PROCEEDINGS

OF THE

Nova Scotian Institute of Science

VOL. 26 - PART I

A STUDY OF BARACHOIS PONDS IN THE BRAS D'OR LAKE AREA OF CAPE BRETON, NOVA SCOTIA

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(Received for Publication, January 1963)

INTRODUCTION

Artificial and natural freshwater ponds and small lakes in the Atlantic provinces of Canada have been managed to provide good crops of the native brook trout (*Salvelinus fontinalis*) and the introduced rainbow trout (*Salmo gairdneri*) to anglers (Smith, 1951, 1955, 1961). Estuaries and other partially enclosed saltwater areas are coastal topographical features of the Atlantic provinces. The use of such saltwater areas to produce trout with measures of control of both habitat and fish has received little attention (Smith, 1946). Some advances in this direction have been made by Danish trout farmers (Anon., 1962). Both the brook and rainbow trout run to saltwater from our streams, and their growth in marine habitats is good (White, 1941; Smith and Saunders, 1958; Leim and Day, 1959).

A number of fresh and brackish water ponds border the shores of Bras d'Or Lake, Cape Breton, N. S. The purpose of this study was to assess these ponds as trout habitats with respect to such conditions as temperature, dissolved oxygen,

and salinity. Suitable ponds might be used for the production of rainbow or brook trout depending on the measures of habitat control possible.

The ponds are generally small in size, few exceeding 30 to 40 acres in area (2.47 acres = 1 hectare). They are also separated from the salt water of Bras d'Or Lake by sand and gravel barriers. Although not peculiar to the area, they are numerous.

According to Johnson (1925), ideal conditions exist in the Bras d'Or Lakes for the formation of bars "since the vigorous wave attack is limited to two directions, opposed to each other, with the result that beach drifting is from opposite directions toward inequalities in the shore, shoals, or protected areas back of islands or in the lee of points projecting from the other shore." Ponds are formed when these bars emerge and cut off heads of inlets.

Considerable variation exists between individual barriers holding ponds, with respect to height, width, consistency, and permanency. Few of the barriers appear to be of a stable nature and conditions of high wind or tide, particularly those of the winter and spring seasons, tend to alter them. Some of the barriers completely cut off the ponds from Bras d'Or Lake and any exchange of water is apparently by percolation through the sand and gravel. Other barriers have openings of varying sizes through which an exchange of water is continuous.

The ponds are sometimes locally known as "barachois ponds". The word "barachois" is of French origin and may be defined as "an extension of water of little depth, separated from the sea by a sandbank, and surrounded by natural grassland. The barachois is generally connected with the sea by a narrow gully. The sandbank itself is also called barachois" (Translated from Savard, 1959, p. 199).

PRELIMINARY SURVEY

A reconnaissance of the area was made during the early part of June, 1961, and the majority of the ponds located and casually observed. Their general features are recorded in Table I. The locations of the ponds are shown on the accompanying map (Figure 1).

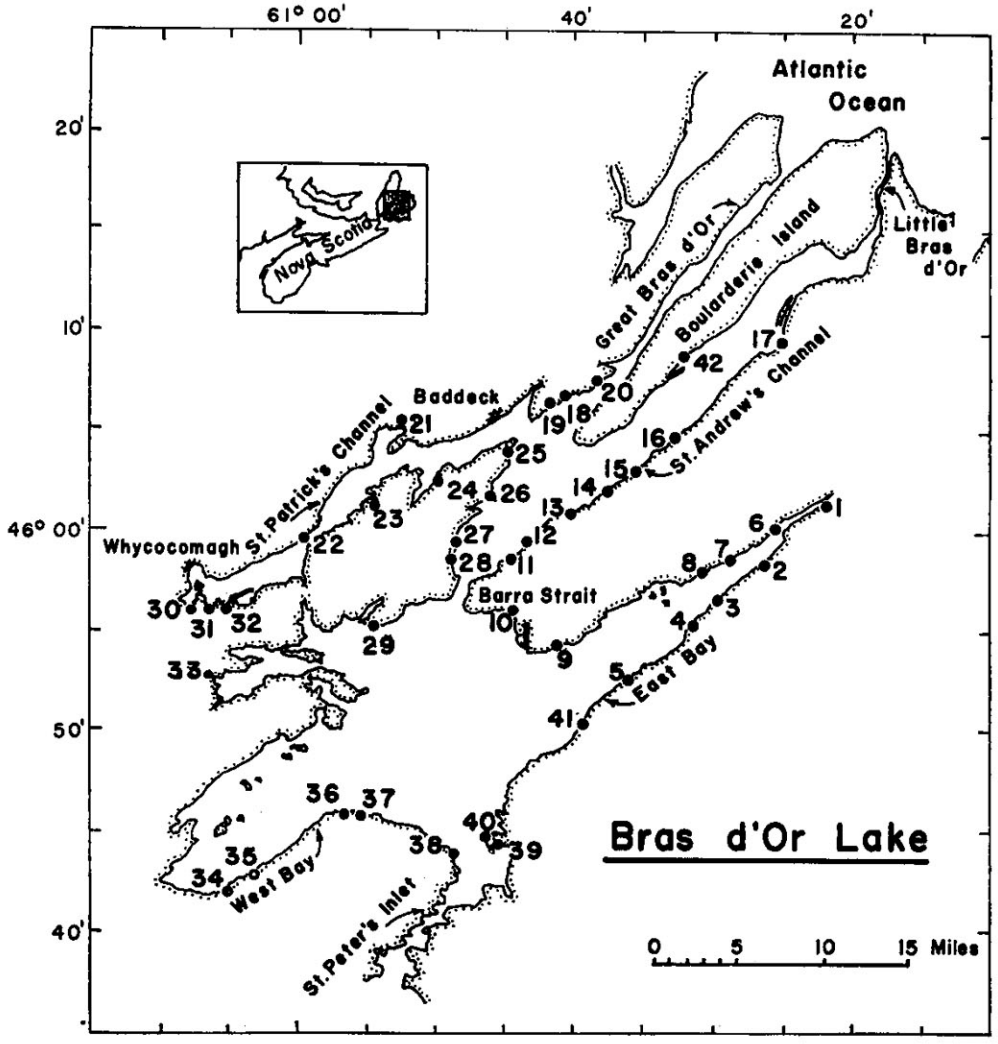

Figure 1. Outline map of Bras d'Or Lake illustrating the location of barachois ponds.

From the information gained, the ponds were classified into four general types. These types are based on the situation as observed during the summer of 1961. The conditions as observed then are not regarded as being permanent.

Type I —Ponds which are completely cut off from the Lake by the barrier—

(a) without a freshwater tributary stream.
(b) with freshwater tributary stream(s).

Type II—Ponds which have an opening through the barrier, allowing an exchange of water with the Lake—

(a) without a freshwater tributary stream.
(b) with freshwater tributary stream(s).

Following the preliminary survey, twelve ponds were selected for more detailed hydrological investigation. Sketches were made of the ponds and approximate bottom contour determined. Approximate areas were calculated from the sketches. Temperature, dissolved oxygen, and salinity conditions were observed and the results recorded in Table II.

SUITABILITY OF WATER IN THE PONDS FOR TROUT

Good brook trout, or rainbow trout, water has temperatures in the range of 14°C to 20°C during the summer, and a dissolved oxygen content of at least 5 parts per million (Fry 1951; Graham 1949). There is considerable evidence, however, that brook trout, at least, will live and do well in water of higher temperature and lower oxygen content where there is little or no competition from other fishes.

The surface water of the ponds becomes warm during the summer months and this warm water becomes deeper as the summer progresses (see data for Jarman's Ponds, number 1 and number 2, in Table II). Cool water is found only in the bottom of the deeper ponds.

Salinity in the ponds obviously varies with the amount of exchange of water through the opening in the barrier, and the amount of freshwater entering from tributary streams. The salinities encountered would probably have little direct effect on yearling, or older, trout which might be introduced into the ponds. In several ponds a marked halocline was noted, resulting also in a stratification of temperature and oxygen. Under these conditions, oxygen content may become low below the halocline. Salinity of the surface water of Bras d'Or Lake, as measured by G. H. Geen in the summer of 1960 (unpublished data), ranged from 6.6 to 24.9 parts per thousand. Much of the surface water has a salinity of about 21 parts per thousand. Surface water of the ponds was usually below this value.

CONTROL OF THE PONDS

The value of the ponds as trout habitats depends, in good part, on the degree of control that could be exercised on the water exchange and fish movements. Many of the barriers are sandy and change readily, particularly under storm conditions of wind and tide. It is possible that some of these barriers could be strengthened by the addition of sand and gravel. Trout might be held in the ponds by anchoring screens across the openings in the barriers. However, spring tide and ice conditions, and heavy storms remain a hazard for year-round control.

Local residents report good spring trout angling in many of the ponds. Summer angling is carried on to a limited degree in the same ponds, but little success is reported. Opinion is that sea-trout move into many of the barachois ponds in the early spring, but it would appear that they leave with the onset of the unfavourable summer conditions of temperature and oxygen.

CONCLUSION

Several of the ponds that were studied appear to have possibilities for use and improvement as trout habitats, since they present favourable temperature and dissolved oxygen conditions, at least during the summer months. A brief description of those ponds which appear most suitable follows:

Castle Bay Pond - number 9, Figure 1

This pond is large but has a small, spring-fed stream flowing in. The pond is bounded along one side by a long, curved spit. This barrier is reported to be open during the winter and spring seasons, allowing an exchange of water between the pond and Lake. It would appear difficult to control during these seasons, although it is closed for most of the summer and fall seasons.

Campbell's Pond - number 30, Figure 1

There is the possibility here of setting up both a freshwater and a saltwater pond. The largest freshwater inlet could be blocked off by completing a partial dam already there and hence form a freshwater pond.

Lieutenant Pond - number 27, Figure 1

A permanent opening in the barrier allows a continual exchange of salt water throughout the summer. Salinities throughout the pond correspond closely to that of the surface water of Bras d'Or Lake in this region.

Jarman's Pond, "one" - number 18, Figure 1

This pond appears to be permanently enclosed by its barrier although some exchange of water may take place through the barrier by seepage. There are numerous freshwater springs draining into this pond.

MacLeod's Ponds, "two" and "three" - number 22, Figure 1.

As the situation exists here, there is a freshwater pond ("three") and a brackish water pond ("two") connected by a small stream. Pond "two" is also open to salt water through a narrow channel.

ACKNOWLEDGEMENTS

This work was supported by the Nova Scotia Research Foundation: Dr. H. D. Smith, President. The assistance of Drs. F. R. Hayes and G. H. Geen is gratefully acknowledged. Protection Officers of the Canada Department of Fisheries kindly aided in the field.

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TABLE I. General Features of Cape Breton Barachois Ponds.

Map location	Type (See text)	Approx. acreage	Barrier	Remarks
1 East Bay Barachois Pond	2(b)	25	Sandy	Large opening in barrier.
2 Ben Eoin Pond	2(a)	10	Low sand bar	
3 MacDougall Pt. Pond	2(b)	15	Sandy	
4 Marble Pt. Pond	2(a)	10	Sand and gravel	
5 Lochnan Fad	2(a)	25	Low sand bar	Barrier open to salt water in several places.
6 MacGillivary's Pond	2(b)	2	Sand and gravel	Pond is shallow.
7 New Aberdeen Camp Pond	2(a)	5	Sandy—covered with grass	Barrier appears stable.
8 MacIntosh's Pond	2(b)	5	Sand and gravel	Opening in barrier closed during summer
9 Castle Bay Pond	2(b)	25	Long, sand and gravel	Barrier reported open during winter and spring.
10 Piper's Cove Pond	2(b)	10	Sandy	Opening subject to change readily.
11 Christmas Island Pond	2(a)	30–40	Sandy	Barrier low and broken.
12 Goose Pond	2(a)	10	Sandy; low	Pond is shallow.
13 Black Pt. Pond	2(b)	30	Sand and gravel	Barrier stable. Pond appears deep.

14	Shunacadie Pond	2(a)	10–15	Sandy and low	Ponds shallow; barriers broken and appear unstable.
15	MacLean's Beach Pond	2(a)	10–15	Sandy and low	
16	Beaver Cove Pond	2(a)	10–15	Sandy and low	
17	Barachois Ponds: (1)	2(b)	20	Sand spit	
	(2)	2(b)	10	Sand spit	Branch of above pond.
18	Jarman's Pond, No. 1	1(a)	15	Sand and gravel appears permanent	Water level in pond is approx. 2 ft. above Lake level.
19	Jarman's Pond, No. 2	2(b)	10	Sand and coarse gravel	Pond appears quite productive.
20	MacDonald Pt. Pond	2(a)	10	Sand and gravel	Pond shallow. Abundance of aquatic vegetation.
21	Indian Bay Pond	2(b)	10	Formed by highway	Some surface drainage into pond.
22	MacLeod's Pond: "one"	2(b)	150	No barrier	Connected to St. Patrick's Channel by narrow channel.
	"two"	2(b)	3	No barrier	Pond is connected to "one" by narrow channel.
	"three"	—	3	No barrier	Pond about 8 ft above level of "two". Small stream joins "two" and "three".
23	Maccrutchie Cove Pond	2(b)	8	Sandy. Forms road bed	Two openings to salt water.
24	MacIvor Cove Pond	2(a)	10	Sandy	Pond is shallow.

TABLE I. General Features of Cape Breton Barachois Ponds. (continued)

Map location		Type (See text)	Approx. acreage	Barrier	Remarks
25 MacKay Pt. Pond		2(a)	7	Sandy	Pond is shallow and has a sandy bottom.
26 Russell's Pond (Pony Pt.)		1(a)	5	Sand and gravel appears permanent	Pond is privately owned. Some surface drainage from springs.
27 Lieutenant Pond		2(b)	7	Sand and gravel	Large opening to salt water.
28 Maccrutchie Pond		2(b)	10	Sandy. Serves as road bed	Salt water enters pond only with very high tides.
29 MacKinnon's Pt. Ponds	(1)	2(b)	10	Sandy	Barriers variable. Surface seepage into ponds.
	(2)	2(b)	10	Sandy	
	(3)	2(b)	30	Sand and gravel	Ponds appear deep. Deep opening through barrier to salt water.
30 Campbell's Pond		2(b)	12	Sandy. Two openings	A large part of pond is shallow.
31 MacDonald's Pond		2(a)	10	Sandy and variable	Shallow pond.
32 MacIvor Pond		2(a)	5–8		Appears shallow.
33 Ashfield Sta. Pond		2(b)	7	Formed by railway beds	Pond is part of Seal Cove.
34 Dundee Pond		2(b)	10	Sandy. Forms road bed	Pond has outlet into Black River.

35	Big Pond	2(b)	7	Two sandy barriers	Pond has sand and mud bottom.
36	Olson Pond	2(b)	5	Sand and gravel	Salt water enters ponds only with very high tides.
37	Urquart's Pond	2(b)	30	Sandy	Large freshwater stream enters pond. Pond has been stocked with hatchery trout.
38	Cape George Pond	2(a)	20–30	Sandy on two sides	Appears shallow. Has been stocked with trout.
39	Bar Point Pond	2(a)	20–30	Sandy	Open to salt water on two sides.
40	Evans Island Pond	2(a)	20	Gravel	Water appears deep.
41	Irish Vale	2(a)	20–30	Low sand bar	
42	MacEachern's Pond	2(b)	10	Gravel	Two streams enter the pond, both persisting during summer.

TABLE II. Vertical distribution of temperature, oxygen, and salinity in 12 barachois ponds, from analyses made during summer, 1961. All temperatures were taken with a Whitney Electric Thermometer to nearest tenth of a degree Centigrade. Dissolved Oxygen was determined by standard Winkler Method (Welch, 1948); salinities were measured with a hydrometer. Field tables for conversion of hydrometer readings to salinities, abbreviated from Knudsen: Hydrographical Tables, 1901, were used. +The water in these ponds had a salinity below 1 part per thousand.

Pond, pond number on map, date and maximum depth	Depth in meters	Temperature °C	Oxygen p.p.m.	Salinity parts per thousand
Olson Pond	Surface	19.9	7.9	1
Map Number: 36	1	—	—	—
Date: June 14, 1961	2	19.6	8.5	1
Maximum Depth: 2 meters				
Jarman's Pond, No. 1	Surface	21.0	10.6	
Map Number: 18	1	20.9	—	+
Date: June 21, 1961	2	20.8	—	
Maximum Depth: 7 meters	3	19.0	—	
	4	15.9	2.1	
	5	12.3	—	
	6	9.4	0	
	7	7.8	—	

Jarman's Pond, No. 1	Surface	24.1	8.1	
Map Number: 18	1	24.0	8.1	+
Date: Aug. 9, 1961	2	23.0	8.1	
Maximum Depth: 7 meters	3	22.8	7.8	
	4	22.5	6.6	
	5	19.2	4.6	
	6	15.1	3.8	
Jarman's Pond, No. 2	Surface	23.4	8.6	21
Map Number: 19	1	22.9	9.3	—
Date: June 26, 1961	2	22.4	10.8	16
Maximum Depth: 5.5 meters	3	17.2	8.5	—
	4	13.6	—	—
	5	13.1	6.7	—
Jarman's Pond, No. 2	Surface	23.6	7.9	13
Map Number: 19	1	26.1	8.1	13
Date: August 10, 1961	2	27.1	7.8	18
Maximum Depth: 5.5 meters	3	24.4	5.7	20
	4	20.4	4.1	20
	5	13.4	0	20
MacLeod's Pond, No. 2	Surface	20.9	8.0	7
Map Number: 22	1	23.2	—	—
Date: July 4, 1961	2	21.0	7.5	—
Maximum Depth: 3 meters	3	19.1	4.8	13

Table II. (continued)

Pond, pond number on map, date and maximum depth	Depth in meters	Temperature °C	Oxygen p.p.m.	Salinity parts per thousand
MacLeod's Pond, No. 3	Surface	22.8	8.9	
Map Number: 22	1	20.4	—	+
Date: June 30, 1961	2	18.6	—	
Maximum Depth: 11.5 meters	3	14.4	11.5	
	4	11.0	—	
	5	7.3	12.8	
	6	6.6	—	
	7	6.3	—	
	8	6.0	0.5	
	9	5.9	—	
	10	5.9	—	
	11	5.9	0	
Campbell's Pond	Surface	20.2	9.7	17
Map Number: 30	1	18.6	—	—
Date: July 7, 1961	2	18.1	—	—
Maximum Depth: 3 meters	3	18.0	8.7	18
Piper Cove Pond	Surface	22.2	7.9	3
Map Number: 10	1	22.0	—	—
Date: July 22, 1961	2	21.4	5.2	4
Maximum Depth: 3 meters	3	17.5	2.0	10

Castle Bay Pond	Surface	22.6	8.1	3
Map Number: 9	1	—	—	—
Date: July 25, 1961	2	22.6	8.3	3
Maximum Depth: 4 meters	3	22.6	8.2	3
	4	17.1	6.1	10
MacIntosh Pond	Surface	24.5	8.0	
Map Number: 8	1	—	—	+
Date: July 27, 1961	2	23.4	7.8	
Maximum Depth: 3 meters	3	21.8	6.0	
Maccrutchie Pond	Surface	21.8	8.9	4
Map Number: 28	1	22.1	8.8	4
Date: August 1, 1961	2	26.3	8.6	5
Maximum Depth: 3 meters	3	22.6	4.9	11
Lieutenant Pond	Surface	20.6	7.8	21
Map Number: 27	1	21.0	8.1	21
Date: August 3, 1961	2	20.3	7.5	22
Maximum Depth: 3.5 meters	3	19.0	6.6	22
Russell's Pond	Surface	23.4	8.2	
Map Number: 26	1	23.4	8.3	+
Date: August 12, 1961	2	23.3	8.2	
Maximum Depth: 6 meters	3	22.8	8.3	
	4	22.5	6.2	
	5	21.6	6.5	