs, (bitten by eel?).
86	6 $\frac{1}{2}$ "	1 $\frac{1}{2}$ oz.	F	1 Dragonfly nymph.
87	6"	1 $\frac{3}{4}$ oz.	F	2 Dragonfly nymphs, shrimps.
88	7"	2 $\frac{1}{4}$ oz.	F	Dragonfly nymphs, earthworm remains, shrimps.
89	5 $\frac{3}{4}$ "	1 oz.	F	2 cc. Dragonfly nymphs, shrimps.
90	6 $\frac{1}{4}$ "	1 $\frac{1}{2}$ oz.	F	4 cc. Dragonfly nymphs.
91	8 $\frac{1}{4}$ "	3 $\frac{1}{4}$ oz.	F	6 cc. Dragonfly nymphs.
92	6 $\frac{3}{4}$ "	2 oz.	M	5 cc. Dragonfly nymphs.
93	6 $\frac{1}{2}$ "	1 $\frac{1}{2}$ oz.	F	2 Dragonfly nymphs.
94	6 $\frac{3}{4}$ "	2 oz.	F	4 Dragonfly nymphs.
95	6 $\frac{1}{4}$ "	1 $\frac{1}{4}$ oz.	F	3 Dragonfly nymphs.
96	6 $\frac{3}{4}$ "	2 oz.	F	1 Dragonfly nymph.
97	6 $\frac{1}{2}$ "	1 $\frac{1}{4}$ oz.	F	3 Dragonfly nymphs, shrimps.

Table 8.() Length in
Millimetres.Bottom Fauna - Headquarters Lake

Dredging number	1	2	3
Area covered (Square feet)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Depth of water (metres)	11.5	5	3.5
Type of bottom	Soft brown organic matter	Soft brown material, some plant remains.	Soft brown material, many leaves and plant parts.

Fauna

Insecta

Diptera

Chironomid larvae	2(5)	2(22)	2(10-23)	
Corethra larvae			1(10)	
Ephemeroptera nymph		1(12)	2(15)	
Trichoptera (wooden cases only)			several	
	_____	_____	_____	<u>Average</u>
Total number of animals	2	3	5	3.3
Total number per sq. metre	86	129	215	143
Dry weight, animals, grms.	0.0002	0.0051	0.0057	
Animal organic matter, dry weight, pounds per acre.	0.08	2.00	2.23	1.44

Table 9.

A - Abundant

C - Common

R - Rare

Plankton - Headquarters Lake.Horizontal surface tow,
50 yards (1.5 cc)Total vertical haul
12 metres (0.6 cc.)Phytoplankton

Bacillariae

Stauroneis sp. RAsterionella sp. R

Chlorophyceae

Quadrigula sp.? R R

Myxophyceae

Aphanizomenon sp. RZooplankton

Insecta

Corethra larvae R 29

Rotifera

Polyarthra sp. C RAnuraea sp. A A

Mastigophora

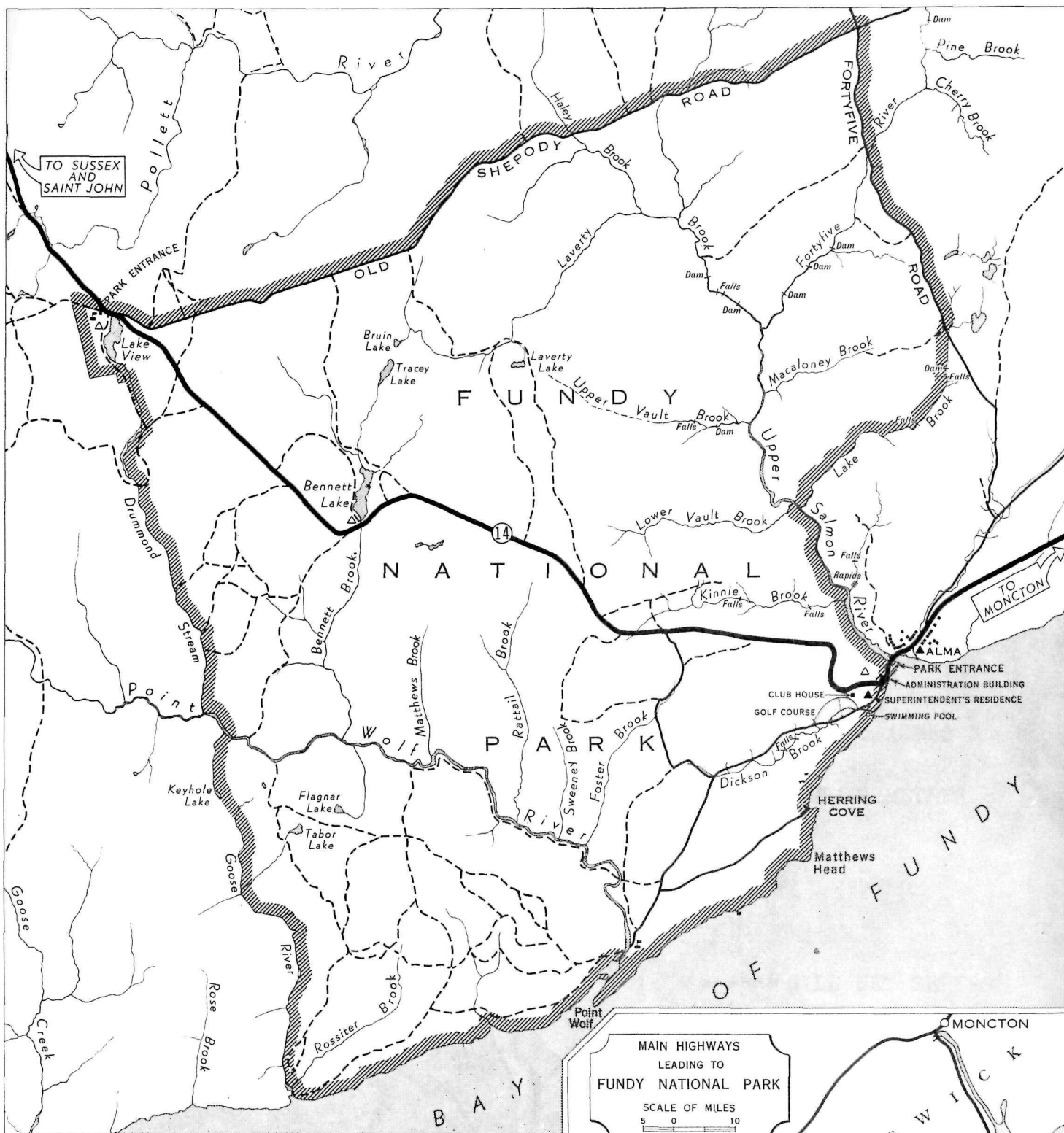
Ceratium hirudinella A ASynura sp.? A ADinobryon sp. C

Copepoda

Nauplii A A

Cladocera

Daphnia longispina R R



CANADA
DEPARTMENT OF RESOURCES AND DEVELOPMENT
NATIONAL PARKS SERVICE
1950

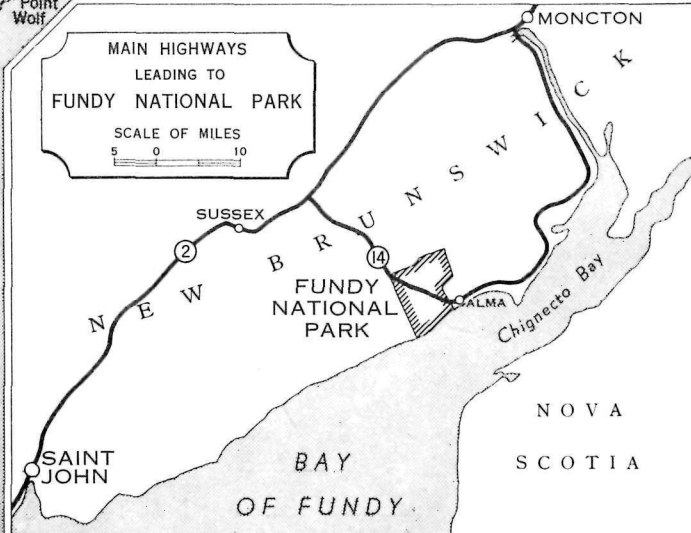
FUNDY NATIONAL PARK

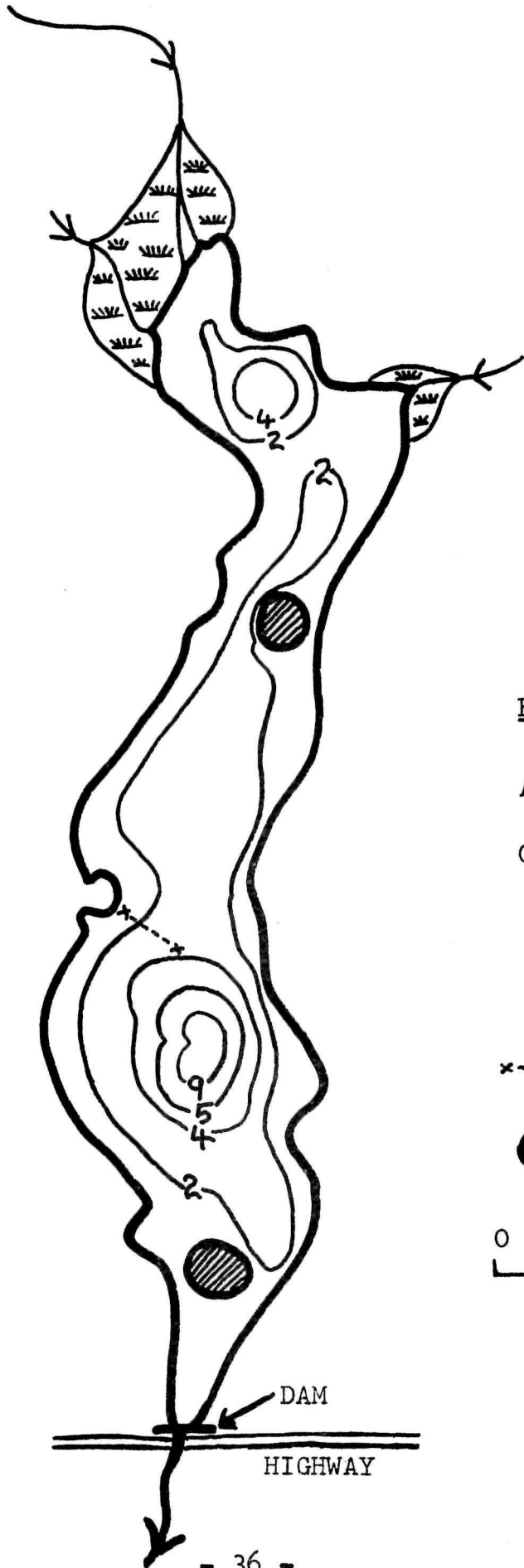
NEW BRUNSWICK

SCALE OF MILES
0 1 2

REFERENCE

Hotel or Bungalow Cabin	▲	Park Boundary	▨
Picnic or Camp-Ground	△	Main Highway	—
Warden's Cabin	■	Secondary Road	- - -
		Trail	⋯





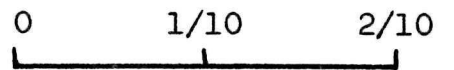
BENNETT LAKE

AREA == 48 ACRES

CONTOURS IN METRES



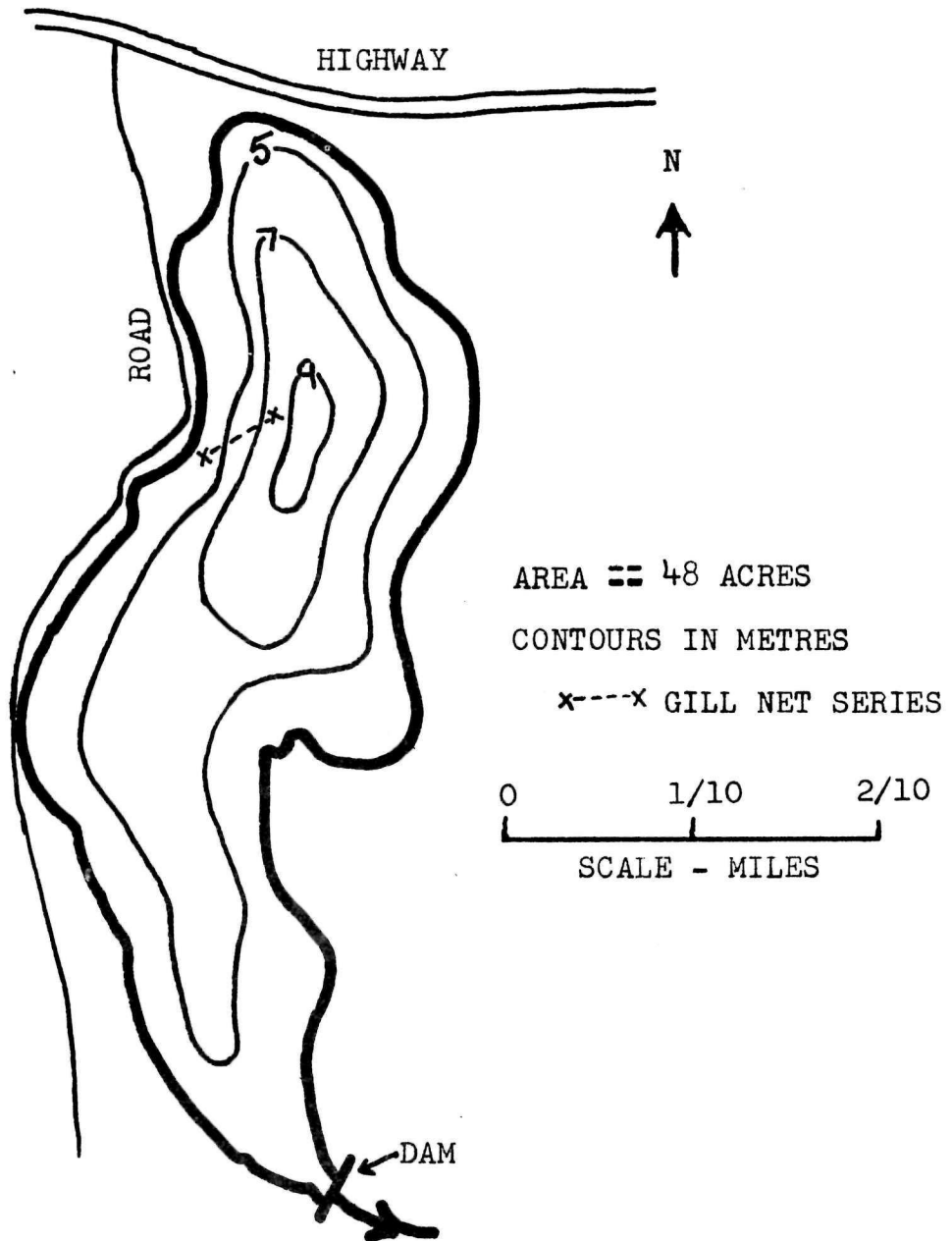
x-----x GILL NET SERIES



SCALE - MILES

DAM

HIGHWAY



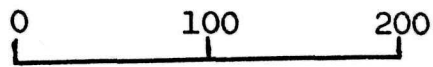
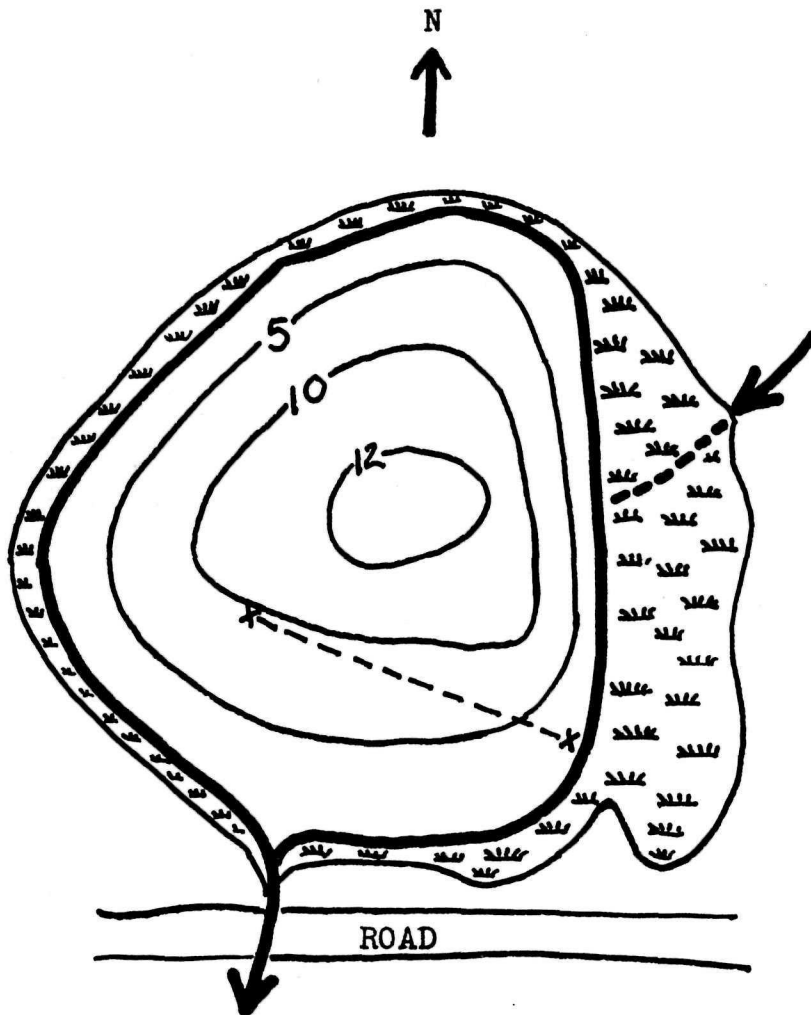
LAKE VIEW

HEADQUARTERS LAKE

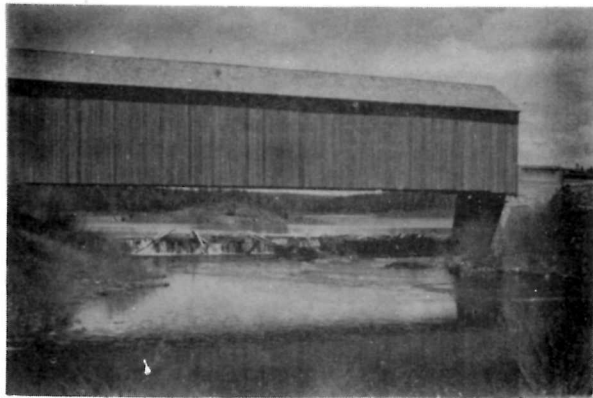
AREA == 1.75 ACRES

CONTOURS IN METRES

X-----X GILL NET SERIES



SCALE - FEET



Bennett Lake looking north up outlet stream to show highway bridge, beaver dam and south end of lake. May 20, 1948.



Bennett Lake looking north from highway bridge at outlet. Note sawdust pile and remains of sawmill on west shore and beaver house on east shore of island. May 20, 1948.



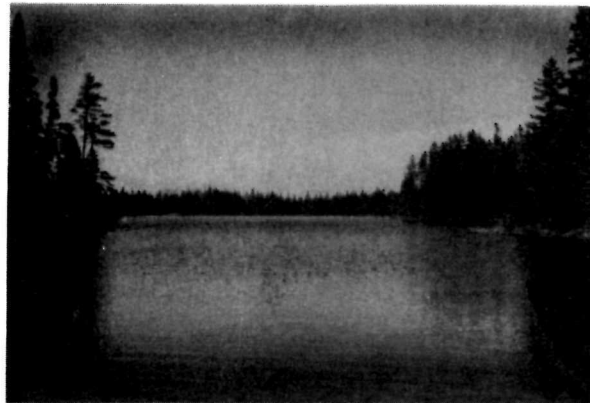
Lake View looking north from near south end. May 21, 1948.



Earth dam and wooden control structure at south (outlet) end of Lake View, looking south. May 21, 1948.



Control structure at outlet of Lake View, looking toward lake, showing log crib which confines stream to narrow channel. May 21, 1948.



Tracy Lake looking north from near south end. May 20, 1948.



Bruin Lake looking north from south shore. May 20, 1948.



Tabor Lake looking south east from the North Shore. May 23, 1948.



Flagnar Lake, looking west from outlet. May 23, 1948.



Headquarters Lake, looking west. May 21, 1948.



Looking west from a point on the park highway about 2 miles east of Alma at an altitude of 900 feet showing fog over Alma and vicinity approximately 600 feet thick. Most of the park area was free of fog at this time. May 26, 1948.



Dam on Upper Salmon River near Alma, looking east to show flow of water over entire face of dam. May 16, 1948.



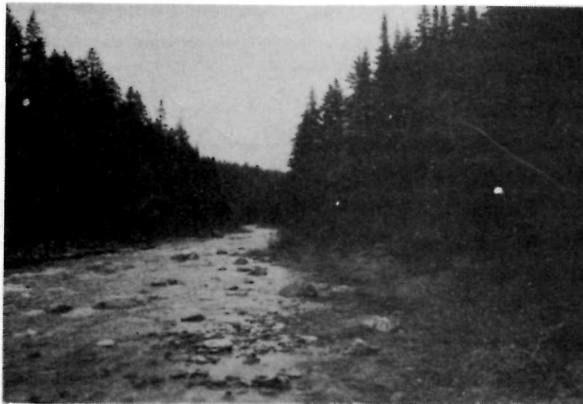
Unserviceable fishway at west end of dam on Upper Salmon River. May 16, 1948.



Unserviceable fishway at west end of dam on Upper Salmon River as seen from south end. May 16, 1948.



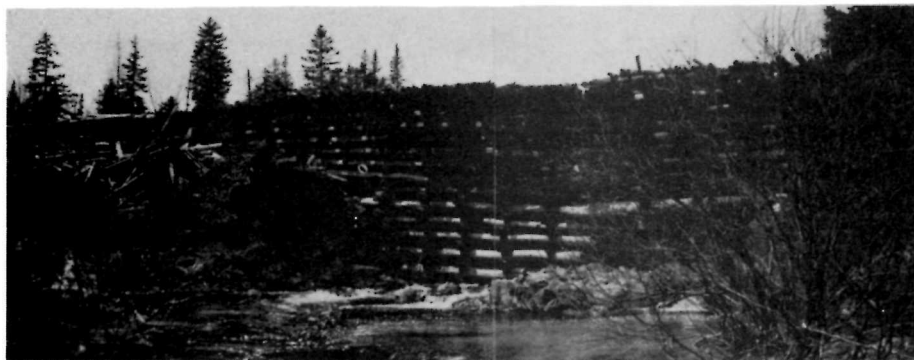
Looking east up Forty-five River showing falls on north branch in background and south branch entering main river in right foreground. May 25, 1948.



North branch of Forty-five River looking upstream, above junction with south branch. May 25, 1948.



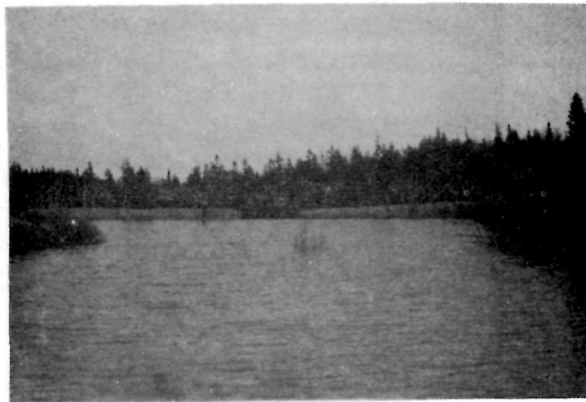
Pool on north branch of forty-five river. Vegetation has been removed from area in background by logs sliding down to river. May 25, 1948.



"Driving" dam on Drummond Stream one and a half miles south of Lake View as seen from downstream side. This dam is over 500 feet long and 20 feet high at midstream. May 24, 1948.



"Driving" dam on Drummond stream as seen from west end looking east. Structure to left of dam face in centre of dam is control for quick release of water for log driving. May 24, 1948.



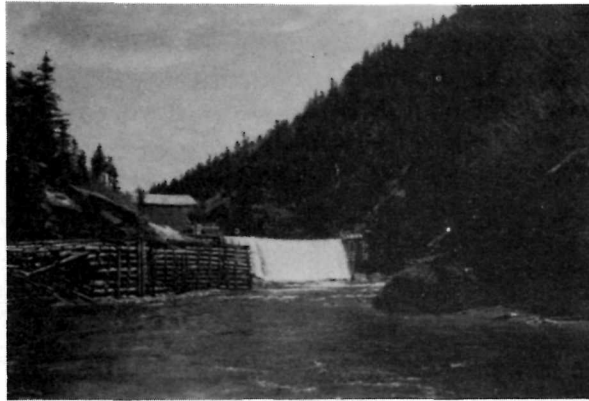
"Driving" dam on Drummond stream looking south from pond above dam. May 24, 1948.



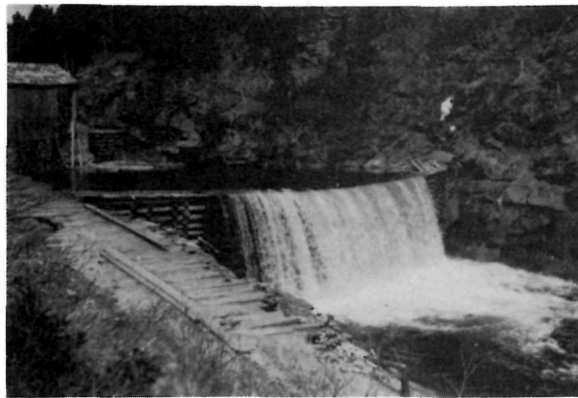
Mouth of Point Wolf River at low tide looking southeast. May 16, 1948.



Looking upstream from mouth of Point Wolf River at low tide to show estuary and in right centre background the dam and bridge. May 16, 1948.



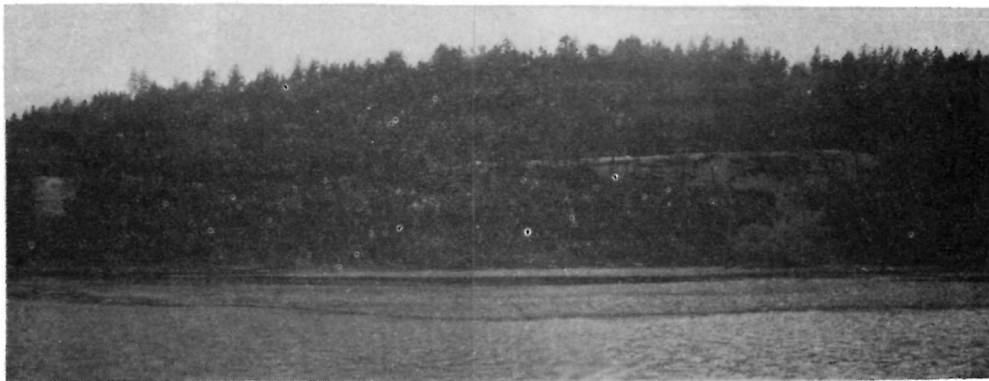
Dam and part of covered bridge over Point Wolf River, looking upstream at low tide. May 16, 1948.



Dam on Point Wolf River showing absence of fishway. End of covered bridge and part of road appear in background. May 16, 1948.



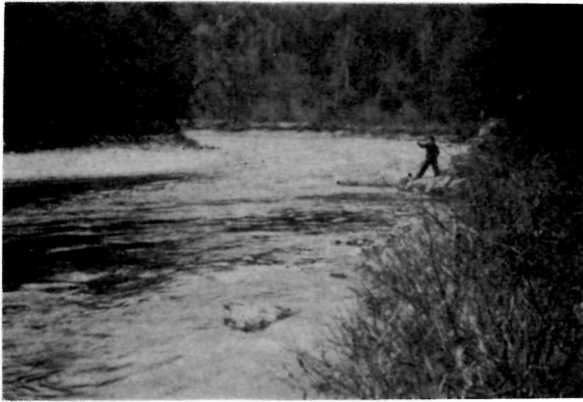
Log pond above dam on Point Wolf River looking downstream. Sawmill and living quarters for employees are visible at right centre. May 16, 1948.



Large pile of sawdust extending upstream from sawmill along west bank of Point Wolf River as seen from east bank. May 16, 1948.



Looking north over sawdust pile behind sawmill on Point Wolf River. May 16, 1948.



Potential salmon pool on Point Wolf River two miles above dam. May 26, 1948.



Point Wolf River looking downstream from point one mile above dam to show log slide down 500 foot bank. Note gravel bar in right foreground. May 26, 1948.

