The Deer Lake Recreational Fishery

By,
Peter Mathews
2nd Year FWR Student
Set H
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Summary

This project involved a study of the recreational fishery at Deer Lake in Burnaby, British Columbia. The purpose of this study was to assess if the current fisheries management strategies are appropriate for Deer Lake and its tributaries and to create some management recommendations for improving the current recreational fishery. The primary objectives were to assess the distribution and abundance of salmonids throughout the system and the publics opinion of the recreational fishery in Deer Lake.

Fish sampling and angler surveys were conducted weekly from late October 1999 to the end of March 2000. Sampling results indicated that the distribution and abundance of salmonids was very low in Deer Lake and it's tributaries during the study period.

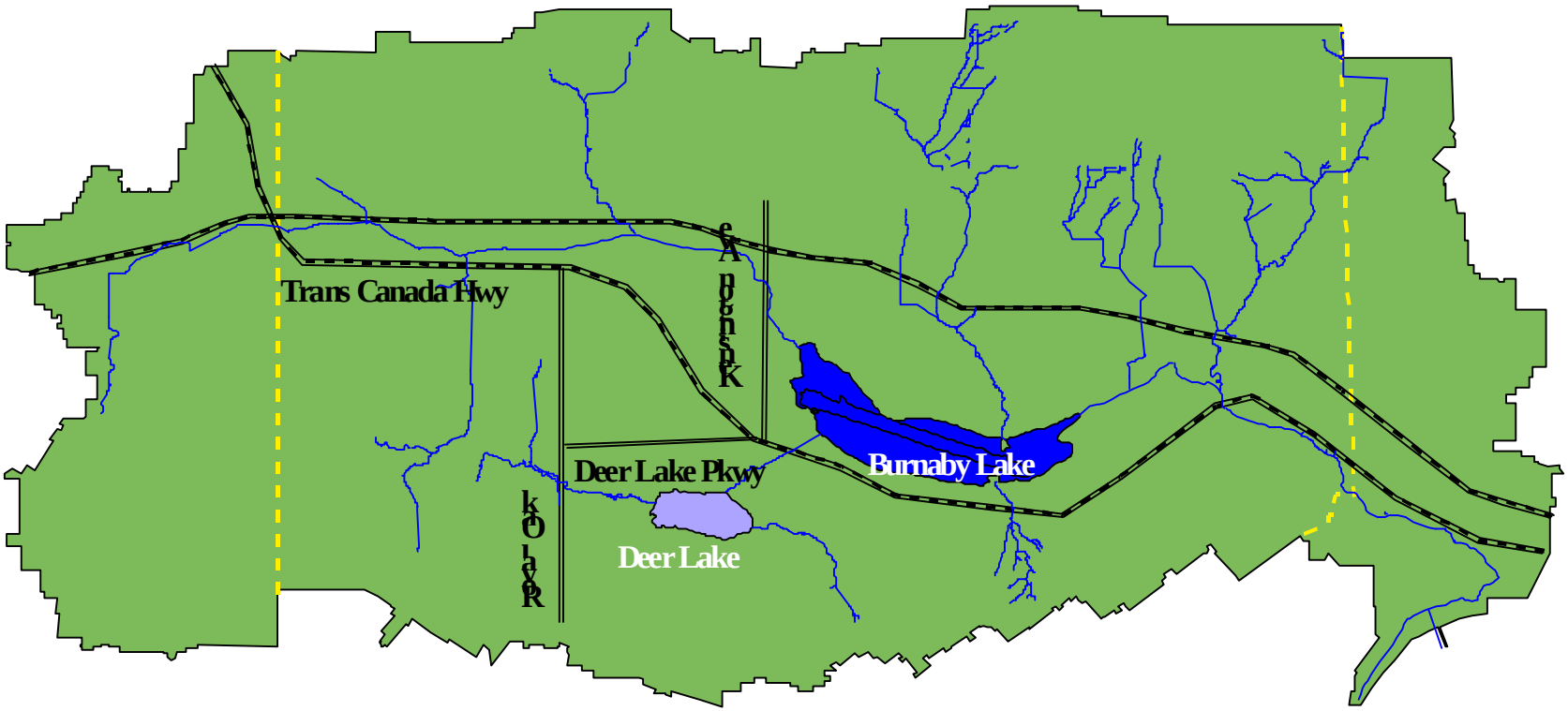
Anglers use was also very low throughout the study period. Habitat conditions, water quality and water flow throughout this system do not appear to be suitable for a healthy salmonid population. The coarse fish population in this system appears to be thriving and is creating habitat competition with salmonid populations. This system has the potential to support a healthy salmonid population if habitat, water quality and water flows are improved. More extensive sampling, rehabilitation and the continuation of an anglers use survey should be considered to improvement of the recreational fishery at Deer Lake

Introduction

1.1 Background

Deer Lake Park is located in Burnaby B.C. and is part of the Brunette River Watershed (Figure 1.). The area once represented the vast wilderness that used to cover the lower mainland, however urbanization and encroachment have lead to the loss of most natural habitat in this watershed. Deer Lake Park provides habitat for a variety of fish and wildlife populations and significant recreational opportunities including recreational fishing. Like many other urban watersheds, the Deer Lake Watershed is affected by rapid fluctuations in water flows, pollution problems and sedimentation. Stocking programs were initiated as early as 1939 to enhance salmonid stocks in the lake and its tributaries and creating sport-fishing opportunities for local residents.

The Stanley Park Hatchery originally stocked Deer Lake in 1939 with rainbow trout (Oncorkynchus mykiss) fry. Through the 1950's and 1960's this hatchery along with the Cultus Lake Hatchery stocked Deer Lake with rainbow trout. The Fraser Valley Trout Hatchery has been stocking Deer Lake annually with rainbow trout fingerlings since 1976, 4000 cutthroat trout (Oncorkynchus clarki clarki) fingerlings were also released in 1992. DFO has been releasing coho salmon (Oncorkynchus ksiutch) fry into Deer Lake in recent years (Coulter-Biouvire 1999). Over 500,000 fish have been stocked in Deer Lake from 1939 to 1999. Few, if any, of these fish survive to spawn in the park. Fish kill from predation is quite common in the summer months. Water temperatures can reach 20 degrees Celsius causing fish to seek refuge in cooler water at stream confluences. Low oxygen levels cause the fish to approach the lakes surface. This behavior is leaving the salmonids prone to predation by wildlife. The coarse fish population in the lake is very successful and includes carp (Cyprinidae), sticklebacks (Gasterosteidae) , suckers (Catostomidae), sculpins (Cottidae) and catfish. These fish are adapted to warm, turbid, low oxygenated water. Some of these species are targeted as sports fish (Pearson& Diamond 1999).



Legend

- Streams
- Roads
  - Major
  - Minor
- Municipal boundary
- Burnaby Lake
- Deer lake
- Brunette watershed boundary

Location of Deer Lake

Scale: 700 0 700 1400 2100 2800 3500 4200 Meters

N W E S

Figure 1. Location of study area at Deer Lake, Burnaby BC

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In 1992, 1993 and in 1995 BCIT fish, wildlife and recreation students conducted fish habitat inventories of Deer Lakes tributaries. These inventories have shown that there is a lack of suitable salmonid spawning and rearing habitat in the system. Many of these tributaries are unsuitable for salmonids due to poor water quality and inadequate habitat (Pearson & Diamond 1999). Through the Burnaby Lake systems Project, BCIT has conducted some enhancement work, on the Deer Lake system including riparian planning's and placement of spawning gravel's. Some recommendations for fish habitat enhancement were also provided by BCIT in the 1996 Deer Lake tributary enhancement project.

BCIT conduct this study at the request of Peter Caverhill, Senior Fisheries Biologist for BC Environment, John Kirbyson, Superintendent for the Burnaby Parks Department has also shown interest in this project.

1.2 Purpose

The purpose of this study was to assess the state of the recreational fishery at Deer Lake. The study will be used to help determine if current management strategies are working and to recommend any options to improve Deer Lake for recreational fishing.

The objectives of this study were:

1)To assess the distribution and relative abundance of salmonids throughout the system, and

2) To assess angler use and public opinion on the recreational fishery of Deer Lake.

2.0 Study Area

2.1 Deer Lake Park

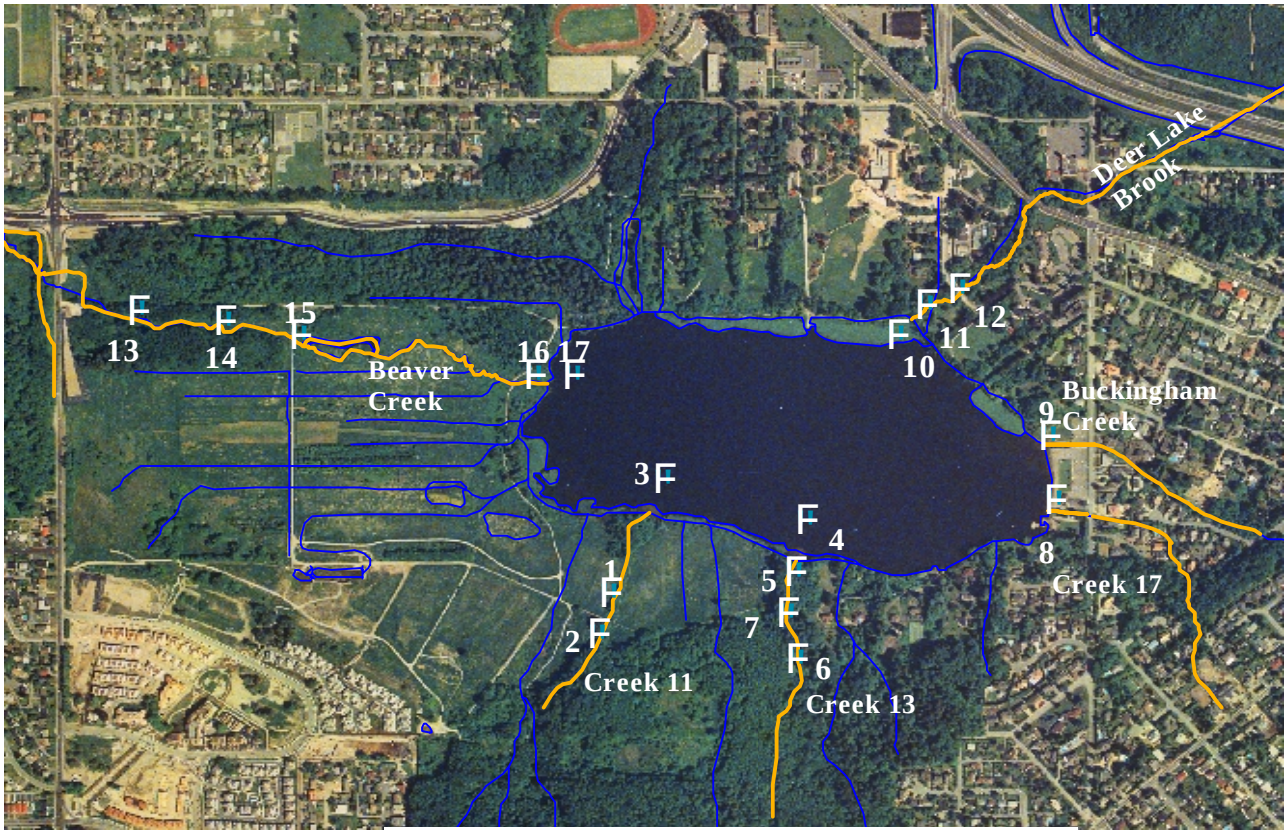
Deer Lake Park's deciduous forests, wetlands and aquatic environment provides habitat for a diversity of fish and wildlife species. Numerous streams provide some habitat for salmonids. The stocked fish and coarse fish in this system provide a food source for wildlife. Access to most of Deer Lake is excellent due to the urban location and series of recreational trails in the park, making it a popular recreational location. There are two docks located on the north and east sides of the lake, which provide good lake access for anglers. Non-maintained angling trails are present throughout the park and provide angling opportunities in less accessible areas of the park.

2.2 Deer Lake and Its Tributaries

Deer Lake is part of an urban storm water system with significant eutrophic conditions. It is approximately 35 hectares is size and is very shallow with a maximum depth of 6.5 meters. The following factors have been identified and appear to limit the potential for healthy salmonid populations in this system:

- Declining water quality resulting from urban storm water inputs such as siltation and nutrient loadings (phosphorous & nitrates), which fertilizes the lake water and simulates algae and weed growth.
- Increased water temperatures in the summer and low oxygen levels
- Large populations of waterfowl (ducks, geese) compromise water quality.
- Flooding occurs during periods of heavy rainfall, effecting the distribution of vegetation and removing stream complexity. (Pearson & Diamond 1999).

Many small creeks are part of the Deer Lake system. Six of these tributaries appear to have the potential to sample salmonids using G-type minnow traps (Figure 2.) and were the focus of this study.



Legend

Trap locations

Minnow traps set in creeks

Creeks

Location of G-type minnow traps in Deer Lake Study Area, Burnaby BC

N

500 0 500 Meters

Figure 2. Minnow trap and tributary location, Deer Lake, Burnaby BC

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2.2.1 Beaver Creek

Beaver creek is located in the western portion of the park (Figure 2.). The headwaters of this creek are located west of Deer lake Park and are fed by urban storm water. Because this is an urban creek flooding is common during storm events, therefore limiting riparian vegetation. Beaver Creek is a low gradient stream and canary reed grass as the pro-dominant riparian vegetation (Figure 3.). Salmonid habitat is poor because of the following factors.

- Poor water quality.
- Limited riparian vegetation.
- Low oxygen levels and high water temperatures in the summer.

Figure 3. Upper section of Beaver Creek, where bank erosion takes place due to a lack of suitable riparian vegetation.

2.2.2 Creek # 11

Creek # 11 is located in the southwestern portion of the park (Figure 2.). The headwaters of this creek are south of Deer Lake Park and are fed by urban storm water. This stream has a high gradient in its upper reaches and runs through primarily deciduous forest. Heavy sedimentation is made evident by the large sand deposits at the mouth Creek # 11 (Figure 4.). This creek appears to lack the following salmonid habitat requirements:

- Stream complexity.
- A stable flow regime.
- Adequate riparian vegetation in the lower portion.
- Lack of refuge habitat.
- Scouring of spawning gravel's, caused by heavy rainfalls
- Poor water quality due to storm water runoff and suspended sediments.
- Access to the upper portion of the creek.

Figure 4. Creek # 11 mouth, where heavy sedimentation has created a sand deposit. This sand bar serves as a beach area for anglers.

2.2.3 Creek # 14

Creek # 14 is located in the southern region of the park (Figure 2.). The headwaters of this creek are south of Deer Lake Park and are fed by urban storm water. This stream has a high gradient in it's upper reaches and runs through primarily deciduous forest. Heavy sedimentation is made evident by the large sand deposits at the mouth Creek # 14. The lower section of this creek contains some suitable salmonid habitat. However there are some factors which could limit salmonid utilization in this creek, including:

- Lack of refuge habitat.
- Scouring of spawning gravel's, caused by heavy rainfalls
- Poor water quality due to storm water runoff and suspended sediments.
- Access to the upper portion of the creek.
- Stream complexity.
- A stable flow regime.
- Adequate riparian vegetation in the lower portion.

Figure 5. G-type minnow trap location 6, showing salmonid habitat where one rainbow trout parr was sampled.

2.2.4 Creek # 16

Creek # 16 is located in the eastern region of the park (Figure 2). The entire upper section of this creek is culverted and fed by urban storm water. Rainbow trout have been observed utilizing the lower, open section of this creek during warm water periods in the summer (Pearson & Diamond 1999).

Figure 6. Lower Section of Creek # 16, where rainbow trout have been observed during warm water periods in the summer.

2.2.5 Buckingham Creek (#17)

Buckingham Creek is located in the eastern region of the park (Figure 2.). Stocked rainbow trout have been observed utilizing the lower, open section of this creek during warm water periods in the summer (Figure 7.), (Pearson & Diamond 1999). The culverts, artificial channels and cemented rock substrates in this creek make salmonid utilization unlikely in the rest of the creek (BCIT, FWR Program).

Figure 7. Open section of Buckingham Creek, were rainbow trout have been observed during warm water periods in the summer.

2.2.6 Deer Lake Brook

Deer Lake Brook is the outlet of Deer Lake, located in the northeastern region of the park (Figure 2.). In 1994, the coarse fish barrier was removed in Deer Lake Brook to allow for the upstream passage of salmonids (Gunn, 2000). In 1994 and 1995 spawning gravel's were placed into Deer Lake Brook and one adult pair of coho salmon was known to utilize these gravel's for spawning (Figure 8.), (Gunn, 2000). Adult rainbow trout and cutthroat trout have been observed in this creek (Pearson & Diamond 1999).

Habitat in Deer Lake Brook is not suitable for salmonids because:

- Spawning substrates are not suitable.
- Unstable flow regimes.
- Poor water quality due to storm water runoff and suspended sediments.
- A lack of stream complexity.
- Limited riparian vegetation.

(BCIT, FWR Program)

Figure 8. Section of Deer Lake Brook, where spawning gravel's were placed in 1994 and 1995.

2.3 Fish Sample Sites

A reconnacence of the study area was conducted to identify appropriate sample locations based on potential salmonid utilization and the ability to submerge minnow traps to an appropriate depth. The sample locations were then recorded on an orthophoto (Figure 2.).

2.4 Angler Use Survey Sites

The east end of Deer Lake provides easy access by anglers due to a dock and open beach area (Figure 9.). The dock on the north side of the lake provides another easy access point for angling. Several non-maintained trails provide angling opportunities in other more remote locations around the lake (Figure 10.). Due to marshy areas and private property the rest of the lake must be accessed by boat.

Figure 9. East dock , Deer Lake.

Figure 10. Example of a non-maintained trail used by anglers, located on the south side of Deer Lake Park.

3.0 Materials and Methods

3.1 Materials

The following equipment was used to complete this study:

- Field notebook.

- Anglers survey form.
- Fish Identification Books.
- Sampling permits.
- Mountain Bike.
- Minnow Traps.
- Bait, lures and flies.
- Fishing rods.
- Ten foot aluminum boat
- Belly boat.
- G007 nw.tif & G007ne.tif, 1996 colour Othophotos, resolution 1.0m/pixel.

3.2 Methods

3.2.1 Fish Sampling

Sampling of fish stocks were done in two ways. The first method was minnow trapping. Traps were set in groups of one to four, depending on limitations in available space in the creek at the trap location. The traps were baited with roe and submerged in different locations (Figure 2.) for 12 to 24 hours. The traps were removed and their contents were examined and released. The data were recorded and are presented in Table I. The second sampling method was angling, primarily fly fishing. Any trout caught were placed in plastic bags and frozen for preservation so that external and internal examinations could be conducted.

The following information was gathered from the fish samples:

- Species
- Fork Length
- Presence of parasites was determined though visual observation (i.e. presence of living parasites or visible tissue damage caused parasites).

- Health of the fish was determined through visual observation (e.g. fat vs. skinny, silver vs. dark colour).
- Water conditions during sample times were also taken into consideration (e.g. high vs. low water levels, large amounts of suspended sediments).

3.2.2 Anglers Survey

Deer Lake was divided into 10 zones, 8 on shore angling zones and 2 open water angling zones (Figure 11.). These zones were being monitored for angling activity on a weekly basis from November 1st, 1999 to April 31st, 2000. Anglers were interviewed and asked to complete a survey form (Figure 12.). The data gathered was entered into an Excel Database and are presented in Table II. The data were analyzed for any consistencies and recommendations made by the anglers. Refer to appendix A for raw survey form data.

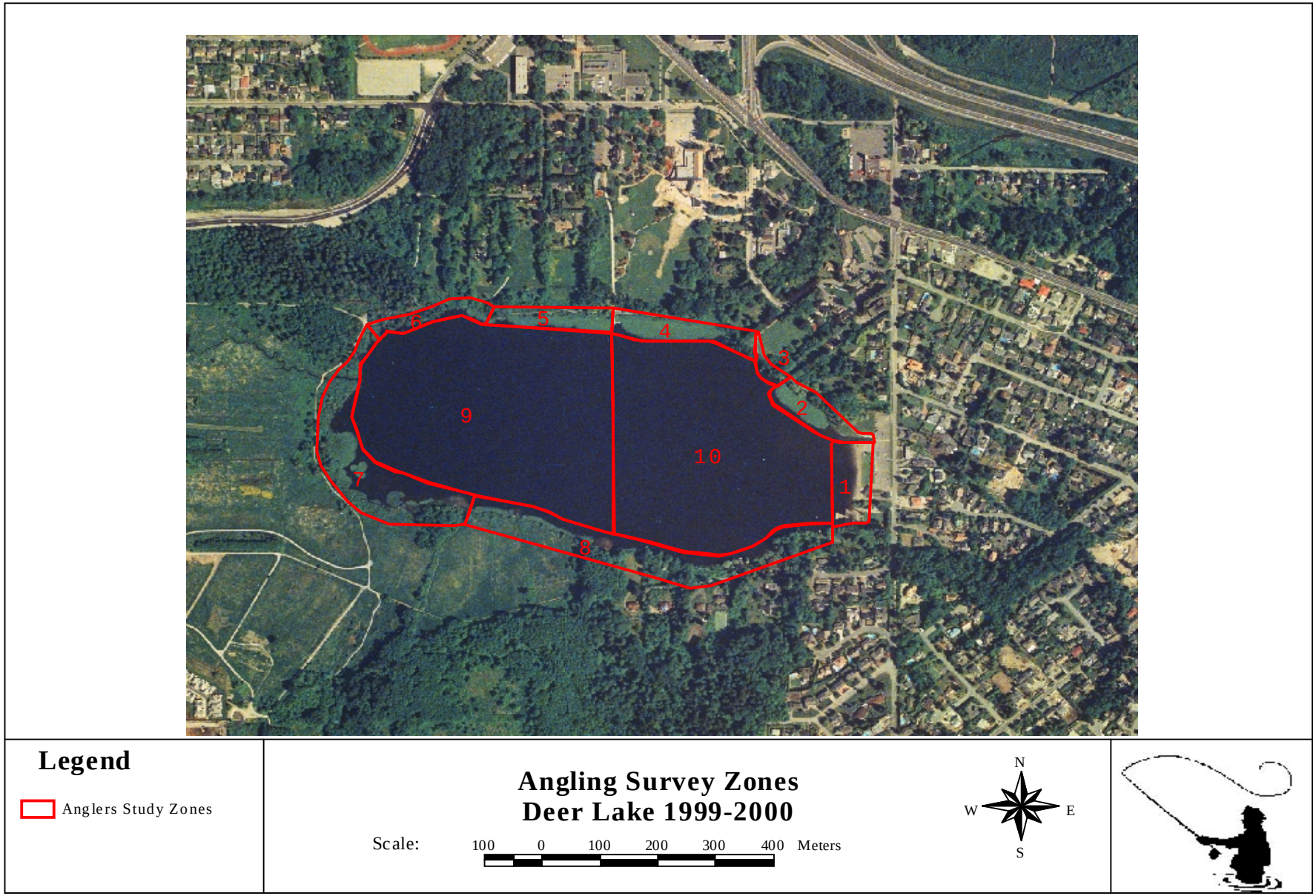

Figure 11. Angling survey zones used to conduct angler use survey on Deer Lake, October1999 through March 2000.

Anglers Survey
Deer Lake - 2000

1) Date_____ 2) Number of anglers in party:_____
3) Number of hours fished by each angler - Angler 1___Angler 2___Angler 3___
4) Catch Information:
Number of trout kept: ____ Number of trout released: ____ Zone Fished: ____
Trout species: _____
Number of char kept: ____ Number of char released: ____ Zone Fished: ____
Char species: _____
Number of coarse fish kept: ____ Number of coarse fish released: ____
Coarse fish species: _____ Zone Fished: ____
5) Did you fish from - boat?___ shore?___ both? ___
6) Details on locations did you fished. _____
7) What was your target species? _____
8) Fishing Methods: Cast:___ Fly: ___ Troll:___
9) Fly, Lure, or Bait type: _____
10) How many years have you fished Deer Lake? _____
12) Have you noticed any changes in catch effort? _____
_____
13) Have you noticed a change in fish health? _____
_____
14) Preferred fish spots _____
15) Where would you fish if Deer Lake was closed to fishing? _____
_____
16) Why do you fish Deer Lake? _____
17) Any ideas on improving fishing opportunities? _____

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Figure 12. Anglers Survey Form, used to survey recreational angling on Deer Lake from November 1999 to March 2000.

Anglers Survey
Deer Lake - 2000

18) Catch Data:

Fish #	Species	Fork Length	General Condition	Lake Zone
1				
2				
3				
4				
5				
6				
7				
8				

Comments: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Figure 12. Anglers Survey Form, used to survey recreational angling on Deer Lake from November 1999 to March 2000.

4.0 Results and Discussion

4.1 Sampling Results

Five, two to four hour long angling sessions were conducted. Only one of these sessions produced samples. Two rainbow trout were caught on March 26th in anglers survey zone #1 (Figure 13). The first was ten inches fork length and the second twelve inches fork length. These fish put up a strong fight and through visual examination both fish appeared to be well fed and had a bright silver colour. These fish were covered in open wounds, which appeared to be parasitic.

Figure 13. Two rainbow trout caught by angling on March 26th, 2000

Minnow trapping results from November 1999 to March 2000 are presented in Table I. Salmonid activity was low, only small numbers of salmonids appeared to utilize Deer Lake's tributaries during the winter months. The coarse fish presence in these creeks appeared to be quite high through the winter. During heavy rainfalls it appeared almost all fish moved into the lake to escape high flows. The lower creek reaches showed the greatest utilization by all fish species.

Table I. Data Results From Minnow Trap Sampling on Deer Lake From November 1999 to March 2000Table 1.

Trap Location	Date	Trap 1 Contence	Trap 2 Contence	Trap 3 Contence	Trap 4 Contence	Water Conditions	Physical Condition of Salmonids	Lenths of Salmonids
#1	Febuary 19-20 2000	Sculpin (1)	n/a	n/a	n/a	Normal	n/a	n/a
#1	Febuary 20-21 2000	Nothing	n/a	n/a	n/a	Normal	n/a	n/a
#1	Febuary 21-22 2000	Nothing	n/a	n/a	n/a	Normal	n/a	n/a
#2	Febuary 19-20 2000	n/a	Nothing	Nothing	Nothing	Normal	n/a	n/a
#2	Febuary 20-21 2000	n/a	Nothing	Nothing	Nothing	Normal	n/a	n/a
#2	Febuary 21-22 2000	n/a	Nothing	Nothing	Nothing	Normal	n/a	n/a
#3	March 25-26 2000	Nothing	Nothing	Sculpin (3) (Float)	n/a	Normal	n/a	n/a
#4	March 25-26 2000	Nothing	Sculpin (1)	Nothing (Float)	n/a	Normal	n/a	n/a
#5	Febuary 22-23 2000	n/a	n/a	Rainbow Trout (1) Stickleback (1) Sculpin (1)	Stickleback (3) Sculpin (1)	Normal	Rainbow appeared heathy	Rainbow trout 120mm
#6	Febuary 22-23 2000	Rainbow Trout (1)	n/a	n/a	n/a	Normal	Rainbow appeared heathy	Rainbow trout 120mm
#7	Febuary 22-23 2000	n/a	Stickleback (1)	n/a	n/a	Normal	n/a	n/a
#8	January 22-23 2000	Nothing	Nothing	n/a	n/a	Normal	n/a	n/a
#8	Febuary 29-March 1 2000	Sculpin (2)	Stickleback (1)	n/a	n/a	Normal	n/a	n/a

Table I continued. Data Results From Minnow Trap Sampling on Deer Lake From November 1999 to March 2000.

Trap Location	Date	Trap 1 Contence	Trap 2 Contence	Trap 3 Contence	Trap 4 Contence	Water Conditions	Physical Condition of Salmonids	Lenths of Salmonids
#9	January 22-23 2000	Stickleback (12)	Stickleback (1)	n/a	n/a	Normal	n/a	n/a
#9	Febuary 29-March 1 2000	Sculpin (1)	Nothing	n/a	n/a	Normal	n/a	n/a
#10	March25-26 2000	Sculpin (4)	Sculpin (1)	Sculpin (2) (Float)	n/a	Normal	n/a	n/a
#11	November 6-7 1999	Nothing	Nothing	n/a	n/a	High Water	n/a	n/a
#11	January 22-23 2000	Nothing	Nothing	n/a	n/a	Normal	n/a	n/a
#12	November 6-7 1999	n/a	n/a	Nothing	Nothing	High Water	n/a	n/a
#12	January 22-23 2000	n/a	n/a	Nothing	Nothing	Normal	n/a	n/a
#13	January 11-12 2000	Nothing	Nothing	Nothing	Nothing	Normal	n/a	n/a
#14	Febuary 29-March 1 2000	Nothing	Nothing	Nothing	Nothing	High Water	n/a	n/a
#15	November 6-7 1999	Stckleback (8)	Sculpin (2)	Stickleback (5) Sculpin (1)	n/a	High Water	n/a	n/a
#16	November 27-28 1999	Stickleback (11) Carp (1)	Stickleback (20) Carp (1) Sculpin(3)	Stickleback (40) Sculpin (2)	Stickleback (43) Sculpin (2)	Normal	n/a	n/a
#17	March 25-26 2000	Nothing	Sculpin (3)	Nothing (Float)	n/a	Normal	n/a	n/a

4.2 Anglers Survey Results

The results of the anglers survey are presented in Table II. Angling pressure in the winter months was very low. One angling party has been successful over the past two years with catching adult rainbow trout in zones #1, #2, #3 and #10. These fish were in the 10inch to 12inch range, appeared well fed, had a bright silver colour and put up a strong fight. These individuals noticed open wounds similar to the ones shown in Figure 13. Refer to appendix A for raw survey form data.

Table II. Anglers Survey Data.

Angling Party #	Number of Anglers in Party	Number of Hours Fished	Zone Fished	Number of Trout Kept	Number of Coarse Fish Kept	Target Species	Angling Method	Time Spent Angling (Months/ Years)	Any Changes in Catch Effort	Any Changes in Fish Health	Preferred Angling Spots	Other Preferred Local Angling Lakes	Reasons For Angling Deer Lake	Ideas on Angling Improvement
1	3	2	7	0	0	Carp	Cast	4 Months	no	no	Creek #10 mouth	N/A	Close to Home	N/A
2	1	0	1	0	0	Trout	Cast	20+ Years	Drasitc Decline	Drasitc Decline	Zones #1,#9,#10	Sasamat	Close to Home	Stock Catchable Size Fish, Improve Habitat
3	2	0	N/A	0	0	Trout	Fly	2 Years	no	no	Zones #2,#3,#4,#10	Sasamat	Close to Home, Low Pressure	Stock Other Trout Species
4	1	0.5	10	N/A	N/A	N/A	Cast	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	1	1	10	0	0	Trout	Fly	First Time	N/A	N/A	N/A	Does not fish Localy	Close to Home	N/A
2	2	1	1	0	0	Trout	Cast	1 Year	no	no	Zones #1, #4	Sasamat	Close to Home	Not Sure

5.0 Conclusions

5.1 Fish Sampling

The coarse fish population in Deer Lakes creek system appears to be thriving. Stickle backs appear to be the most successful species. Most of the utilization by coarse fish was in the slower flowing lower reaches of the creeks. Salmonid presence appears to be affected by the following factors:

- Unstable flow regimes.
- Poor water quality.
- A lack of stream complexity.
- A lack of riparian vegetation.
- Habitat competition with Deer Lake's coarse fish populations.

These creeks have the potential to support salmonids if water quality, water flow and habitat are improved (Pearson & Diamond 1999).
The two rainbow trout sampled by angling give evidence of an adult population in this system. The success and health of this population is not known.

Presently, water quality is unsuitable for a productive coldwater trout fishery. Coarse fish thrive in these poor conditions. There is an opportunity for lake water quality improvement to a level capable of sustaining a salmonid fishery, however, it would be unrealistic (biologically and fiscally) to attempt to return the lake to pristine conditions. (Pearson & Diamond 1999).

5.2 Anglers Survey

Angling pressure in the winter months was very low. This was most likely due to poor weather conditions and what appears to be a low numbers of sport fish (salmonids) in this system. As the weather improves the number of anglers at Deer Lake should increase.
The creation of non-maintained access trails has led to the degradation of riparian habitat in some areas.

6.0 Recommendations

As a result of this study the following recommendation should be considered:

- A more extensive sampling program should be considered, with the use of gill nets and minnow trapping to acquire more accurate data of the salmonid population in the entire Deer Lake system.
- Water samples be taken to assess water quality during the sample period to determine if any correlation's between salmonid utilization and sample areas is apparent.
- Rehabilitation of some creeks in this system, to create salmonid spawning and rearing habitat, is essential if this system is to support a healthy salmonid population.
- An anglers use survey be conducted through the spring and summer months to better assess the recreational fishery.

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Appendix A

Anglers Survey Data Forms

Appendix B

Fish Collection Permits