WILDLIFE MANAGEMENT BULLETIN

DEPARTMENT OF RESOURCES AND DEVELOPMENT
NATIONAL PARKS BRANCH
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DEPARTMENT OF RESOURCES AND DEVELOPMENT

NATIONAL PARKS BRANCH

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LIMNOLOGICAL INVESTIGATIONS IN CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA, 1947.

Victor E.F. Solman

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Wildlife Management Bulletins are produced to make available to wildlife administrators the information contained in reports which are submitted by officers of the Canadian Wildlife Service.

The reports do not, in most cases, cover extensive studies and are not written primarily for publication. Recommendations arising from the studies are not included.

I. LIMNOLOGICAL INVESTIGATIONS OF EIGHT STREAMS, JUNE 17 TO 24

Preliminary limnological investigations were conducted by the writer on Trout, Clyburn, Black, Warren, Corney, Jumping, and Mackenzie Brooks and the North Aspy River. These investigations were undertaken in order to provide information in regard to the physical and chemical nature of stream environments in the area as well as availability of food for trout.

A brief survey of the fish populations in many of the streams in the park was made in August, 1937, by Drs. A.G. Huntsman and A.H. Leim of the Atlantic Biological Station, Fisheries Research Board of Canada. This survey consisted mainly of collecting information in regard to the presence or absence of young salmon and trout in the various streams.

Specimens of young trout and salmon were secured by Drs. Huntsman and Leim from almost all streams investigated and it appeared that individuals of these species were present in all accessible streams in the park during at least a part of the year.

It was well known that adult salmon entered the Cheticamp River sufficiently early in the season to make them available to anglers. In the other rivers in the park, young salmon were present during the summer, but adult salmon did not enter from the sea sufficiently early or in sufficient numbers to attract anglers. Conditions relative to the salmon population of the Cheticamp River are discussed in Part II of this report.

The trout populations of the streams examined by Drs. Huntsman and Leim consisted for the most part of numerous small individuals, few more than eight inches in length. The views of wardens and other members of the park staff, members of the local Royal Canadian Mounted Police detachment, and residents of areas adjacent to the park supported the conclusion that trout more than eight inches long were of rare occurrence in the upper waters of the smaller streams of the park.

Satisfactory angling for eastern brook trout more than eight inches long appeared to be limited to the estuaries and barachois of certain of the smaller streams and to certain pools in the lower reaches of the larger streams. The absence of large trout from the upper waters of the smaller streams appeared to indicate that conditions in these areas were unsuited to tenancy by large trout.

Collections of food organisms were made by the writer from eight streams, using a standardized technique in order that the samples would be quantitatively comparable. The material so collected was analysed and complete data on the collections will be found in Tables 1 to 8.

A summary of the findings is presented in the following table. The locations of the areas studied are marked on the map at the back of this report.

Name of Water Area	Standing crop of bottom fauna in pounds per acre	Temperature	pH	Time	Date
Trout Brook	5.00	10°C	6.2	3.00 P.M.	17/6/47
Clyburn Brook	0.12	9.5°C	7.0	10.30 A.M.	20/6/47
Black Brook	0.64	14.5°C		4.15 P.M.	20/6/47
Warren Brook	0.87	10.3°C		8.30 P.M.	20/6/47
North Aspy River	1.88	13.5°C	6.8	3.00 P.M.	21/6/47
Corney Brook	1.00	16.0°C	7.0	4.00 P.M.	23/6/47
Jumping Brook	3.74	15.0°C	6.7	1.15 P.M.	24/6/47
Mackenzie Brook	2.40	18.5 C	7.1	4.00 P.M.	24/6/47
Average	1.96				

It will be noted from the above table that, while there were wide variations in the standing crop of bottom fauna in the streams, the average approached two pounds per acre.

Examination of stomachs of trout from such streams indicated that terrestrial insects formed a large part (approximately 100 per cent in certain areas at certain times) of the food of the trout. This terrestrial food, together with a standing crop of bottom fauna averaging 2 pounds per acre, was thought to be sufficient to provide adequate food for moderate to large size trout, at least during the summer months.

The explanation of the absence of large trout may lie in the high temperature of the water during midsummer. It will be noted from the foregoing table that the temperature of Mackenzie Brook was

18.5°C on June 24. Considerably higher temperatures were recorded in many streams by Drs. Huntsman and Leim in August, 1937, and it is possible that temperatures in excess of 25°C (77°F) may occur at times. Even the temperatures observed by Drs. Huntsman and Leim, which are tabulated in Table 9, are in some cases above the upper limit of tolerance for eastern brook trout.

The work of Dr. F.E.J. Fry of the University of Toronto has demonstrated that small trout are able to become acclimatized to extremes of temperature more rapidly than large trout. Thus, it is logical to suppose that large trout leave the streams first as temperatures approach the lethal level. It is quite possible that, when large trout seek to enter the streams to spawn, the temperature of the water prevents them from doing so. The result is that large fish are not present in the streams during the legal angling season except in those large streams which have cool pools and in the estuaries and barachois where other influences combine to maintain a lower water temperature.

Eastern brook trout less than seven inches long showed evidence of having spawned. This was taken to indicate that trout remained in the cooler headwaters of the small streams for two years after hatching and spawned once before moving to sea. The return of large trout to spawn was probably delayed until after the end of the angling period by high water temperatures and, according to local residents, large fish were not present at any time in some streams.

It was probable that the few large trout taken by angling in estuaries and barachois were the survivors of the many trout that had entered the sea from small streams at the onset of warm weather.

The number of young trout seen in some streams appeared to indicate that populations were large enough to encourage trout more than seven inches in length to leave the streams because of crowding and competition for food. All fish examined were in good condition, indicating that competition for food was not of great importance, at least during the summer.

It was realized that the carrying capacity of the streams is considerably reduced during the winter and at that time, with the supply of terrestrial food not available, competition for food may become an important factor in the ecology of the trout.

As shown in Figs. 1 to 12, many of the stream valleys are so shaped that the water in the streams is exposed to the sun for several hours a day, causing high water temperatures to be reached during the summer.

On the basis of the data secured in this preliminary survey it was considered that water temperature might well be one of the more important factors which restricted the trout populations of the streams of the park to individuals of small size.

This matter was discussed with several fisheries biologists. In a personal communication from Dr. Paul F. Elson, of the Fisheries

Research Board, stationed at Petticodiac, New Brunswick, he indicated that in certain streams in New Brunswick speckled trout populations consisted only of small individuals. In some areas rainbow trout had been introduced and a marked improvement in angling resulted. The rainbow trout inhabited areas of the streams little used by the eastern brook trout and the competition between the species for food was not considered important.

In view of the experience with rainbow trout in New Brunswick streams, and in view of the higher temperature tolerance of this species, it appeared that there was a possibility of introducing to the streams of Cape Breton Highlands Park another species of trout more capable of effective use of local conditions than the native eastern brook trout, thus improving the angling in the area.

The rainbow trout has shown considerable evidence of a migratory tendency when introduced into streams in the Western Mountain National Parks. The idea was advanced by J.A. Rodd, formerly Director of Fish Culture, Department of Fisheries, that the migratory tendency of rainbow trout was less evident in acid or neutral waters than in alkaline waters. This may explain the successful introduction of rainbow trout into the acid streams of New Brunswick. The streams of Cape Breton Highlands Park are, as indicated in the foregoing table, mainly acid or neutral in reaction, and in this respect should prove suitable for rainbow trout.

APPENDIX I.

Table 1. BOTTOM FAUNA - TROUT BROOK, JUNE 17, 1947.

Sample number	SS #1	SS #2
Area covered	All stones in 1 square ft. of bottom.	Surfaces of 20 stones, 3"-6" long.
Type of bottom	Stones 2" - 8" on substrate of smaller stones and sand	Stones on small stones and sand.
Depth of water	4"-6"	4"-12"
Rate of flow	1.5-2 f.p.s.	1.4 f.p.s.
Temperature at 3:00 p.m.	10°C	10°C
pH	6.2	6.2
FAUNA		
Insecta		
Ephemeroptera		
Mayfly nymphs	11(3-21 mm. long)	24 (10-15 mm. long)
Diptera		
Chironomid larvae	3(3-7 mm. long)	Nil
Unspecified larvae	3(4-10 mm. long)	Nil
Simuliid larvae	Nil	11(3-6 mm. long)
Tipulid larvae (*Pedicia sp.*)	1(21 mm. long)	Nil
Plecoptera		
Stonefly nymphs	59(4-11 mm. long)	2(8-10 mm. long)

Table 1. (Cont'd)

Trichoptera		
Psilotreta sp. larvae	6(3-7 mm. long)	19(3-6 mm. long)
Rhyachophyllid larvae	17(5-9 mm. long)	Nil
Caddis pupae (Hydroptilidae, Lymnephilidae and Leptoceridae)	4(6-8 mm. long)	3(6-11 mm. long)
Hymenoptera		
Ant (wings attached)	1(6 mm. long)	Nil
Coleoptera		
Elmis sp. larvae	Nil	4(3-3.5 mm. long)
Annelida		
Leech	Nil	1(1.5 mm. long)
Hydracarina	Nil	1(1.5 mm. long)
Total number of organisms	105	65
Total dry weight	0.0554 gms.	
Less weight of incombustible residue	0.0033 gms.	
Organic matter		
per sq. ft., dry weight	0.0521 gms.	
per acre, dry weight	5.00 lbs.	

Table 2. BOTTOM FAUNA - CLYBURN BROOK, JUNE 20, 1947.

Sample number	SS #4	SS #3
Area covered	All stones in 1 sq. ft. of bottom.	Surfaces of 20 stones, 2"-4" in diameter.
Type of bottom	Stones 1"-2½" in diameter on smaller stones and gravel.	Stones on smaller stones and gravel.
Depth of water	1 ft.	1 ft.
Rate of flow	1.5-2 f.p.s.	1.5-2 f.p.s.
Temperature at 10:30 a.m.	9.5°C	9.5°C
pH	7.0	7.0
FAUNA		
Insecta		
Diptera		
Chironomid larvae	Nil	1(5.5 mm. long)
pupae	1(3.5 mm. long)	Nil
Simulium sp. larvae	1(3 mm. long)	5(3-4 mm. long)
Ephemeroptera		
Mayfly nymphs	2(7-9 mm. long)	17(4-13 mm. long)
Plecoptera		
Stonefly nymphs	2(7-8 mm. long)	1(8 mm. long)
Trichoptera		
Macronema sp. larvae	Nil	2(4-10 mm. long)
Total number of organisms	6	26

Table 2. (Cont'd)

Total dry weight	0.0013 gms.
Less weight of incombustible residue	Nil
Organic matter per sq. ft., dry weight	0.0013 gms.
per acre, dry weight	0.12 lbs.

Table 3. BOTTOM FAUNA - BLACK BROOK, JUNE 20, 1947.

Sample number	SS #5	SS #6
Area covered	All stones in 1 sq. ft. of bottom.	Surfaces of 10 stones, 3"-6" long.
Type of bottom	Stones 1"-5" long on smaller stones.	Stones on smaller stones and gravel.
Depth of water	6"	6"
Rate of flow	1.5-2 f.p.s.	1-1.5 f.p.s.
Temperature at 4:15 p.m.	14.5°C	14.5°C
FAUNA		
Insecta		
Diptera		
Tipulid larvae	1(5 mm. long)	Nil
Chironomid larvae	16(4-9 mm. long)	5(2-3.5 mm. long)

Table 3. (Cont'd)

Plecoptera		
Stonefly nymphs	6(6-8 mm. long)	2(8-12 mm. long)
Ephemeroptera		
Mayfly nymphs	1(8 mm. long)	11(4-10 mm. long)
Trichoptera		
Rhyacophilia sp. larvae	1(5.5 mm. long)	Nil
Psilotreta sp. larvae	Nil	11(3.5-7 mm. long)
Neuronia sp. larvae	Nil	3(8-9 mm. long)
Annelida		
Oligochaet worm	Nil	1(8 mm. long)
Mollusca		
Mussel glochidium	1(3 mm. long)	Nil
Pisces		
Anguilla americana	1(65 mm. long) free swimming	Nil
Total number of organisms	26	33
Total dry weight	0.0072 gms.	
Less weight of incombustible residue	0.0005 gms.	
Organic matter per sq. ft., dry weight	0.0067 gms.	
per acre, dry weight	0.64 lbs	

Table 4. BOTTOM FAUNA - WARREN BROOK, JUNE 20, 1947.

Sample number	SS #8	SS #7
Area covered	All stones in 1 sq. ft. of bottom.	Surfaces of 10 stones, 3"-6" long.
Type of bottom	Stones 2"-5" long on smaller stones.	Stones on smaller stones.
Depth of water	4"-6"	6"-10"
Rate of flow	1.5-2 f.p.s.	1.5-2 f.p.s.
Temperature at 8:30 p.m.	10.3°C	10.3°C
FAUNA		
Insecta		
Diptera		
Ceratopogonid larva	1(4 mm. long)	Nil
Chironomid larvae	3(10 mm. long) 1(3 mm. long)	Nil
Ephemeroptera		
Mayfly nymphs	7(5-10 mm. long)	7(7-10 mm. long)
Plecoptera		
Stonefly nymphs	4(5-9 mm. long)	3(7-10 mm. long)
Trichoptera		
Neuronia sp. pupa	1(7 mm. long)	Nil
Psilotreta sp. larvae	Nil	4(3 mm. long)
Glossosoma sp. larvae	Nil	2(6 mm. long)
Coleoptera		
Elmis sp. larva	1(4 mm. long)	Nil
Annelida		
Oligochaet worm	1(9 mm. long)	Nil

Table 4. (Cont'd)

Mollusca		
<u>*Physa* sp.</u>	1(5 mm. long)	Nil
<u>*Pisidium* sp.</u>	1(4 mm. long)	Nil
Total number of organisms	21	16
Total dry weight	0.0149 gms.	
Less weight of incombustible residue	0.0058 gms.	
Organic matter, per sq. ft., dry weight	0.0091 gms.	
per acre, dry weight	0.87 lbs.	

Table 5. <u>BOTTOM FAUNA - NORTH ASPY RIVER, JUNE 21, 1947.</u>

Sample number	SS #9	SS #10
Area covered	All stones in 1 sq. ft. of bottom.	Surfaces of 20 stones averaging 5" long.
Type of bottom	Stones 2"-7" on substrate of smaller stones.	Stones on smaller stones.
Depth of water	6"-8"	6"-8"
Rate of flow	1.5-2 f.p.s.	1.5-2 f.p.s.
Temperature at 3:00 p.m.	13.5°C	13.5°C
pH	6.8	6.8

Table 5. (Cont'd)

BOTTOM FAUNA

Insecta	
Diptera	
Chironomid larvae	2(8 mm. long)
pupa	1(4.5 mm. long)
Tipulid larvae	
Antocha sp.	1(7 mm. long)
Pedicia sp.	2(9 mm. long)
Plecoptera	
Stonefly nymphs	3(7-14 mm. long)
Ephemeroptera	
Mayfly nymphs	12(7-11 mm. long)
Coleoptera	
Elmis sp. larva	1(3 mm. long)
Trichoptera	
Psilotreta sp. larvae	14(3-7 mm. long)
Hydropsyche sp. larva	1(8 mm. long)
Neuronia sp. (pupae)	2(6 mm. long)
Glossosoma sp. larvae	13(4-7 mm. long)
Glossosoma sp. (pupa)	1(5 mm. long)
Philopotamid larva	1(4.5 mm. long)
Hydracarina	2(1.3 mm. long)
Total number of organisms	56
Total dry weight	0.0216
Less weight of incombustible residue	0.0020 gms.
Organic matter per sq. ft., dry weight	0.0196 gms.
per acre, dry weight	1.88 lbs.

Table 6. BOTTOM FAUNA - CORNEY BROOK, JUNE 23, 1947.

Sample number	SS #11	SS #12
Area covered	All stones in 1 sq. ft. of bottom.	Surfaces of 20 stones 6"-8" long.
Type of bottom	Stones 2"-8" on sand and gravel.	Stones on sand and gravel.
Depth of water	6"-8"	6"-8"
Rate of flow	1.5-2 f.p.s.	1-1.2 f.p.s.
Temperature at 4:00 p.m.	16.0°C	16.0°C
pH	7.0	7.0
Dissolved Oxygen	7.0 cc. per litre	7.0 cc. per litre
FAUNA		
Insecta		
Ephemeroptera		
Mayfly nymphs	10(10-12 mm. long) 6(2.5-5.5 mm. long)	21(11-21 mm. long) 7(3-4 mm. long)
Diptera		
Chironomid larvae	3(2.5-6 mm. long)	Nil
Simulium sp. larvae	Nil	54(2-6 mm. long)
Blepharocerca sp. larvae	Nil	2(7 mm. long)
Blepharocerca sp. pupa	Nil	1(5 mm. long)
Trichoptera		
Hydropsyche sp. larva	Nil	1(8 mm. long)

Table 6. (Cont'd)

Hydracarina	1(0.8 mm. long)	Nil
Total number of organisms	20	86
Total dry weight	0.0122 gms.	
Less weight of incombustible residue	0.0018 gms.	
Organic matter per sq. ft., dry weight	0.0104 gms.	
per acre dry weight	1.00 lbs.	

Table 7. BOTTOM FAUNA - JUMPING BROOK, JUNE 24, 1947.

Sample number	SS #13
Area covered	All stones in 1 sq. ft. of bottom.
Type of bottom	Stones 1/2"-3" long on substrate of finer stones and sand. Stones covered with green algae.
Depth of water	2"
Rate of flow	1-1.5 f.p.s.
Temperature at 1.15 p.m.	15°C
pH	6.7
FAUNA	
Insecta	
Trichoptera	
Neuronia sp. larva	1(16 mm. long)
Philopotamus sp. larva	1(12 mm. long)

Table 7. (Cont'd)

Diptera	
Simuliid larva	1(2.5 mm. long)
Ephemeroptera	
Mayfly nymphs	16(8-22 mm. long) 3(4-5 mm. long)
Plecoptera	
Stonefly nymphs	6(3-9 mm. long)
Coleoptera	
Terrestrial beetle (adult)	1(2 mm. long)
Total number of organisms	29
Total dry weight	0.0411 gms.
Less weight of incombustible residue	0.0021 gms.
Organic matter per sq. ft., dry weight	0.0390 gms.
per acre, dry weight	3.74 lbs.

Table 8. BOTTOM FAUNA, MACKENZIE BROOK, JUNE 24, 1947.

Sample number	SS #14
Area covered	All stones in 1 sq. ft. of bottom.
Type of bottom	Stones 2"-8" long on substrate of smaller stones.

Table 8. (Cont'd)

Depth of water	1 ft.
Rate of flow	1.5-2 f.p.s.
Temperature at 4:00 p.m.	18.5°C (Ocean temperature 13.5°C)
pH	7.1
FAUNA	
Insecta	
Trichoptera	
Glossosoma sp. larvae	6(4.5-6 mm. long)
Ephemeroptera	
Mayfly nymphs	18(4-18 mm. long)
Diptera	
Simuliid larva	1(3.5 mm. long)
Chironomid larva	1(8 mm. long)
Plecoptera	
Stonefly nymph	1(9 mm. long)
Coleoptera	
Elmis sp. larva	1(24 mm. long)
Terrestrial beetle	1(2.5 mm. long)
Hydracarina	3(1 mm. long)
Total number of organisms	32
Total dry weight	0.0267 gms.

Table 8. (Cont'd)

Less weight of incombustible residue	0.0017 gms.
Organic matter per sq. ft., dry weight	0.0250 gms.
per acre, dry weight	2.4 lbs.

Table 9. TEMPERATURES RECORDED BY DRS. HUNTSMAN AND LEIM, CAPE BRETON HIGHLANDS PARK, 1937.

Stream	Temperature		Time	Date	
Corney Brook	17.3 C		1.45 p.m.	August	1
Mackenzie Brook	19.5 C		4.30 p.m.	"	"
North Aspy River	16.3 C		11.00 a.m.	"	2
Glasgow Brook	19.2 C		2.00 p.m.	"	"
South Brook	19.0 C		2.30 p.m.	"	"
Trout Brook	17.0 C		3.00 p.m.	"	"
Rochel Brook	22.0 C	Approx.	4.00 p.m.	"	"
Neil Brook	22.5 C	"	5.00 p.m.	"	"
Halfway Brook	20.2 C		5.40 p.m.	"	"
Black Brook	20.2 C	"	6.00 p.m.	"	"
Mary Ann Brook	19.2 C	"	6.45 p.m.	"	"
Warren Brook	19.0 C		6.00 a.m.	"	3
Roper Brook	16.8 C	"	8.00 a.m.	"	"
Clyburn Brook	18.2 C		10.00 a.m.	"	"

Fig. 1 - Fishing Cove and mouth of Fishing Cove River as seen from near Cabot Trail looking west, to show broad open valley. June 24, 1947.

Fig. 2 - Looking up valley of Fishing Cove River (south), to show open valley. June 24, 1947.

Fig. 3 - North Aspy River, looking upstream (southwest) from Cabot Trail, to show shallow water and gravel bars. June 21, 1947.

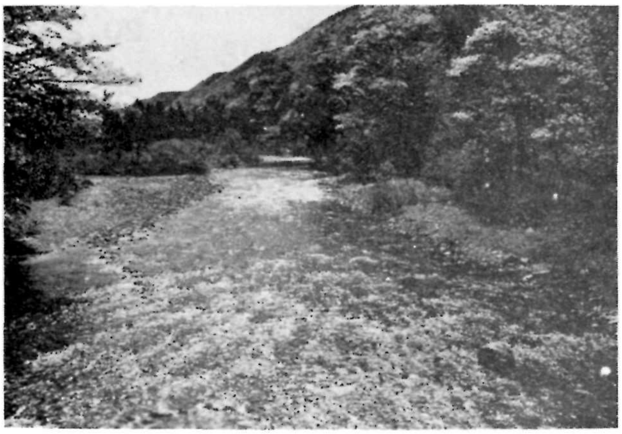


Fig. 4 - Warren Brook, looking upstream (west) from Cabot Trail. June 21, 1947.

Fig. 5 - Broad Cove Barachois at mouth of Warren Brook, looking upstream (west) from outlet to sea. June 20, 1947.

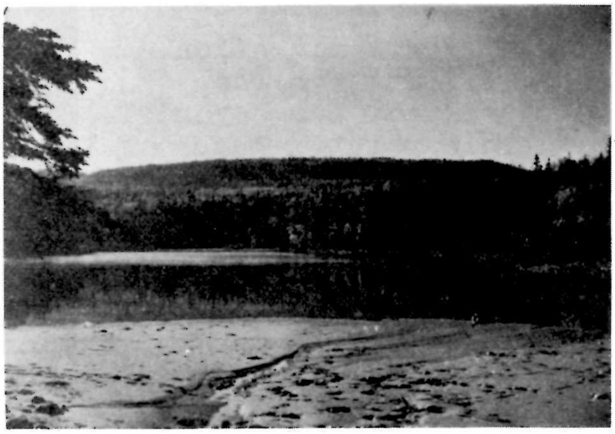


Fig. 6 - Broad Cove Barachois at mouth of Warren Brook showing outlet to sea, looking northeast, June 20, 1947.

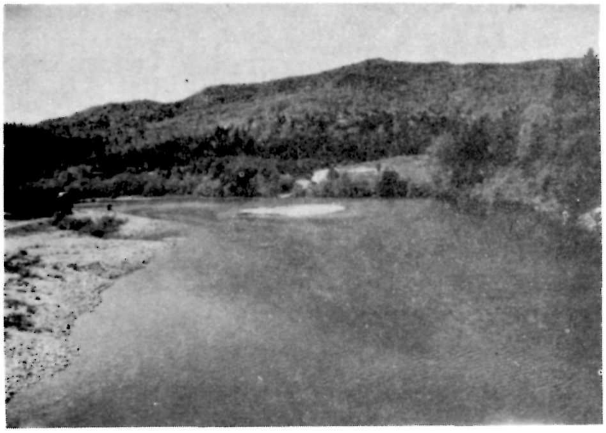


Fig. 7 - Clyburn Brook, looking upstream (west) near mouth, to show gravel bars and deep water areas. June 20, 1947.

Fig. 8 - Falls on Mary Ann Brook just east of Cabot Trail which prevents migration of fish from the sea upstream beyond this point. June 21, 1947.

Fig. 9 - Trout Brook looking upstream (west) from Cabot Trail showing large volume of flow in area reported to become almost dry in late summer. June 17, 1947.

Fig. 10 - Jumping Brook looking upstream (southeast) at point approximately 4 miles from mouth to show limited shade. June 24, 1947.

Fig. 11 - Mackenzie River looking downstream (north) from point about one-half mile from mouth, to show shallow water and absence of shade. June 24, 1947.

Fig. 12 - Corney Brook looking upstream (southeast) from point about one-quarter mile from mouth to show evidence of severe flooding and lack of shade. June 23, 1947.

II. LIMNOLOGICAL RECONNAISSANCE OF SALMON ANGLING IN THE CHETICAMP RIVER

In connection with a preliminary investigation of the streams of Cape Breton Highlands National Park it was considered desirable to enquire into the quality of salmon angling in the Cheticamp River.

Dr. A. G. Huntsman found that young salmon were present in all of the streams in the park, which he investigated during August 1937, but that only the Cheticamp River supported a run of adult salmon at a suitable time of year to provide angling. In his report entitled "Salmon for Angling in the Margaree River" (published 1939 by the Fisheries Research Board of Canada as Bulletin No. LVII) he stated:

"The salmon appear generally along the shore as the water warms up, and earlier or later depending upon the rate of local warming. They are quite clearly moving to and fro both coastwise and at right angles to the shore. No matter where they are liberated, tagged salmon are recaptured in both directions along the coast, skipping few to many nets on the way. The view that they come in along the coast from the Atlantic is substantiated neither by the times of their appearance in the successive nets along the route nor by the times of their maximum abundance in these nets, since they appear a week or so later and reach their height about two weeks later at Pleasant

Bay than they do at Cheticamp fifteen miles farther into the gulf.

"Nor do the movements of the tagged fish give any support to such a view. Some of the salmon liberated near the mouth of the Margaree estuary travelled out of the gulf around the north side of the island to St. Lawrence and Aspy Bays and around the south side through the gut of Canso to Chedabucto Bay".

In regard to the Margaree River Dr. Huntsman made the following remarks:

"Unfortunately for the guidance of the salmon into the estuary, the bodies of surface water recognizable through their lower salinity as having more river water are connected with the estuary only part of the time, during the ebbing tide. When the flood tide begins to flow strongly, it stops the outflow of fresher water, and fills the estuary mouth with deep, salt water that rises to the surface in the inward tidal movement over the bar outside the estuary mouth. This movement is very strong, since the estuary is so extensive and falls and rises fully with the tide outside. This salter water intervenes between the river water in the estuary and the bodies of surface water with recognizable river influence that are outside and are the result of outflows of river water during ebb tides. This is a very important matter for an understanding of the slowness with which most of the salmon that reach the coast enter the estuary and river, although it is only part of the explanation. This slowness is clearly shown by the angling catch in the river reaching its peak about two months after the peak has been reached in the catches of the coastal nets. It may be taken for granted that the larger the volume of water discharged by the river into the estuary, the larger will be the amount of comparatively fresh water issuing from the estuary, the longer will be the period during which it issues, and the shorter will be the time during which outside bodies of "river" water with salmon concentrated in them will be definitely separated from the "river" water of the estuary. Heavy floods will thus aid the entrance of salmon into the estuary."

In contrast to the Margaree River the arrangement of the barachois of the Cheticamp River is such that an almost continuous outflow of fresh water occurs. In regard to this phenomenon Dr. Huntsman stated:

"The explanation would seem to be in the character of the estuary. That of the Cheticamp is quite short and has a bar across its mouth that prevents its water lowering to low tide level. As a result comparatively little salt water enters it and it very steadily discharges river water into the gulf. In fact it approximates those rivers whose waters flow abruptly into the sea.

"Because of the embayment of the coast into which the estuary empties, tidal movements are little apt to dissipate its water, when poured into the sea. Salmon that reach its influence (they may be most abundant there as early as June 8) have, instead of the delaying to and fro current of the tides, only a steady, short stretch of seaward current to stem and then they are in the estuary, almost away from tidal influence. The width and depth of the estuary are so great in comparison with the amount of water entering from the sea that there must be very little tidal current. The shortness of the estuary brings all the salmon in it into close proximity to the increasing, outward current of a freshet. As the spring freshets usually continue into June, the salmon are apt to ascend the river soon after their entrance in the estuary early in that month.

"The Cheticamp River does indeed offer a great contrast to the Margaree in the conditions that determine early entrance of salmon, and nothing more seems necessary to explain the fact that its best angling is so much earlier than that of the Margaree".

The combination of early warming of the sea near Cheticamp Island and a continuous outflow of fresh water from the Cheticamp River provided an attraction which caused salmon to enter this river earlier in the season than they entered other rivers on the west coast of Cape Breton, and the largest angling catch was taken in June. The number of salmon that entered the river at any time depended partly on the volume of flow and it was probable that more salmon entered the river at times of freshet, following heavy rains. When such freshets occurred in June or July the angling catch during those months might be increased but when freshets occurred in August, September, or October the angling catch might not increase since most of the angling at that time was carried on at the Margaree River and few anglers were visiting the Cheticamp River to benefit from the increased availability of salmon.

Salmon had been stocked into the Cheticamp River since 1916 from the Fisheries Department hatchery on the Margaree River. From 1916 to 1945, 4,420,400 young salmon of various sizes were released in the river. The details of these distributions are given in Table 10.

The reported catches of salmon by anglers for the period 1928 to 1947 with the exception of the year 1936 are tabulated below. The data are derived from reports of the fisheries inspector for the area for the years 1928 to 1935 and from records kept by Park Warden John W. Roach for the years 1936 to 1947.

Salmon Catch by Anglers - Cheticamp River

1928 - 1935

	June	July	August	September	October	Total
1928	55	18	20	28	0	121
1929	28	15	34	18	0	95
1930	90	36	8	12	0	146
1931	59	47	10	6	0	122
1932	29	22	16	0	0	62
1933	63	46	4	3	0	116
1934	0	2	1	0	0	3
1935	31	6	2	6	8	53
Average	44	24	12	9	1	90

1937 - 1947

	June	July	August	Total
1937	63	3	0	66
1938	25	41	20	86
1939	55	40	0	95
1940	19	16	0	35
1941	47	29	4	80
1942	30	6	1	37
1943	10	6	0	16
1944	45	0	0	45
1945	49	10	0	59
1946	50	3	0	53
1947	70	20	0	90
Average	42	15	2	62
Grand Average (19 years)	43	19	6	72

Warden Roach pointed out that his records (from 1937 to 1947) dealt only with salmon he had actually seen and he felt that they represented about half the actual catch in each year. The records for the period from 1928 to 1935, secured from the fisheries inspector, probably do not represent the total catch for the years reported.

The Director of Eastern Fisheries of the Fisheries Department stated that the annual commercial catch of Atlantic salmon for the Maritime Provinces had been reduced from over three million pounds 30 years before to approximately one-half million pounds in 1947. This reduction occurred in spite of the production and liberation of large numbers of young salmon from hatcheries, the control of fish eating birds, and other management procedures. The above noted angling catch statistics for the Cheticamp River indicated that the quality of angling had changed little during the previous 20 years in spite of the large introductions of young salmon to the river and the general decline in commercial catch of salmon in the Maritime Provinces.

Since, as pointed out by Dr. Huntsman, (quoted above) salmon move about in all directions in the sea before entering rivers, the catch of salmon by fishermen occupying salmon berths near the mouth of the Cheticamp River probably had little effect on the number of salmon taken by anglers from the Cheticamp River. The anglers did not subscribe to this view however and claimed that all salmon taken in salmon berths near the river mouth would have been available for angling had they not been so taken. As an example of this attitude two anglers were met on the Cheticamp River on June 23, 1947, who as soon as they learned of the writer's official position, proceeded to urge that steps be taken to have commercial fishing activities removed from areas near the river mouth. They claimed to have fished for several hours with no success since "no salmon get into the river past the nets". On proceeding upstream to the pool just vacated by these unsuccessful anglers it was possible to observe two 8-to 10-pound salmon resting quietly, in four feet of water. As long as salmon were present in the river, in numbers in excess of those captured by anglers, a change in the location or intensity of commercial fishing operations probably would not improve angling and might seriously interfere with the livelihood of the commercial fishermen in the area.

In regard to stocking of salmon into the Cheticamp River it should be noted that in spite of 29 years of stocking the angling catch remained relatively unchanged.

While there was no evidence that introduction of young salmon into the Cheticamp River had in any way benefited the angling there was equally no evidence that such introductions had had a detrimental effect.

APPENDIX II

Table 10. INTRODUCTION OF SALMON TO CHETICAMP RIVER

F indicates fingerlings; 2F, No. 2 fingerlings; all others are fry.

1916		100,000	1928		50,000
				F	25,000
1919		98,400			
			1929		75,000
1920		60,000			
			1930		50,000
1921		50,000		F	75,000
1922		100,000	1931		110,000
1923		90,000	1932	F	100,000
				2F	20,000
1924	F	136,000			
			1934	F	50,000
1925		100,000		2F	401,000
1926		50,000	1935	F	465,000

Table 10. (Cont'd)

1936	F	150,000
		200,000
1937	F	130,000
	2F	40,000
1938	F	150,000
	2F	35,000
1939	F	215,000
1940	F	175,000
1941	F	200,000
1942		50,000
	F	200,000
1943		150,000
	F	110,000
	2F	40,000
1944		50,000
	F	100,000
	2F	100,000
1945		50,000
	F	70,000

Fig. 13 - First pool, Cheticamp River looking upstream, June 23, 1947.

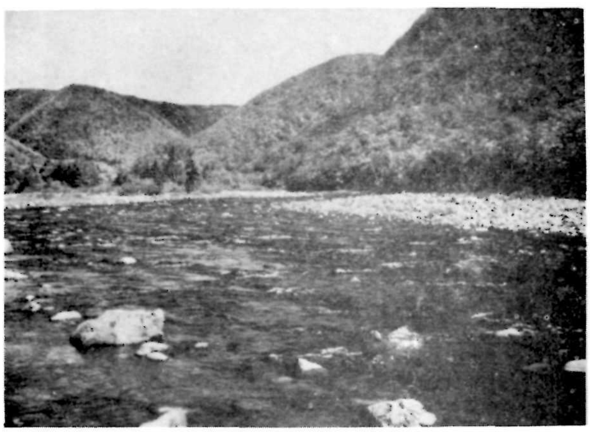


Fig. 14 - Looking up Cheticamp River from beginning of trail to salmon pools to show shallow water and gravel bars. June 22, 1947.

Fig. 15 - Barachois of Cheticamp River looking north, showing bar in centre distance, outlet to sea at right of bar and large area of freshwater in foreground. June 22, 1947.

Fig. 16 - Close-up of outlet from barachois of Cheticamp River to sea, looking north. This area appears in the left centre of the photograph next above. June 22, 1947.

III. LIMNOLOGICAL RECONNAISSANCE OF LAKES OF SOUTHEASTERN PART OF THE PARK

During the investigations conducted in June, 1947, at Cape Breton Highlands Park it was found possible to ascend to the "barrens" at the headwaters of the Clyburn Brook and to visit several small lakes in that area. The journey to and from the areas numbered 4 and 5 on the map at the back of this report occupied the time from 6:30 a.m. until 7:00 p.m. and of this time, approximately four hours were spent on the "barrens". The district was accessible only on foot and without the guidance of the Park Superintendent and Warden Farquharson, it is doubtful if the areas would have been reached, since in many places there was no definite trail. For all practical purposes, they were inaccessible to tourists.

The lakes visited included Two Island Lake (numbered 4 on the map), a small lake to the east (numbered 5 on the map) and another small lake to the north.

In view of the considerable ascent necessary to reach the lakes, only a limited amount of equipment was taken into the area.

The surroundings and some of the lakes are shown in Figures 17 to 19. The lakes appeared to be shallow, probably not over 10 feet deep at the deepest point, with large areas of water varying in depth from 2 to 3 feet.

The bottom fauna of the lakes included caddis larvae and mayfly nymphs and probably also chironomid larvae, though the latter were not observed, possibly due to their small size.

Many of the lakes and small streams supported large populations of eastern brook trout. In the lakes, the trout were concentrated along the margin under the overhanging grasses and small trees. This was a natural condition on a clear sunny day since trout exhibit what is considered to be a physiological need for shade. In walking along the east shore of Two Island Lake, trout were seen to leave the shore cover and head out into the lake in numbers as great as 50 in 50 yards of shoreline. These trout appeared plump and well fed and ranged in length from 6 to 10 inches. In the smaller lake to the north, the population of trout appeared to be of similar density, but the small lake to the east was reported to contain no trout. In the small streams trout were seen on several occasions, but no estimate of population was possible since parts of the streams were inaccessible due to thick clumps of small, gnarled trees.

Physical and chemical observations were as follows: Two Island Lake: pH 5.8; surface temperature, 15°C at 12:05 p.m. Small lake east of Two Island Lake: pH 5.5; surface temperature, 15°C at 2:00 p.m.

It will be noted that both lakes were quite acid in reaction. This was probably due to leaching from the muskeg and tundra areas in which the lakes were situated. The drainage basins were small in each case. These small lakes were connected by streams to Clyburn Brook but the streams made precipitous descents from the "barrens" to the river valley below. How the observed trout populations became established in the lakes is unknown. There were no records of planting and it was inconceivable that trout could have ascended to the lakes by way of the small outlet brooks. Possibly the trout populations had become established in the area at some time in the past when conditions of access were different.

No specimens of trout were collected during the visit to the lake. During a later visit, on July 8, 1947, the Park Superintendent, T.C. Fenton, collected several trout from Two Island Lake and forwarded their scales and measurements to the writer. The trout ranged in length from 5¾ to 10½ inches, in weight from 1½ to 7 ounces, and in age from 1+ to 3+ years. The fish were taken by angling and the fact that individuals of several different sizes were caught indicated the presence of a well-balanced population. During the visit to the lake several trout three to five inches long were observed in the outlet stream from the lake and there was no reason to suppose that natural reproduction was lacking. Data regarding the fish secured by the Park Superintendent are included in Table 11.

It was stated by members of the park staff that many of the small lakes in the "barrens" area of the park supported populations of eastern brook trout but that in no case did the fish reach a length greater than 10 or 11 inches.

In addition to a brief visit to several lakes in the "barrens" it was found possible to spend a short time at the Freshwater Lake near Park Headquarters. This lake appeared to provide an excellent habitat for eastern brook trout but according to creel census data collected during 1947, the catch was small and the fishing effort high. Two trout caught by angling from the lake on June 21 were examined and data regarding them are tabulated below.

No.	Length (Ins.)	Weight (Ozs.)	Sex	Years	Stomach Contents
98	$10\frac{3}{4}$	8	F	4+	Remains of two 1-inch fish.
99	$9\frac{1}{2}$	$6\frac{1}{4}$	F	4+	8 cc. insect remains and remains of a 3-inch fish.

The two trout examined appeared to be sea run. Dr. Huntsman recorded a surface temperature of 23.2°C in this lake at 11:00 a.m., on August 3, 1937. Such a high surface temperature might indicate that the temperature of the entire body of water at times approached the upper limit of tolerance for trout. Such a condition would explain the rather limited angling catch reported in the creel census, since large numbers of trout would not enter the lake from the sea to spawn until water temperatures became lower in the autumn, after the close of the angling season.

Round Lake, a small lake about three miles west of Ingonish was apparently a popular place during 1947 for anglers. From this lake a catch of 35 trout was recorded in the creel census with a very low fishing effort. The lake was not visited, but Superintendent Fenton provided data regarding two trout caught on July 4 together with scale samples from these fish. The following data apply to these fish:

Length (Ins.)	Weight (lbs.)	Sex	Age (Years)
7½	¼	F	2+
9	½	M	3+

In view of the catch reported in the Creel Census and the low fishing effort recorded it appeared that Round Lake offered the best eastern brook trout angling available in areas accessible to tourists in the park, at least as indicated by the 1947 creel census data.

APPENDIX III

Table 11. EASTERN BROOK TROUT FROM TWO ISLAND LAKE - CAPE BRETON HIGHLANDS PARK.

Length (ins.)	Weight (ozs.)	Sex	Age (years)
5¾	1½	M	1+
6¼	1½	M	
6¾	2	M	
7½	2½	M	
7½	2½	M	
7½	2½	M	2+
7¾	2¾	F	
8	3½	F	
8	3	M	2+
8½	3¾	F	
8¼	3½	F	
8¼	3¾	F	

Table 11. (Cont'd)

Length (ins.)	Weight (ozs.)	Sex	Age (years)
8½	3½	F	
8½	3¾	F	
9	4¾	F	
10½	6	M	
10½	7	M	3+

Fig. 17 - East shore, Two Island Lake, looking north. June 19, 1947.

Fig. 18 - Looking north across small lake (numbered 5 on map) on barrens near Two Island Lake. June 19, 1947.

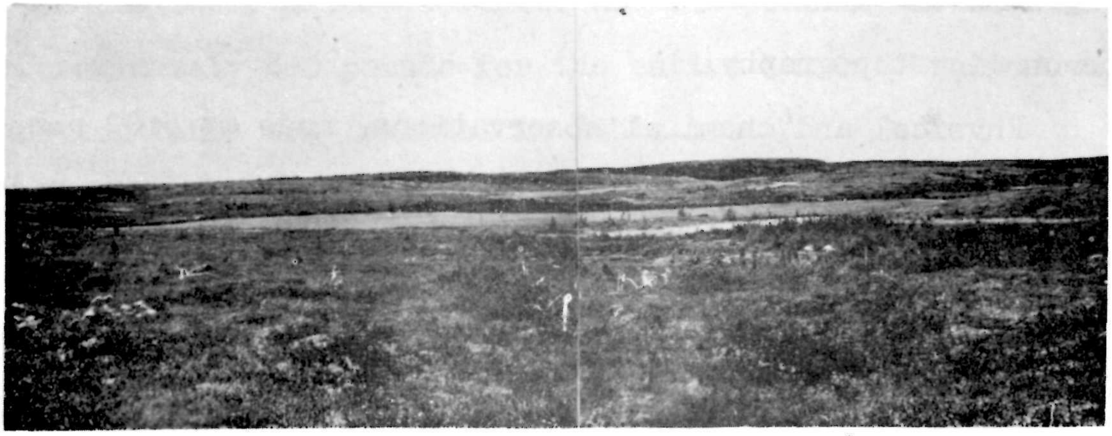


Fig. 19 - Small lake on barrens near Two Island Lake, looking north. June 19, 1947.

IV. LIMNOLOGICAL INVESTIGATION OF WARREN LAKE, JUNE 17 AND 18, 1947

A limnological investigation of the fish, plankton and bottom fauna of this lake and observations on its physical and chemical conditions were made during the captionally noted period.

Prior to 1947 the lake was accessible only by a trail leading in from the Cabot Trail north of Ingonish, N.S. During the spring of 1947 a road was constructed to the east end of the lake, and at the time of the investigation it was possible to drive within 50 yards of the lake, although the road was not open to general traffic until later in the season. The lake is very attractive and now that it is accessible by automobile, it is very popular as a picnic site as well as a fishing area.

Several series of soundings were made on June 18 and from these the map (Fig. 20), showing bottom contours, was drawn up. Figs. 21 to 23 show the inlet and outlet of the lake as well as a view of the surrounding topography.

Physical and chemical observations, made at 5:00 p.m., June 18, under thin high cloud and with a moderate west wind are recorded below.

Depth in metres	Temperature	Dissolved Oxygen per litre	% Saturation	pH	Dissolved Carbon Dioxide
0	10.0°C	8.9 cc.	110	6.3	Less than 1 ppm.
5	10.0°C				
10	9.0°C				
20	8.0°C				
30	8.0°C	8.1 cc.	97	6.1	Less than 2 ppm.

Secchi's disc (transparency) 2.25 metres.

The flow of water leaving the lake by way of Warren Brook formed a stream about 30 feet wide, $1\frac{1}{2}$ feet deep and flowing at a rate of about 1.8 feet per second, giving a volume of flow of approximately 80 cubic feet per second. In view of the time of year and the recent heavy rains it was considered that this flow represented nearly the maximum flow from the lake and that during the summer and autumn, the flow would be much less.

The bottom fauna of the lake was sampled by three dredgings each covering an area of one-fourth square foot and representing water depths of 1, 9 and 30 metres. The bottom fauna consisted of dipterous larvae, amphipods, annelids, molluscs and caddis larvae. The dipterous larvae and annelids comprised 79.4 per cent of the total numbers observed. The standing crop of bottom fauna at the time of the observations amounted to 4.16 pounds per acre or a total of approximately 820 pounds for the entire lake. Complete details of the bottom fauna are included in Table 12.

The plankton population of the lake was sampled by a total vertical haul of 30 metres and a horizontal surface tow of 50 yards, in each case using a 25 cm. "Wisconsin" type net. The volume of plankton in the total vertical haul was only 0.45 cc. of which almost all was zooplankton. The zooplankton consisted for the most part of copepods and cladocera. Large numbers of pollen grains were also present. Complete date regarding the plankton are included in Table 13.

The fish fauna of the lake was sampled by using a series of gill nets. This series consisted of 25 yards of each of $1\frac{1}{2}$-inch, 2-inch, 3-inch, 4-inch, 5-inch and 5½-inch meshes and was set at 8:30 p.m., on June 17, with one end of the 1½-inch mesh in 0.7 metres of water and the opposite end of the 5½-inch mesh in 27 metres of water. The location of the net series is shown in Fig. 20. The gill net series was lifted at 10:00 a.m., on June 18, and the catch consisted of the following numbers and species of fish:

No.	% of Total No.	Species	Length Range	Weight Range	Total Weight	% of Total Wt.
1	1.6	Eastern Brook Trout *Salvelinus fontinalis* (Mitchell)	9¾"	6 ozs.	6 ozs.	3.9
1	1.6	Gasperau *Pomopolus pseudoharengus*	10½"	8½ ozs.	8½ ozs.	5.6
58	95.2	White Perch *Morone americana* (Gmelin)	4½" - 6¾"	5/8 - 3 ozs.	5 lbs. 1 oz.	53.1
1	1.6	Eel *Anguilla americana*	34"	3 lbs. 9 ozs.	3 lbs. 9 ozs.	37.4
					9 lbs. 8½ ozs.	

The gasperau was taken in the 3-inch mesh at a depth of approximately 18 metres. All the other fish were taken in the 2-inch and 1½-inch meshes at depths not exceeding 13 metres.

Warren Lake was stocked with 8,000 eastern brook trout fingerlings in 1933, 4,000 in 1934 and 15,000 in 1936, and probably contained a population of this species prior to the introductions. The presence of an eel and a gasperau in the gill net catch indicated that, at least during times of high water, it was possible for fish of these species to enter the lake from the ocean. The single trout taken in the net appeared to be a sea run trout. During 1947, 18 trout were reported taken from this lake by anglers. These fish ranged in length from 8 to 13 inches.

That, due to its depth, Warren Lake did not have a high basic productivity was indicated by the small standing crops of bottom fauna and plankton observed during the investigation. The drainage area supplying the lake is fairly large and at the time of observation a considerable volume of water was passing through the lake to the ocean. The pH of 6.3 is characteristic of water draining from areas of igneous rocks and such acidity is often associated with low basic productivity.

A part of the basic productivity of the lake was being utilized by a population of white perch. The few scale samples examined in detail indicated that the growth rate of this population of white perch was lower than in other areas studied by the author. The one trout examined showed a growth rate comparable to that determined for trout in streams in the park by Dr. A. A. Blair from material collected by Drs. A.G. Huntsman and A.H. Leim in 1937.

The size and depth of the lake would make the use of poison for controlling the population of white perch very expensive, not to mention the uncertainty of results in such deep water. Even if the perch population was removed by poisoning, unless a suitable structure was erected at the outlet from the lake, perch would re-enter from the ocean.

In view of the probable cost of any practical method which might be devised for the control of the perch population in this lake, it seemed more feasible to plant, on an annual basis, the largest size of eastern brook trout fingerlings available in numbers not exceeding 10,000 in each planting, if fish 2 inches in length were used and not exceeding 6,000 in each planting, if fish 3 inches in length were available. The larger the size of trout available for planting, the greater the chance of survival in competition with the white perch. The adult trout in the lake might feed on the perch and thus the population of perch, though stunted, might serve a useful purpose.

Some of the trout introduced into this lake might ultimately find their way to the sea and be lost to the fish population of the lake, but most of the satisfactory trout angling in the park is for sea run trout and this angling depends on the stock of trout in the sea, regardless of their source. Thus, trout lost from Warren Lake might spend a part of their life in the sea and grow at a greater rate than in the lake and might return and again become available to anglers, though not necessarily in Warren Lake.

APPENDIX IV

Table 12. BOTTOM FAUNA - WARREN LAKE, JUNE 18, 1947.

Dredging number	14	12	13
Type of bottom	Sand	Red mud balls and sand. Little organic matter.	Fine silt and much organic matter.
Area covered	1/4 sq. ft.	1/4 sq. ft.	1/4 sq. ft.
Depth of water	1 metre	9 metres	30 metres
FAUNA			
Diptera			
Chironomid larvae	4 (3-6 mm. long)	14 (4-7 mm. long)	26 (6-10 mm. long)
Trichoptera			
Helicopsyche borealis	1 (5 mm. in diameter)	Nil	Nil
Limnophilid larvae	4 (6-9 mm. long)	"	"
Amphipoda			
Hyalella knickerbockeri	22 (2-4 mm. long)	"	"
Mollusca			
Amnicola sp.	1 (4 mm. long)	"	"
Annelida			
Oligochaeta	Nil	"	64 (10-64 mm. long)

Table 12. (Cont'd)

Total number of organisms	32	14	90
Total dry weight	0.0119 gms.	0.0009 gms.	0.0239 gms.
Less weight of incombustible residue	0.0036 gms.	0.0000 gms.	0.0019 gms.
Organic matter per 1/4 sq. ft. dry weight	0.0083 gms.	0.0009 gms.	0.0220 gms.
per acre, dry weight	3.32 lbs.	0.36 lbs.	8.80 lbs.

Average dry weight organic matter, all depths - 4.16 lbs. per acre.

Table 13. PLANKTON - WARREN LAKE, JUNE 18, 1947.

VA - Very abundant; A - abundant; C - common; R - rare.

	Vertical haul, 30 metres. Total volume 0.40 cc. after standing 1 hour.	Surface tow, 50 yds. Total volume 0.65 cc. after standing 1 hour.
Phytoplankton		
Desmidiaceae		
Closterium sp.	R	R
Zooplankton		
Cladocera		
Daphnia pulex	R	Nil

Table 13. (Cont'd)

Leptodora kindtii	Nil	R
Bosmina sp.	R	C
Copepoda (immature and adult stages)		
Cyclops biscuspidatus	VA	Nil
Diaptomus sp.	A	A
Rotifera		
Anuraea sp.	A	Nil
Rattulus sp.	Nil	R
Notholca longispina	Nil	R
Miscellaneous material		
Pollen grains	A	A

Table 14. GILL NET CATCH - WARREN LAKE.

Number	Species	Length (Ins.)	Weight (Ozs.)	Sex	Age (years)	Stomach Contents
88	Eastern Brook Trout	9¾"	6	F seed eggs	5+	Condition good - possibly sea run, fish remains.
89	White Perch	6	2	F ripe	3+	Empty.
90	White Perch	6¾	3	F ripe	3+	2 cc. insect remains, bottom fauna.

Table 14. (Cont'd)

91	White Perch	5	1	M ripe	3+	Empty.
92	White Perch	$4\frac{3}{4}$	3/4	M imm-ature	3+	1 cc. insect larvae
93	Gasperau	$10\frac{1}{2}$	$8\frac{1}{2}$	M ripe		Empty.
94	White Perch	6	2	F ripe		Empty.
95	White Perch	$4\frac{1}{2}$	3/4	M imm-ature		3 cc. insect remains.
96	White Perch	$4\frac{1}{2}$	5/8	F imm-ature	3+	Empty.
97	Eel	34	57	M?		One $5\frac{3}{4}$" perch.

Unnumbered, unopened, 51 white perch, total weight, 71 ozs.

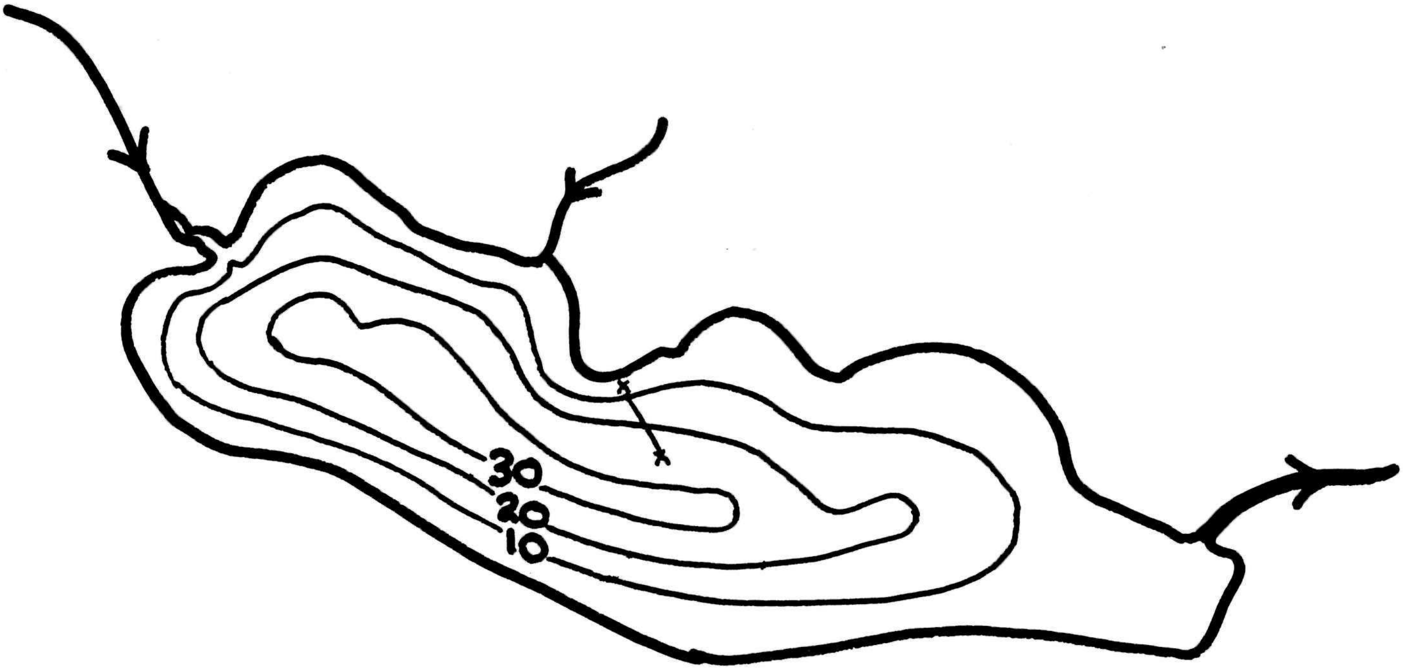


Fig. 20.-

N ↑

WARREN LAKE

5" = 1 MILE

CONTOURS IN METRES

AREA = 197 ACRES

x—x GILL NET SERIES

Fig. 21 - Warren Brook at entrance to Warren Lake, looking east. June 18, 1947.

Fig. 22 - Warren Lake looking west from beach at east end to show surrounding topography and Warren Brook valley in centre background. June 18, 1947.

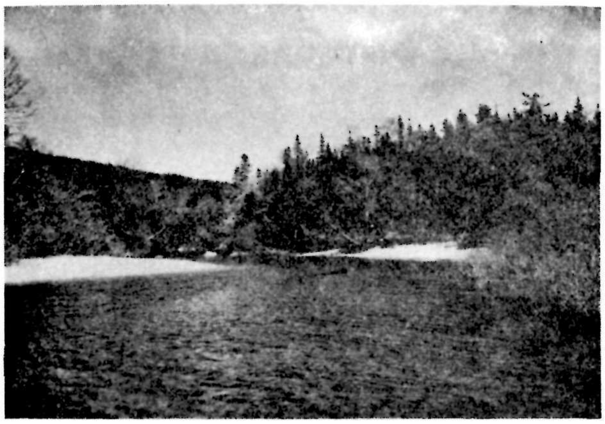


Fig. 23 - Looking east down Warren Brook as it leaves Warren Lake, June 18, 1947.

V. LIMNOLOGICAL INVESTIGATION OF PRESQU'ILE LAKE, JUNE 23 AND 24

A limnological investigation of the fish, plankton, and bottom fauna as well as observations on the physical and chemical conditions of the lake were made during the captionally noted period.

The lake is accessible from the Cabot Trail as indicated in Figs. 25 and 26 and in fact is crossed by the Cabot Trail near the south end. At times of high water and during severe storms with west winds, at high tide the south end of the lake was reported to be in open communication with the sea. This part of the lake is shown in some detail in Fig. 25. In the Superintendent's monthly and annual reports for the years 1939, 1940, and 1943 mention is made of good catches of eastern brook trout from this lake. In 1947 no such catches had been reported in recent years and the investigation was undertaken to determine, if possible, if trout were still present in the lake.

Several series of soundings were made in the lake on June 23 and from these, the map, Fig. 24, showing bottom contours, was constructed.

Physical and chemical observations, made at 10:00 a.m., June 24, are recorded below.

Depth in metres	Temperature	Dissolved Oxygen per litre	% Saturation	pH	Dissolved Carbon Dioxide
0	16.5°C	7.2 cc.	108	8.7	Nil
2.5	16.5°C	7.3 cc.	112	8.7	Nil

Secchi's disc (transparency) 3.0 metres - bottom.

The pH values obtained with three separate, independent sets of indicators and colour standards were different and the values reported above are averages of the values obtained with the different indicators. It was probable that the water of the lake was brackish, although a saline taste was not noted, and that the presence of dissolved salts affected the pH indicator solutions in some manner. Equipment for use in determining salinity of water was not available at the time of the investigation.

In spite of heavy rains before the investigation there was no outflow from the lake and no evidence of any inflowing stream. The lake surface was approximately at sea level and undoubtedly the water was brackish much of the time.

The bottom of the lake was almost completely covered by a growth of submerged aquatic plants including pondweeds Potamogeton sp. and water milfoil Myriophyllum sp.

The bottom fauna of the lake was sampled by two dredgings each covering an area of one-fourth square foot and representing water depths of 1.5 and 3 metres. The bottom fauna consisted of chironomid larvae, caddis larvae, dipterous pupae, and water mites of which the chironomid larvae comprised 86 percent of the total numbers of individuals observed. The standing crop of bottom fauna at the time of the observations amounted to 2.84 pounds per acre or a total of approximately 57 pounds for the entire lake. Complete details of the bottom fauna are included in Table 15.

The plankton population of the lake was sampled by a total vertical haul of three metres and a horizontal surface tow of 50 yards, in each case using a 25 cm. "Wisconsin" type net. The volume of plankton secured in the total vertical haul was only 0.3 cc. of which approximately 10 percent was phytoplankton and the remainder zooplankton. The zooplankton was rich in rotifers and copepods. Complete details regarding the plankton are included in Table 16.

The fish fauna of the lake was sampled by the use of a series of gill nets. This series consisted of 25 yards of each of $1\frac{1}{2}$-inch, 2-inch and 3-inch meshes and was set in the position indicated in Fig. 24 at 8:30 p.m., June 23, with one end of the $1\frac{1}{2}$-inch mesh in a water depth of 1 metre and the opposite end of the 3-inch mesh in a depth of 2.5 metres. The net series was lifted at 8:45 a.m., June 24. The catch included two smelts (Osemerus Mordax). The following data apply to these fish:

Number	Length	Weight
100	$4\frac{1}{4}$"	$\frac{1}{4}$ oz.
101	$7\frac{1}{2}$"	$1\frac{1}{2}$ oz.

The posterior portion of fish Number 101, including the internal organs, had been removed while the fish was in the net. This suggested the presence of eels in the lake. Eels are not caught readily in gill nets and their absence from the catch is not proof that they were not present.

A set line bearing a large baited hook was found near where the gill net series was set and in another part of the lake a lobster trap, modified for use as an eel or minnow trap, was found. These items were brought to the attention of the local park warden.

The good trout angling reported from this lake during the years 1939, 1940 and 1943 may have been due to large influx of trout from the sea at times when the lake was in open connection with the ocean during those years.

The absence of trout from the 1947 gill net catch and the fact that no catches of trout had been reported from the lake in recent years indicated unfavourable conditions for the entry of trout from the sea during recent years. The finding of unauthorized types of fishing tackle in the lake suggested that some trout had been removed from the lake though illegal means.

The low basic productivity of the lake coupled with the uncertainty of suitable conditions for the entrance of sea trout rendered difficult the production of stable angling in the lake.

APPENDIX V

Table 15. BOTTOM FAUNA - PRESQU'ILE LAKE

Dredging number	15	16
Type of bottom	Sand and decaying organic matter.	Sand, rooted aquatic plants.
Area covered	1/4 square foot.	1/4 square foot.
Depth of water	3 metres	1.5 metres.
FAUNA		
Diptera		
Chironomid larvae	45 (3.5-10 mm. long)	28 (2.5-10 mm. long)
Pupae	1 (5 mm. long)	1 (5 mm. long)
Trichoptera		
Limnophilid larvae	Nil	2 (4.5-6 mm. long)

Table 15. (Cont'd)

Hydracarina	5 (1-1.5 mm. long)	3 (1-1.5 mm. long)
Total number of organisms	51	34
Total dry weight	0.0086 gms.	0.0066 gms.
Less weight of incombustible residue	0.0004 gms.	Nil
Organic matter per 1/4 sq. ft. dry weight	0.0082 gms.	0.0066 gms.
per acre, dry weight	3.15 lbs.	2.53 lbs.

Average dry weight organic matter, all depths - 2.84 lbs. per acre.

Table 16. PLANKTON - PRESQU'ILE LAKE.

VA - Very abundant; A - Abundant; C - Common; R - Rare.

	Vertical haul, 3.0 metres. Total volume 0.30 cc. after standing for 1 hour.	Surface tow, 50 yards. Total volume 0.85 cc. after standing 1 hour.
Phytoplankton		
Chlocophyceae		
Spirogyra sp.	C	C
Mougeotia sp.	Nil	R
Desmidiaceae		
Cosmarium sp.	Nil	R
Staurastrum sp.	Nil	R

Table 16. (Cont'd)

Zooplankton		
Cladocera		
Bosmina sp.	R	R
Copepoda		
Cyclops sp. (adult and young)	A	A
Rotifera		
Anuraea sp.	A	VA
Polyarthra sp.	Nil	A
Filina sp.	R	R
Miscellaneous material		
Pollen grains	Nil	C

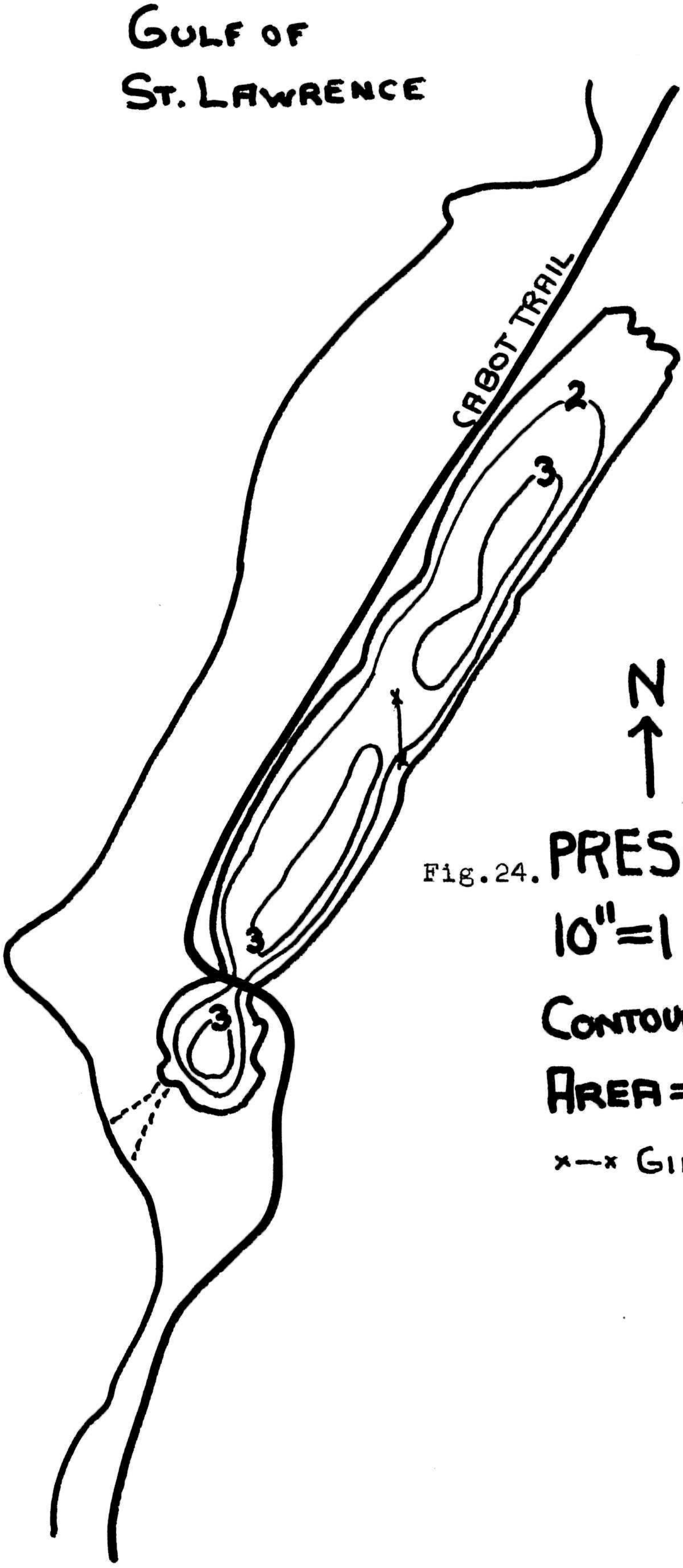


Fig.24. PRESQUILLE LAKE

10" = 1 MILE

CONTOURS IN METRES

AREA = 20·3 ACRES

x—x GILL NET SERIES

Fig. 25 - Presqu'Ile Lake looking north from Cabot Trail. Area in foreground is where lake connects with ocean at times of high water and during severe storms. June 22, 1947.

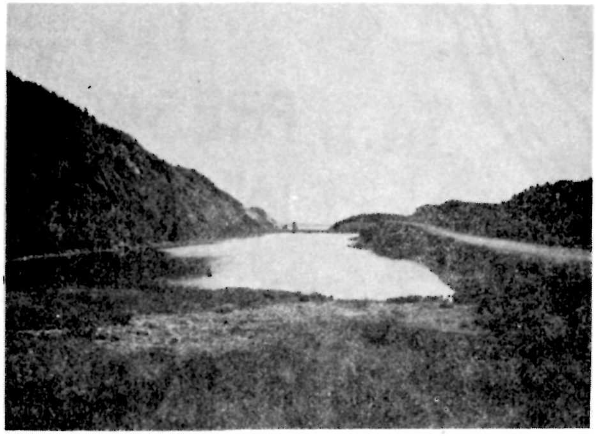
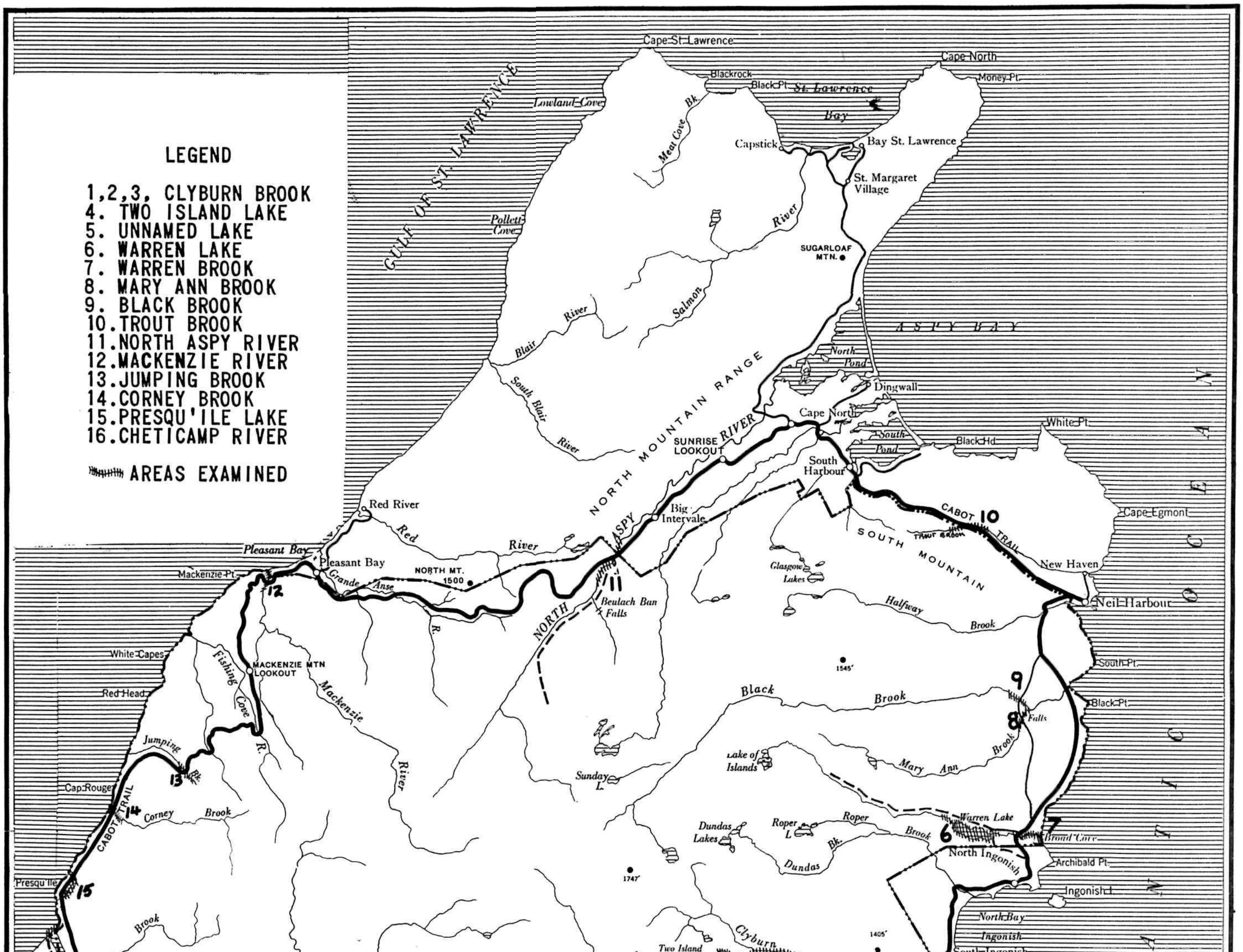


Fig. 26 - Presqu'Ile Lake looking south, Cabot Trail to the right and in centre background. June 24, 1947.


LEGEND
1,2,3, CLYBURN BROOK
4. TWO ISLAND LAKE
5. UNNAMED LAKE
6. WARREN LAKE
7. WARREN BROOK
8. MARY ANN BROOK
9. BLACK BROOK
10. TROUT BROOK
11. NORTH ASPY RIVER
12. MACKENZIE RIVER
13. JUMPING BROOK
14. CORNEY BROOK
15. PRESQU'ILE LAKE
16. CHETICAMP RIVER
AREAS EXAMINED
CAPE BRETON HIGHLANDS
NATIONAL PARK
NOVA SCOTIA
SCALE
MILES 2 0 2 4 MILES
REFERENCE
Main Highway
Secondary Road
Trail
Park Boundary
PREPARED AT THE SURVEYS AND MAPPING BRANCH, OTTAWA
GULF OF ST. LAWRENCE
ASPY BAY
ATLANTIC OCEAN
Cape St. Lawrence
Cape North
Money Pt.
Blackrock
Black Pt.
St. Lawrence Bay
Lowland Cove
Meat Cove Bk.
Capstick
Bay St. Lawrence
St. Margaret Village
Pollett Cove
River
SUGARLOAF MTN.
Salmon
Blair River
South Blair River
North Pond
Dingwall
Cape North
South Pond
White Pt.
Black Hd.
NORTH MOUNTAIN RANGE
SUNRISE LOOKOUT
RIVER
South Harbour
ASPY
NORTH
Big Intervale
Red River
Red River
Pleasant Bay
Mackenzie Pt.
Grande Anse R.
NORTH MT. 1500
Beulach Ban Falls
CABOT TRAIL
TROUT BROOK
SOUTH MOUNTAIN
Cape Egmont
New Haven
Neil Harbour
Glasgow Lakes
Halfway Brook
1545'
South Pt.
Black Brook
Black Pt.
Falls
White Capes
MACKENZIE MTN LOOKOUT
Fishing Cove R.
Mackenzie River
Red Head
Jumping Bk.
Lake of Islands
Mary Ann Brook
Sunday L.
Cap Rouge
CABOT TRAIL
Corney Brook
Dundas Lakes
Roper L.
Roper Brook
Warren Lake
Broad Cove
Dundas Bk.
North Ingonish
Archibald Pt.
Presqu'Ile
1747'
Ingonish I.
North Bay Ingonish
Robert Brook
Two Island Lake
Clyburn Brook
1405'
South Ingonish
Middle Hd.
Cheticamp L.
1625'
PARK H'Q'RS.
Freshwater L.
South Bay Ingonish
CHETICAMP RIVER
Belle Marche
Artemise Brook
Fisset Brook
Margaree River
Indian Brook
Northeast