

LIMNOLOGICAL INVESTIGATIONS

GLACIER NATIONAL PARK

V.E.F. SOLMAN

1947

National and Historic Parks Branch
Direction des parcs nationaux et
des lieux historiques



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DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT
MINISTÈRE DES AFFAIRES INDIENNES ET DU NORD CANADIEN



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Canadian Wildlife Service,
CALGARY, Alberta,
July, 1972.

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TABLE OF CONTENTS

Introduction	1
Marion Lake	1
Cougar Brook	3
Bear Creek	4
Loop Brook	5
Illecillewaet River	6
Flat Creek	7
Recommendations	8
APPENDICES	9

LIMNOLOGICAL INVESTIGATIONS

GLACIER NATIONAL PARK, 1947

Physical and chemical observations as well as collections of bottom fauna were made from four streams and one lake in Glacier National Park during the period July 20 and 22 inclusive, 1947. In view of the limited data available from each water area, observations on all five areas are included in this report.

Marion Lake

This small lake lies on the north slope of Mount Abbott at an altitude of 5800 feet above sea level. The area of the lake is approximately 1 acre and the maximum depth was estimated to be approximately 3.5 metres. Surface and bottom water temperatures as recorded at 11:15 AM on July 21, 1947 are recorded below.

Surface	0 metres	18.5°C	pH 6.5
Bottom	3.5 metres	12.9°C	

By 3:00 PM the surface water temperature had increased to 19.5°C.

The only water entering the lake at the time of observation was a small stream percolating through a rockslide on the south side of the lake. This rockslide is shown in one of the attached photographs. The temperature of the water entering the lake from this source was 12.0°C at 11:45 AM. There was no outflow of water from the lake at the time of observation. The water in the lake was clear and appeared to be free from silt. The out-let of the lake is on the north side, as seen in one of the attached photographs, and it appeared that a stream of water one foot wide and 8 inches deep flowed from the lake at times.

A 25 yard length of 1 1/2 inch mesh gill net was set from a point on

the south shore of the lake out in a north-easterly direction into water 3 metres deep at 11:30 AM, July 21, 1947. The net was lifted at 1:30 PM. No fish were taken in the net and none were observed in the lake during the period of observation.

Ten thousand cutthroat trout fry were introduced into the lake in 1942 and ten thousand fingerlings of the same species were planted in 1944. No information is available regarding the survival of these fish.

Mr. Alex Nelles, Warden, Glacier National Park reported that a great depth of snow accumulated in the area of the lake during the winter but that on some occasions, there was open water near the centre of the lake throughout all or most of the winter. The presence of open water during the winter suggests that water may enter the lake in the form of springs in the lake bottom. It is probable that during some winters a complete ice cover forms on the lake with the possibility of "Winter-kill" of the fish population. This may explain the absence of fish at the time of observation in spite of the introductions made in 1942 and 1944.

A collection of bottom and shore animals was made from the margin of the lake by means of a fine-mesh dip net. This collection contained the following immature stages of insects and related forms.

Diptera

Chironomid larvae
Chironomid pupae
Corethna sp. larvae

Odonata

Dragonfly nymphs

Coleoptera

Cyprinid beetles

Hemiptera

Corixidae

Hydracarina

Since there is no other lake in the park that is readily accessible, since invertebrate food organisms are present in considerable numbers at least during the summer and since the fate of the trout fry and fingerlings previously introduced is unknown it would seem desirable that a further introduction of trout fingerlings be made into the lake. In view of the success which has attended their introduction in other areas where cutthroat trout have not been successful it is suggested the Eastern Brook trout be introduced to Marion Lake. The initial introduction should include 400 Number 2 or 3 fingerlings and if these survive and increase in size, a further introduction should be made during the following year. The first introduction of this species should be made during 1948.

Cougar Brook

This stream which flows through the Nakimu Caves (see attached photograph), which were a considerable tourist attraction in the early years of the history of the park, descends steeply over the greater part of its length and finally enters the Illecillewaet River at a point approximately two and a half miles west of Glacier station. Since only the lower reaches of the stream are accessible to fish, the investigation was confined to this portion. The following observations were recorded at 5:30 PM on July 21, 1947 at a point near the main line of the CP railway.

Temperature	9.2°C
pH	7.7
Width	35 feet
Average depth	1 foot
Rate of flow	7-8 ft. per second
Water clear	
(Temperature of seepage pools in Nakimu Caves	4 to 5°C)
(" " stream above " " "	8.0°C)

A collection of bottom fauna was made from one square foot of stream bottom in this area. This collection contained immature stages of insects

of several species and the standing crop at the time of observation amounted to a dry weight of 2.38 pounds of organic matter per acre. Complete details regarding this collection are included in appendix table I. Simuliid larvae (Blackfly) were present on stones in the stream bed above the Nakimu Caves but no other immature insects were observed in that region.

Bear Creek

This stream, sometimes referred to as Rogers Pass creek was investigated at a point near the location of what was formerly the station of Rogers Pass. This point is approximately 4 1/2 miles from the present Glacier station by way of the abandoned railway grade and approximately one mile north of the summit of Rogers Pass. The following observations were recorded during the afternoon of July 20, 1947.

Temperature	10.5°C (at summit 8.5°C)
pH	6.8-7.0
Width	2 ft.
Depth	1 ft.
Rate of flow	2-3 ft. per second
Water slightly silty	

Two collections of stream bottom fauna were made from different kinds of bottom material near the above noted point. These collections included immature stages of insects belonging to several families. The dry weight of organic matter represented by the immature insects collected was equivalent, at the time of observation, to a standing crop of 3.29 pounds per acre. Complete details regarding these collections are included in appendix table 2.

Five thousand Cutthroat trout fry were released into Bear Creek during 1942. Warden Nelles of Glacier informed me that none of these trout had been taken by anglers in the area of the stream investigated by me but that it was possible that some of these fish had contributed to the angling in

the Beaver River to Tourist Anglers, further introductions of trout to Bear Creek are not recommended at this time.

Loop Brook

This stream, which crosses the main line CP Railway at a point approximately one mile west of Glacier station was visited at 6:15 PM on July 21, 1947. This stream, though flowing through a broad valley near its mouth still has a sufficient current to roll stones along the bottom. The attached photograph shows a portion of Loop Brook immediately upstream from the point where the observations recorded below, were made. In the centre background may be seen one of the stone abutments which supported a portion of the old railway trestle which circled over the brook to gain height on the approach to Rogers Pass. This circling of the railway in the area is responsible for the name Loop applied to the stream.

The following observations were recorded.

Temperature	8.0°C
pH	6.8
Depth	2 ft.
Width(average)	25 ft.
Rate of flow	8-10 ft. per second
Water very silty	

Instead of a quantitative collection from one square foot of stream bottom, a qualitative collection of immature stages of insect larvae was made from 10 hand-sized stones which included representatives of the families Diptera and Ephemeroptera, as tabulated below.

Ephemeroptera

Mayfly nymphs	22 (3-7 mm. long)
	8 (9-14 " ")
Diptera	1 (17 " ")
Chironomid larvae	2 (3 mm. long)
Total individuals	<u>33</u>

This number of individual immature insects from the surfaces of 10

stones represents a standing crop comparable to that observed in Cougar Brook. The standing crop therefore probably contained a dry weight of organic matter of the order of 2 to 3 pounds per acre, at the time of observation.

Illecillewaet River

This stream, which flows from the Illecillewaet glacier, for which Glacier station is named, parallels the main line CP Railway from Glacier Station to the Columbia River. The upper portion of the river, paralleled by the CP Railway grade and the old coach road to the Nakimu Caves, is shown in the attached photograph. The switching facilities at Glacier Station are visible in the lower right corner of the photograph. The area in which the observations recorded below were made is also shown near the lower right corner of the photograph. Observations were made on this stream at 8:30 PM on July 21, 1947 at a point one hundred yards west of Glacier Station. The following observations were recorded.

Temperature	7.0°C
pH	6.8
Depth	2.5 feet
Average width	40 ft.
Rate of flow	8-10 ft. per second
Water very silty	

A collection of bottom fauna was made from one square foot of bottom of the stream in water 4 to 6 inches deep. The stones ranged from 8 inches in diameter to small pebbles. Immature insects belonging to three families were secured as listed in appendix table 3. The standing crop of bottom fauna amounted to 2.86 pounds of organic matter (dry weight) per acre. One 4 1/2 inch fish was observed in shallow water, probably a Dolly Varden though positive identification was impossible due to silty water.

Outside the boundary of Glacier Park a power dam has been erected across the Illecillewaet River. This dam, of cement over 20 feet high, is not provided with a fishway and consequently serves as a barrier to upstream migration of fish. Verbal reports collected during the investigation indicates that prior to the construction of the dam there was considerable angling for Dolly Varden carried on in park waters. Two years after the construction of the dam the angling above the dam had become so poor that little angling has been done since.

Park Warden Alex Nelles of Glacier has reported some catches of small Dolly Varden from parts of the river between Cougar Brook and Flat Creek by the warden stationed at Flat Creek but it would appear that little angling, of the quality available in other National Parks, is, or can easily be made available, in Glacier National Park.

Some reports received during this investigation indicated that better angling was available in the portion of the park north of Rogers Pass than in the portion investigated. The north-eastern portion of the park is not now readily accessible to anglers and consequently the present investigation was limited to the southwestern portion of the park.

The provision of tourist facilities in the northeastern portion of the park at some future date may render desirable a limnological investigation of the Beaver River and its tributaries at that time.

The productivity of bottom fauna of the streams of Glacier National Park, as represented by an average standing crop of 2.84 pounds per acre from the three streams sampled quantitatively during the present investigation, compares favourably with the average standing crop of 1.96 pounds per acre observed in eight streams in Cape Breton Highlands National Park during June 1947.

It is considered that the rapid rate of flow and heavy scouring which occurs in the early summer floods is responsible for the fact that moderate sized fish are present in the streams in limited numbers only while large fish are rarely found. The bottom food supply, at least during the summer, together with the terrestrial material which falls into the streams would be capable of supporting a somewhat larger population of game fish than inhabit the streams at present but the severity of the scouring and the length of the relatively unproductive winter season combine to restrict the population to a level which appears to be below that which might be expected to occupy the streams in view of the available summer food supply.

Recommendation

The only fisheries management work recommended for Glacier Park as a result of the presently reported investigation is the introduction of 400 number 2 or 3 fingerling Eastern Brook trout to Marion Lake in 1948 as a final test of the fish-carrying capacity of this water area. These trout could be supplied from the Banff hatchery, shipped to Glacier station by CP Express and transported to the lake by packhorse. The transportation within Glacier Park could be carried out by Warden Nelles of Glacier who has had considerable experience transporting trout fingerlings during his years of service as a warden in Jasper Park.

Appendix Table 1

Bottom Fauna - Cougar Brook

Sample number	SS #17
Area covered	All stones in 1 square foot
Type of bottom	Hand-sized and smaller stones, some covered with algae.
Depth of water	3 inches
Rate of flow	7-8 ft. per second
Temperature	9.2°C at 5:30 PM July 21, 1947
pH	6.2

Bottom Fauna

Insecta

Diptera

Chironomid larvae	8(4-6 mm. long)
" pupae	1(4 " ")

Ephemeroptera

Mayfly nymphs	24(3-6mm. long)
" "	26(8-12 mm. long)

Plecoptera

Stonefly nymphs	3(4-7 mm. long)
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Trichoptera

Misc. caddis larvae	4(5-7 mm. long)
<u>Psilotreta sp.</u>	<u>1(5 " ")</u>

Total number of organisms 67

Total dry weight 0.0268 gms.

Less weight of incombustible residue 0.0020 "

Organic matter, per square foot, dry weight 0.0248 gms.

Organic matter, pounds per acre, dry weight 2.38

Appendix Table 2

Sample number	SS #15	SS #16
Area covered	All stones in 1 square foot	All surfaces of 10 pieces of wood each approximately 1 ft. x 1 1/2 in. by 1 1/2 ins.
Type of bottom	Stones 1-3 ins. in diameter	Wood debris
Depth of water	8 inches	1 foot
Rate of flow	2 ft. per second	3 ft. per second
Temperature	10.5°C afternoon July 20, 1947	10.5°C
pH	6.8	7.0

Bottom Fauna

Insecta

Diptera

<u>Blepharocerca</u> sp. pupae	3(4-5 mm. long)	
<u>Simulium</u> sp. larvae	2(6-7 mm. long)	3(3-9 mm. long)
Chironomid larvae	2(5 mm. long)	

Trichoptera

Misc. caddis larvae	3(5-7 mm. long)	
<u>Ryacophillia</u> sp. larvae	3(6-12mm. long)	3(8-15mm. long)

Ephemeroptera

Mayfly nymphs	29(10-14 mm. long)	32(10-16 mm. long)
" "	7(5-7 mm. long)	

Plecoptera

Stonefly nymphs		1(6 mm. long)
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Arachnida

Spider	<u>1</u> (2.5 mm. long)	—
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Total number of organisms	50	39
Total dry weight	0.0392 gms.	
Less weight of incombustible residue	<u>0.0050</u> "	
Organic matter, per square foot, dry weight	0.0342 "	
Organic matter, dry weight, pounds per acre	<u>3.29</u>	

Appendix Table 3

Bottom Fauna - Illecillewaet River

Sample number	SS #19
Area covered	All stones in 1 square foot
Type of bottom	Stones from 8 inches in diameter to pebbles
Depth of water	4-6 inches
Rate of flow	8-10 ft. per second
Temperature	7.0°C at 8:30 PM July 21, 1947
pH	6.8

Bottom Fauna

Insecta

Diptera

Chironomid larvae 6(3-5 mm. long)

Trichoptera

Caddis larvae 1(18 mm. long)

Ephemeroptera

Mayfly nymphs 16(3-10 mm. long)

1(28 mm. long)

Total number of organisms 24

Total dry weight 0.0321 gms.

Less weight of incombustible residue 0.0023 "

Organic matter, per square foot, dry weight 0.0298 "

Organic matter, pounds per acre, dry weight 2.86