Report on the Transfer of Adult Lake Whitefish from Lake of Bays to Mary Lake, 2009

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Mary Lake is a large waterbody located in Brunel and Stephenson Townships in the District of Muskoka within MNR's Parry Sound District. It has a surface area of 10.7km². Its' maximum depth is 65 m, while its mean depth is 25 m. It is located in the watershed of the North Muskoka River.

Lake whitefish (*Coregonus clupeaformis*) are native to the lake but the population declined severely some time around the late 1970's. Very little data exists on the status of the population up to that time and the reason for the decline is not known for certain. It is speculated that the main cause was interaction with non-native rainbow smelt, possibly combined with other contributing factors, such as water quality and contaminants, water level management and other changes to the aquatic community (OMNR 2009). Today, only a very low density remnant population exists. Five years (2003-2006) of lake trout assessment conducted by the Muskoka Lakes Fisheries Assessment Unit captured only one individual.

A review of management of Fairy, Mary, Peninsula and Vernon Lakes recommended that a trial re-introduction of whitefish be attempted (OMNR 2009). Mary Lake was chosen as the first candidate due to its habitat, accessibility and likelihood of creating a fishery. A trial rehabilitation effort was begun in 2009. It has two components; an adult transfer of a local stock (subject of this report) and stocking of fingerlings of the Lake Simcoe strain, which are available from the provincial fish culture system. The intent is to stock both strains for three years and then monitor to determine if natural reproduction is re-established. If not, ongoing stocking of fingerlings could be started to create a put-grow-take fishery if sufficient demand materializes.

Lake of Bays was chosen as the donor lake based on its proximity to Mary Lake and the known presence of a moderately dense population of whitefish. It is a very large water body with several basins spread throughout the Townships of Sherbourne, Ridout, McLean, Franklin, and Brunel, in the District of Muskoka. It has a surface area of 67.8 km². The maximum depth is 70.1 m, while the mean depth is 22.3 m. It is located in the watershed of the South Muskoka River, directly adjacent to the watershed in which Mary Lake is located.

This report presents the results of the first attempt to transfer adult lake whitefish to Mary Lake from Lake of Bays in November 2009. Results of a lake trout egg collection from Lake of Bays, part of the same initiative are described in Ivany (2009).

Methods

No literature was located to suggest what the appropriate stocking density might be. An arbitrary target of 300 adults (100/year for three years), with a roughly 50:50 sex ratio, was chosen. This number approximates the suggested density for adult walleye transfers (1/3ha) (OMNR 2002).

As the goal was to capture whitefish alive and healthy, collections had to be done during early spring or late fall, when water temperatures are cold. The fall of 2009 was the first opportunity to attempt a collection. It was hoped that whitefish could be captured in reasonable numbers before spawning occurred; failing that, an attempt would be made to locate staging or spawning areas.

No information was available on where whitefish spawn in Lake of Bays. Literature descriptions of utilized spawning substrate vary greatly. Boulder, cobble, gravel, sand, detritus and vegetation have all been cited (Anras et al 1999, Fudge and Bodaly 1984, Bryan and Kato 1975). Use of areas of current and runs up rivers also occur. With little to go on we chose locations with a variety of habitats to try to locate concentrations of fish.

Two types of gear were used. Initially, standard 6- foot (1.8 m) trap nets with 46 m leads were used to try to capture whitefish in shallow water, not necessarily at spawning areas.

When trap nets failed to catch many whitefish, small mesh gill nets were used; initially to locate concentrations of fish and then moving the trap nets to those locations, then ultimately to catch a large proportion of the whitefish that were transferred as well.

The gill nets used were panels of Spring Littoral Index Netting (SLIN) gillnet. The 76 mm (2.5 in) mesh size was found to be effective at catching whitefish without excessive damage to the fish. Gangs of two to four panels were set for varying lengths of time from a half hour to one hour to minimize the mortality.

Captured whitefish were measured for their fork length, the adipose fin was clipped to mark the fish to be able to recognize the fish from this project and to obtain a sample for genetic analysis, and the fish was sexed by expressing gametes. If gametes could not be produced, the fish was assumed to be a pre-spawning female. No ageing structures were collected in order to minimize stress.

Fish were held on board the boat in a half-size (~ 1 m x 1m x 0.5 m h) insulated commercial fish tote (www.bonarplastic.com) then transferred to a full size tote (~0.75 m h) in a pick-up truck. The maximum number of fish transferred at one time was 50 individuals; or an approximate loading rate of approximately 0.15 kg/l. Oxygen was supplied using compressed oxygen diffused through an air stone. Fish were released at the public dock on Mary Lake in Port Sydney.

Results

Operations were conducted over parts of a four week period between Nov 2 and November 25, 2009. The first week (Nov 2-5) was expected to be prior to whitefish spawning. In this week, an attempt was made to capture whitefish by trap net during general movements in shallow waters, not necessarily near spawning areas; although some lake trout spawning areas were targeted. This effort yielded only five whitefish caught of which three were stocking into Mary Lake. Net set locations and catch are shown in Figure 1 and Table 1.

During the second week (Nov 9-13), shortened by a holiday on Wednesday, night time observations were done on two nights at what were guessed to be potential spawning areas; including prominent lake trout spawning areas, main lake sand and gravel points, narrows and the major tributary streams (Table 2). Little was knowledge was gained; only a small number of individual whitefish were observed.

The third week (Nov 16-20) was expected to be within the expected window for whitefish spawning. In this week, trap nets were set again, beginning at what were thought to be high probability locations. Small mesh gill nets were then used to search more areas for congregations of whitefish. This effort quickly determined that whitefish could be caught in substantial numbers just downstream of the Dorset Narrows.

The remainder of the third week and two additional days in the following week were spent concentrating on the Dorset Narrows area to catch the target number of whitefish.

A total of 76 whitefish were caught in trap nets; one on the south shore of Bigwin Island, eight at Elizabeth Point and 67 at Dorset (Table 1). In addition, 78 were caught in gill nets, four from the Elizabeth shoal and approximately 5 from the mouth of Paint Lake Creek and the remainder just downstream of the narrows at Dorset (Table 3).

Of the 154 whitefish caught, one was dead on capture, one was released at the net due to a serious existing wound and 152 were retained (Table 4). Of the 152 retained, 11 died in transit resulting in 141 fish successfully transferred to Mary Lake. The transit mortalities were exclusively gill net caught fish that were in poor condition at the time of capture.

A total of 79 transferred whitefish were known to be mature males, the other 62 were known or assumed to be mature females (Table 5). A substantial proportion of the females caught after November 16 were ripe.

The whitefish ranged from 370 to 600 mm FL, with most occurring in the 376 to 450 mm size classes (Figure 2). The sex ratio was surprisingly well balanced within most size classes.

A length-weight regression was used to estimate the weight of the whitefish:

$$log(RWT)=3.229log(FL)-5.438$$

The estimated weights ranged from 0.7 to 3.4 kg, averaging 1.3 kg. In total, 184 kg of whitefish were stocked (0.17 kg/ha).

Surface water temperature data was obtained from the gauging stations at both lakes (Figure 3). Temperatures ranged from about 8^{o}C at the beginning of the project to 6.5 ^{o}C at the end. The temperatures varied slightly from those obtained by hand thermometer at the net set sites.

Discussion

Whitefish were found to concentrate at the Dorset Narrows. Many of the females caught were ripe; however, the precise location where spawning occurs remains unknown. One evening of night time observation during the period when ripe whitefish were caught revealed only two fish visible in shallow water in the narrows proper, suggesting they do not spawn in that area. It was noted that there is a noticeable current for a distance downstream of the narrows, along the north shore, where the majority of whitefish were caught. Depths in that area ranged up to 8 m deep. We speculate that spawning may be occurring in this area. The nearshore substrate was primarily sand.

An initial gill net set near the mouth of Paint Lake Creek caught several whitefish in a short time, suggesting the creek mouth area or creek itself may be a spawning area. Subsequent night observations from the Highway 117 bridge and a trap net set failed to reveal any more fish, but further exploration of spawning in this area is warranted.

Gill nets were effective at capturing whitefish. We were initially hesitant to use gill nets as past experience has shown that mortality is high. The short net set duration, shallow depths and cold water temperature helped reduce losses for this project. Many gill net caught fish were unable to maintain equilibrium initially when placed in the holding tank, but most had recovered and appeared healthy by the time they were released.

With the knowledge gained in 2009, the target number of whitefish (100) could be easily captured at Dorset with a few days of work using a combination of trap and gill nets or even using only gill nets. However, it might be prudent to try to obtain fish from other locations in the lake, from the points of view of maximizing diversity of transferred fish and increasing our knowledge of whitefish distribution in Lake of Bays.

Table 1 Trap net catch by date and location, Lake of Bays, November, 2009.

		Species - Number Caught								
Date	Location	lake whitefish	cisco	lake trout	small-mouth bass	rock bass	white sucker	large-mouth bass	northern pike	burbot
03-Nov-09	Marie Bianca Is.			1						
03-Nov-09	S. shore Bigwin Is.	1		1	2	7	1			
04-Nov-09	Marie Bianca Is.									
04-Nov-09	Elizabeth Pt.	2		1	5	8	1			
05-Nov-09	Elizabeth Pt.	2			1	38	1	2		
05-Nov-09	Norway Pt.					8	1		1	
17-Nov-09	Marie Bianca Is.				2	4				2
17-Nov-09	Elizabeth Pt.	1				5			1	1
18-Nov-09	Lake Trout Shoal 30			1		1				
18-Nov-09	Elizabeth Pt.	2				9	1			
19-Nov-09	Elizabeth Pt.	1			3	11				
19-Nov-09	Dorset - N shore	9				1	11			
20-Nov-09	Paint Lake Creek					1			1	
20-Nov-09	Dorset - N shore	34								
24-Nov-09	Dorset - S shore				2	60				
24-Nov-09	Dorset - N shore	13	1				1			1
25-Nov-09	Dorset - S shore	1				53				1
25-Nov-09	Dorset - N shore	10					1			
Totals		76	1	4	15	206	18	2	3	5

Table 2 Summary of night time observations for lake whitefish, Lake of Bays, 2009

Location	10-Nov-09	12-Nov-09
Castle Island	2	0
Elizabeth Pt	1	0
Marie Bianca Is.	1	0
Gull Rock	3	0
Black Pt.	1	0
Norway Pt	0	0
Bigwin I Shoal 17		0
Bigwin I Shoal 20	0	0
Pancake Is.	0	0
Turners Is.	0	0
Oxtongue R, Marshs Falls		0
Boyne R mouth	0	0
Dorset bridge	0	2
Hollow R bridge	0	0

Table 3 Gill net catch summary, Lake of Bays, 2009.

Date	Elizabeth Pt	Paint L Ck mouth	Dorset	Total
17-Nov-09	4			4
18-Nov-09		~5	~5	10
19-Nov-09			10	10
20-Nov-09			20	20
24-Nov-09			15	15
25-Nov-09			19	19
Total				78

Table 4 *Stocking details for transfer of adult lake whitefish from Lake of Bays to Mary Lake, November, 2009. Transit mortality was primarily due to poor initial condition of some fish captured in gill nets.*

Date	Date	# of Fish Caught	Released/ Dead on Capture	Transit Mortality	Number Stocked	Mean Weight (kg)	Weight Stocked (kg)	Loading Time	Stocking Time	Lake of Bays Temp. (°C)	Holding Temp. (°C)	Mary Lake Temp. (°C)
03-Nov-09	03-Nov-09	1	1	0	0	1.3						
04-Nov-09	04-Nov-09	2	1	0	1	1.7	1.7	11:00	11:45	8.5	7.0	7.0
05-Nov-09	05-Nov-09	2	0	0	2	1.7	3.3	11:00	11:45	7.8	6.0	7.0
17-Nov-09	17-Nov-09	5	0	0	5	1.1	5.6	16:00	16:45	7.0	6.0	7.0
18-Nov-09	18-Nov-09	12	0	3	9	1.2	10.7	15:45	16:30	6.0	7.0	7.0
19-Nov-09	19-Nov-09	20	0	0	20	1.1	22.4	13:00	15:00	7.0	7.0	7.0
20-Nov-09	20-Nov-09	54	0	4	50	1.5	74.0	11:15	13:30	6.0	6.0	6.0
24-Nov-09	24-Nov-09	28	0	1	27	1.1	31.0	11:30	13:30	6.0	6.0	6.0
25-Nov-09	25-Nov-09	30	0	3	27	1.3	35.5	12:30	15:00	6.0	6.0	6.0
Total	Total	154	2	11	141	1.3	184.3					

Table 5 *Summary of captures, mortalities/releases and stocked lake whitefish, by gender.*

Date	Male	Female	Unknown	Total
Nov-03	0	0	1	1
Nov-04	1	0	1	2
Nov-05	0	2	0	2
Nov-17	2	3	0	5
Nov-18	3	9	0	12
Nov-19	12	8	0	20
Nov-20	39	15	0	54
Nov-24	15	13	0	28
Nov-25	12	18	0	30
Total	84	68	2	154
Mort./ Rel.	5	6	2	13
Stocked	79	62	0	141

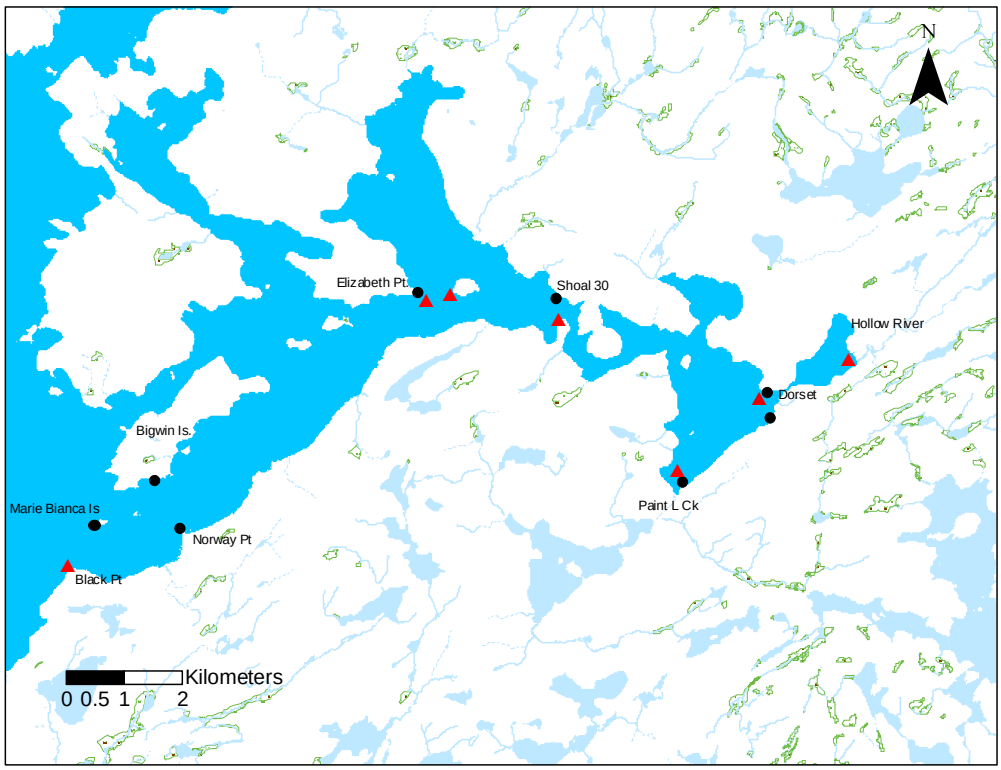

Figure 1 *Map of eastern Lake of Bays showing locations of trap net (black circles) and gill net (red triangles) sets.*

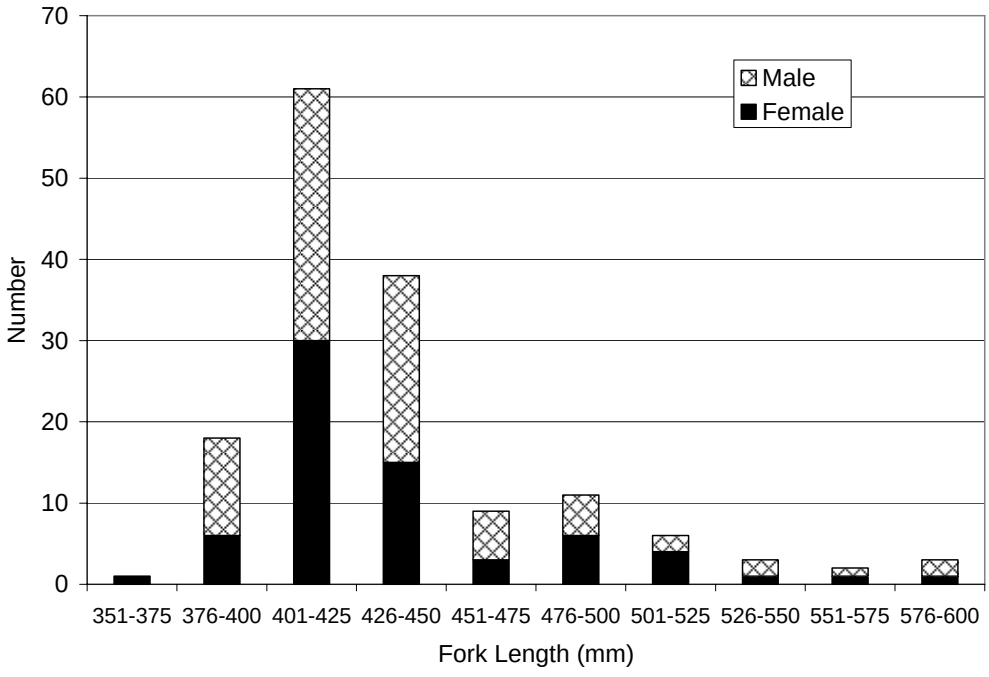

Figure 2 *Fork length composition, by sex, of lake whitefish captured in Lake of Bays, November, 2009. Includes fish transferred to Mary Lake and mortalities.*

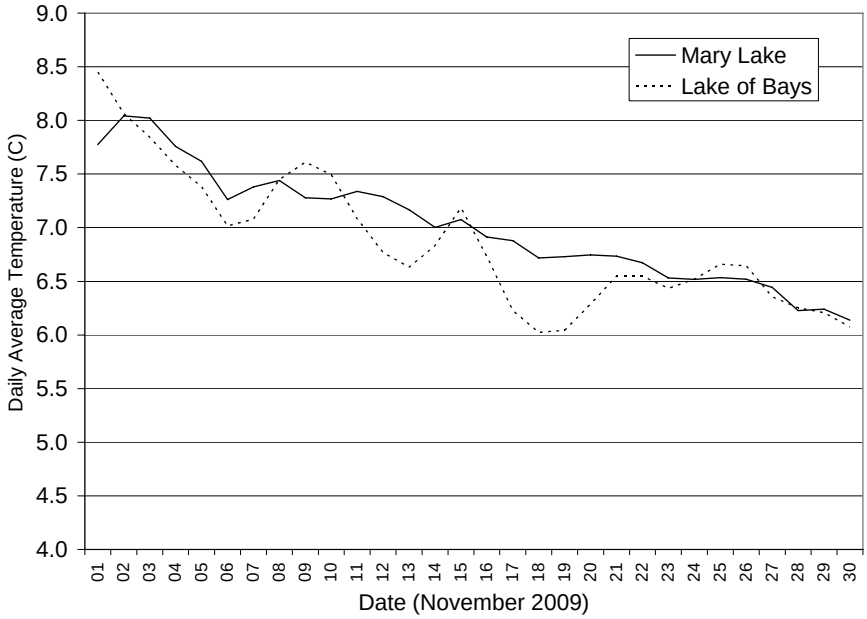

Figure 3 *Daily average water temperature measured at water level gauges on Mary and Lake of Bays, November 2009.*

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Appendix *Descriptive statistics for lake whitefish captured in Lake of Bays, November 2009. Table includes several fish that died and were not transferred to Mary Lake. Round weight is estimated from: log(RWT)=3.229log(FL)-5.438.*

Date	FL	RWT	Sex
04-Nov-09	480	1.69	M
05-Nov-09	435	1.23	F
05-Nov-09	515	2.12	F
17-Nov-09	438	1.26	M
17-Nov-09	421	1.10	F
17-Nov-09	438	1.26	F
17-Nov-09	415	1.05	F
17-Nov-09	404	0.97	M
18-Nov-09	445	1.32	F
18-Nov-09	410	1.01	F
18-Nov-09	420	1.10	F
18-Nov-09	405	0.97	M
18-Nov-09	480	1.69	F
18-Nov-09	395	0.90	F
18-Nov-09	430	1.18	F
18-Nov-09	410	1.01	F
18-Nov-09	415	1.05	F
18-Nov-09	400	0.94	F
18-Nov-09	483	1.72	M
18-Nov-09	450	1.37	M
19-Nov-09	420	1.10	M
19-Nov-09	425	1.14	M
19-Nov-09	440	1.27	M
19-Nov-09	450	1.37	F
19-Nov-09	450	1.37	F
19-Nov-09	420	1.10	M
19-Nov-09	415	1.05	M
19-Nov-09	415	1.05	F
19-Nov-09	420	1.10	F
19-Nov-09	420	1.10	F
19-Nov-09	430	1.18	M
19-Nov-09	430	1.18	M
19-Nov-09	430	1.18	M
19-Nov-09	410	1.01	F
19-Nov-09	380	0.79	M
19-Nov-09	410	1.01	F
19-Nov-09	440	1.27	M
19-Nov-09	430	1.18	M
19-Nov-09	400	0.94	M
19-Nov-09	410	1.01	F
20-Nov-09	410	1.01	M
20-Nov-09	415	1.05	M
20-Nov-09	435	1.23	M
20-Nov-09	415	1.05	F
20-Nov-09	395	0.90	F
20-Nov-09	500	1.92	M
20-Nov-09	425	1.14	M
20-Nov-09	420	1.10	F
20-Nov-09	425	1.14	F
20-Nov-09	510	2.05	M
20-Nov-09	465	1.52	M
20-Nov-09	415	1.05	F
20-Nov-09	490	1.80	M
20-Nov-09	440	1.27	M
20-Nov-09	600	3.47	F
20-Nov-09	520	2.18	M
20-Nov-09	570	2.94	M
20-Nov-09	560	2.77	F
20-Nov-09	410	1.01	M
20-Nov-09	420	1.10	M
20-Nov-09	450	1.37	M
20-Nov-09	440	1.27	M
20-Nov-09	465	1.52	M
20-Nov-09	460	1.47	M
20-Nov-09	450	1.37	M
20-Nov-09	405	0.97	F
20-Nov-09	415	1.05	M
20-Nov-09	410	1.01	M
20-Nov-09	535	2.39	M
20-Nov-09	385	0.83	M
20-Nov-09	480	1.69	F
20-Nov-09	410	1.01	M
20-Nov-09	425	1.14	F

Date	FL	RWT	Sex
20-Nov-09	600	3.47	M
20-Nov-09	510	2.05	F
20-Nov-09	435	1.23	F
20-Nov-09	410	1.01	F
20-Nov-09	420	1.10	M
20-Nov-09	415	1.05	M
20-Nov-09	405	0.97	M
20-Nov-09	440	1.27	M
20-Nov-09	435	1.23	M
20-Nov-09	590	3.28	M
20-Nov-09	530	2.32	M
20-Nov-09	445	1.32	F
20-Nov-09	500	1.92	M
20-Nov-09	400	0.94	M
20-Nov-09	435	1.23	F
20-Nov-09	420	1.10	M
20-Nov-09	430	1.18	M
20-Nov-09	420	1.10	M
24-Nov-09	400	0.94	M
24-Nov-09	420	1.10	F
24-Nov-09	410	1.01	F
24-Nov-09	430	1.18	F
24-Nov-09	520	2.18	F
24-Nov-09	400	0.94	M
24-Nov-09	400	0.94	F
24-Nov-09	370	0.73	F
24-Nov-09	410	1.01	F
24-Nov-09	400	0.94	M
24-Nov-09	400	0.94	M
24-Nov-09	450	1.37	F
24-Nov-09	420	1.10	M
24-Nov-09	420	1.10	M
24-Nov-09	430	1.18	F
24-Nov-09	480	1.69	F
24-Nov-09	395	0.90	M
24-Nov-09	420	1.10	F
24-Nov-09	410	1.01	M
24-Nov-09	440	1.27	M
24-Nov-09	450	1.37	M
24-Nov-09	415	1.05	M
24-Nov-09	405	0.97	M
24-Nov-09	400	0.94	M
24-Nov-09	440	1.27	M
24-Nov-09	410	1.01	F
24-Nov-09	450	1.37	M
24-Nov-09	465	1.52	F
25-Nov-09	420	1.10	F
25-Nov-09	460	1.47	M
25-Nov-09	395	0.90	F
25-Nov-09	500	1.92	F
25-Nov-09	520	2.18	F
25-Nov-09	425	1.14	F
25-Nov-09	460	1.47	F
25-Nov-09	410	1.01	F
25-Nov-09	500	1.92	F
25-Nov-09	470	1.58	M
25-Nov-09	405	0.97	F
25-Nov-09	415	1.05	M
25-Nov-09	500	1.92	F
25-Nov-09	400	0.94	F
25-Nov-09	425	1.14	M
25-Nov-09	475	1.63	F
25-Nov-09	390	0.86	M
25-Nov-09	460	1.47	M
25-Nov-09	430	1.18	M
25-Nov-09	420	1.10	M
25-Nov-09	430	1.18	F
25-Nov-09	410	1.01	M
25-Nov-09	420	1.10	M
25-Nov-09	420	1.10	F
25-Nov-09	440	1.27	F
25-Nov-09	390	0.86	M
25-Nov-09	530	2.32	F

Fork Length	
Mean	438.7
Standard Error	3.5
Median	425
Mode	420
Standard Deviation	43.1
Range	230
Minimum	370
Maximum	600
Count	152

Appendix *Daily average water temperatures recorded at the water level gauges on Lake of Bays and Mary Lake, November, 2009.*

Date	Mary Lake	Lake of Bays
1-Nov-09	7.8	8.5
2-Nov-09	8.0	8.1
3-Nov-09	8.0	7.8
4-Nov-09	7.8	7.6
5-Nov-09	7.6	7.4
6-Nov-09	7.3	7.0
7-Nov-09	7.4	7.1
8-Nov-09	7.4	7.4
9-Nov-09	7.3	7.6
10-Nov-09	7.3	7.5
11-Nov-09	7.3	7.1
12-Nov-09	7.3	6.8
13-Nov-09	7.2	6.6
14-Nov-09	7.0	6.8
15-Nov-09	7.1	7.2
16-Nov-09	6.9	6.7
17-Nov-09	6.9	6.2
18-Nov-09	6.7	6.0
19-Nov-09	6.7	6.0
20-Nov-09	6.7	6.3
21-Nov-09	6.7	6.5
22-Nov-09	6.7	6.5
23-Nov-09	6.5	6.4
24-Nov-09	6.5	6.5
25-Nov-09	6.5	6.7
26-Nov-09	6.5	6.6
27-Nov-09	6.4	6.4
28-Nov-09	6.2	6.3
29-Nov-09	6.2	6.2
30-Nov-09	6.1	6.1

Appendix Photographs