



Minnesota Department of Natural Resources
 Fisheries Management
LAKE SURVEY REPORT



Lake Name: Leo

Survey Type: Standard Survey

DOW Number: 16-0198-00

Survey ID Date: 09/30/2015

Lake Identification

Alternate Lake Name: N/A
 Primary Lake Class ID: 8

DNR Sounding Map Number: C0343
 Alternate Lake Class ID: 4

Lake Location

Primary County: Cook

Nearest Town: Grand Marais

Legal Descriptions

Lake Center: Township - 64N Range - 1W Section - 5
 PLS Section Lake Center: 6400105

All Legal Descriptions:

Cook County: Township - 64N Range - 1W Sections - 4, 5

Area Office

Area Name: Grand Marais
 Region Name: Northeast

ORG Code: F218
 Region Number: 2

Lake Access

(Information based on Population Assessment dated 09/28/2006)

Station ID	Ownership	Public Use	Type	Location / Comments
AC - 1	County	Open to Public use	Carry-In	Off County Road 65. Roadside parking for four vehicles.

Lake Characteristics

Lake Area (planimetered acres):	101.20	GIS Shoreline Length (miles):	2.10
GIS Lake Area (acres):	102.40	Maximum Fetch (miles):	0.80
DOW Lake Area (acres):	114.00	Fetch Orientation (degrees):	67
Littoral Area (acres):	38.00	USGS Quad Map Number:	F28c
Area in MN (acres):	102.40	USGS Quad 24K GIS Index:	1155
Maximum Depth (feet):	28.0		
Mean Depth (feet):	16.7		

Watershed Characteristics

Major Watershed

Name: Lake Superior - North
 Watershed Number: 1
 Watershed size (acres): 1,015,865

Minor Watershed

Name: From Daniels L
 Watershed Number: 41
 Watershed size (acres): 6,589

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Surveys and Investigations

Initial Survey: 08/27/1957.
Population Assessment: 09/27/2010, 09/28/2006, 09/27/2004, 10/02/2000, 10/18/1993, 09/26/1990, 10/05/1987, 05/19/1986, 10/28/1985, 06/20/1983, 06/15/1983, 08/14/1981, 09/18/1979, 08/24/1978, 08/02/1976, 09/08/1971, 09/10/1970, 11/12/1964.
Standard Survey: 09/30/2015.

Current Water Level

Station ID	Date	Level	Reading (feet)	Reading Type
BM - 2	09/30/2015	Normal	-3.15	Above or below Benchmark

Benchmark and Gauge Descriptions / Locations

Station ID	Location Description
BM - 2	Highest point on large angular lichen-covered boulder on shore 15 ft west of an open-grown spruce. New in 2010.

Water Level History - Readings

Station ID	Date	Level	Reading (feet)	Reading Type
BM - 2	09/30/2015	Normal	-3.15	Above or below Benchmark
	09/28/2010	N/A	-3.70	Above or below Benchmark

Water Level History - Station Summary

Station ID	Minimum Level		Maximum Level		Range (feet)	Average Level (feet)	Reading Type (and number of readings)
	Feet	Date	Feet	Date			
BM - 2	-3.70	09/28/2010	-3.15	09/30/2015	0.55	-3.43	Above or below Benchmark (2)

Dissolved Oxygen and Temperature Profile of Lake Water

Station ID	Sampling Date	Bottom Depth (Feet)	Sample Depth (Feet)	Water Temperature (°F)		Dissolved Oxygen (ppm)
WQ - 2	09/30/2015	26.0	Surface	61.0	8.2	
			5.0	60.8	8.1	
			10.0	60.6	8.1	
			15.0	60.6	8.1	
			20.0	60.4	8.1	
			25.0	60.3	8.0	

Field Measurements of Water Quality

Station ID	Sampling Date	Sample Depth (Feet)	Secchi Depth (Feet)	Field pH	Alkalinity (ppm)	Water Color	Color Cause
WQ - 2	09/30/2015	Surface	14.0	N/A	N/A	Brown	Bog-stain
						brown but clear	

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Net Catch Summary by Numbers for GN

Standard gill net sets

Number of Sets: 2
 First Set Date: 09/30/2015
 Last Lift Date: 10/02/2015
 Target Species: N/A

Abbr	Species	Total Fish	Number Per Set	Quartiles for Lake Class 8*		
				25%	50%	75%
RBT	Rainbow Trout	13	6.50	N/A	N/A	N/A
Total Fish/Set:			6.50	* Quartiles for Number Per Set		

Net Catch Summary by Weight for GN

Standard gill net sets

Abbr	Species	Total Weight (Pounds)	Pounds Per Set	Mean Weight	Quartiles for Lake Class 8*		
					25%	50%	75%
RBT	Rainbow Trout	9.78	4.89	0.75	N/A	N/A	N/A
Total Pounds Fish/Set:			4.89	* Quartiles for Mean Weight			

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Net Catch Summary by Numbers for TN

Standard 3/4-in mesh, double frame trap net sets

Number of Sets: 6
 First Set Date: 09/30/2015
 Last Lift Date: 10/02/2015
 Target Species: N/A

Abbr	Species	Total Fish	Number Per Set	Quartiles for Lake Class 8*		
				25%	50%	75%
GSF	Green Sunfish	10	1.67	N/A	4.29	N/A
RBT	Rainbow Trout	33	5.50	N/A	N/A	N/A
SMB	Smallmouth Bass	2	0.33	1.10	2.70	25.60
Total Fish/Set:			7.50	* Quartiles for Number Per Set		

Net Catch Summary by Weight for TN

Standard 3/4-in mesh, double frame trap net sets

Abbr	Species	Total Weight (Pounds)	Pounds Per Set	Mean Weight	Quartiles for Lake Class 8*		
					25%	50%	75%
GSF	Green Sunfish	0.71	0.12	0.07	N/A	0.07	N/A
RBT	Rainbow Trout	27.58	4.60	0.84	N/A	N/A	N/A
SMB	Smallmouth Bass	2.55	0.42	1.27	0.17	0.35	0.57
Total Pounds Fish/Set:			5.14	* Quartiles for Mean Weight			

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Length Frequency Distribution for GN

Standard gill net sets

(Field work conducted between 09/30/2015 and 10/02/2015)

	<u>RBT</u>
< 3.00	-
3.00 - 3.49	-
3.50 - 3.99	-
4.00 - 4.49	-
4.50 - 4.99	-
5.00 - 5.49	-
5.50 - 5.99	-
6.00 - 6.49	-
6.50 - 6.99	-
7.00 - 7.49	-
7.50 - 7.99	-
8.00 - 8.49	-
8.50 - 8.99	-
9.00 - 9.49	-
9.50 - 9.99	-
10.00 - 10.49	-
10.50 - 10.99	-
11.00 - 11.49	1
11.50 - 11.99	-
12.00 - 12.99	8
13.00 - 13.99	2
14.00 - 14.99	1
15.00 - 15.99	1
16.00 - 16.99	-
17.00 - 17.99	-
18.00 - 18.99	-
19.00 - 19.99	-
20.00 - 20.99	-
21.00 - 21.99	-
22.00 - 22.99	-
23.00 - 23.99	-
24.00 - 24.99	-
25.00 - 25.99	-
26.00 - 26.99	-
27.00 - 27.99	-
28.00 - 28.99	-
29.00 - 29.99	-
30.00 - 30.99	-
31.00 - 31.99	-
32.00 - 32.99	-
33.00 - 33.99	-
34.00 - 34.99	-
35.00 - 35.99	-
= > 36.00	-

	<u>RBT</u>
Total	13
Min. Length	11.42
Max. Length	15.39
Mean Length	13.00
# Measured	13
No Lengths for	0

Note: Unless all fish were measured in the catch, totals shown for some length-frequency distributions may differ from the total number of fish in the catch, due to rounding of fractions used in the estimation of length frequency from a subsample of measured fish

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Length Frequency Distribution for TN

Standard 3/4-in mesh, double frame trap net sets

(Field work conducted between 09/30/2015 and 10/02/2015)

	<u>GSF</u>	<u>RBT</u>	<u>SMB</u>
< 3.00	-	-	-
3.00 - 3.49	-	-	-
3.50 - 3.99	1	-	-
4.00 - 4.49	4	-	-
4.50 - 4.99	3	-	-
5.00 - 5.49	1	-	-
5.50 - 5.99	1	-	-
6.00 - 6.49	-	-	-
6.50 - 6.99	-	-	1
7.00 - 7.49	-	-	-
7.50 - 7.99	-	-	-
8.00 - 8.49	-	-	-
8.50 - 8.99	-	-	-
9.00 - 9.49	-	-	-
9.50 - 9.99	-	-	-
10.00 - 10.49	-	1	-
10.50 - 10.99	-	-	-
11.00 - 11.49	-	2	-
11.50 - 11.99	-	3	-
12.00 - 12.99	-	16	-
13.00 - 13.99	-	6	-
14.00 - 14.99	-	3	-
15.00 - 15.99	-	1	-
16.00 - 16.99	-	1	1
17.00 - 17.99	-	-	-
18.00 - 18.99	-	-	-
19.00 - 19.99	-	-	-
20.00 - 20.99	-	-	-
21.00 - 21.99	-	-	-
22.00 - 22.99	-	-	-
23.00 - 23.99	-	-	-
24.00 - 24.99	-	-	-
25.00 - 25.99	-	-	-
26.00 - 26.99	-	-	-
27.00 - 27.99	-	-	-
28.00 - 28.99	-	-	-
29.00 - 29.99	-	-	-
30.00 - 30.99	-	-	-
31.00 - 31.99	-	-	-
32.00 - 32.99	-	-	-
33.00 - 33.99	-	-	-
34.00 - 34.99	-	-	-
35.00 - 35.99	-	-	-
= > 36.00	-	-	-

	<u>GSF</u>	<u>RBT</u>	<u>SMB</u>
Total	10	33	2
Min. Length	3.98	10.43	6.85
Max. Length	5.51	16.30	16.34
Mean Length	4.53	12.82	11.59
# Measured	10	33	2
No Lengths for	0	0	0

Note: Unless all fish were measured in the catch, totals shown for some length-frequency distributions may differ from the total number of fish in the catch, due to rounding of fractions used in the estimation of length frequency from a subsample of measured fish

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Length At Capture with Last Incremental Length

(Body-Scale constant, all lengths, and all length increments in inches)

Species: Rainbow Trout
Body-Scale Constant: 1.30
Total Sample Size: 46

Length at Capture in 2015 for Each Age Class, with Incremental Lengths for 2015

Year Class	Age	Sample Size	Length At Capture			Standard Error	Length Increments	
			Average Length	Maximum Length	Minimum Length		Increment	Standard Error
2014	1	34	12.33	14.25	10.43	0.111	4.35	0.106
2013	2	9	13.98	14.76	13.03	0.199	2.88	0.187
2012	3	2	15.37	15.39	15.35	0.020	1.86	0.315
2011	4	1	16.30	16.30	16.30	N/A	2.32	N/A

Species: Smallmouth Bass
Body-Scale Constant: 1.42
Total Sample Size: 2

Length at Capture in 2015 for Each Age Class, with Incremental Lengths for 2015

Year Class	Age	Sample Size	Length At Capture			Standard Error	Length Increments	
			Average Length	Maximum Length	Minimum Length		Increment	Standard Error
2013	2	1	6.85	6.85	6.85	N/A	2.58	N/A
2012	3	0	-	-	-	-	-	-
2011	4	0	-	-	-	-	-	-
2010	5	0	-	-	-	-	-	-
2009	6	0	-	-	-	-	-	-
2008	7	0	-	-	-	-	-	-
2007	8	0	-	-	-	-	-	-
2006	9	0	-	-	-	-	-	-
2005	10	0	-	-	-	-	-	-
2004	11	1	16.34	16.34	16.34	N/A	0.37	N/A

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Back-Calculated Lengths for Each Age Class and Average Annual Increments of Back-Calculated Lengths

Species: Rainbow Trout

Gear Type: Combined Gear Types (GN and TN)

Class	Age	N	1	2	3	4
2014	1	34	7.98	-	-	-
			7.98	-	-	-
2013	2	9	7.20	11.10	-	-
			7.20	3.90	-	-
2012	3	2	8.26	11.34	13.52	-
			8.26	3.09	2.18	-
2011	4	1	5.68	8.63	11.47	13.98
			5.68	2.95	2.84	2.51
Mean Length			7.79	10.93	12.83	13.98
Mean Increment			7.79	3.69	2.40	2.51
Total N			46	12	3	1

Species: Smallmouth Bass

Gear Type: Combined Gear Types (TN)

Class	Age	N	1	2	3	4	5	6	7	8	9	10	11
2013	2	1	2.71	4.27	-	-	-	-	-	-	-	-	-
			2.71	1.56	-	-	-	-	-	-	-	-	-
2004	11	1	2.98	4.78	7.31	9.13	10.24	11.70	12.69	13.83	14.86	15.40	15.97
			2.98	1.80	2.53	1.82	1.11	1.46	0.99	1.14	1.03	0.54	0.57
Mean Length			2.85	4.53	7.31	9.13	10.24	11.70	12.69	13.83	14.86	15.40	15.97
Mean Increment			2.85	1.68	2.53	1.82	1.11	1.46	0.99	1.14	1.03	0.54	0.57
Total N			2	2	1	1	1	1	1	1	1	1	1

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Age Class Frequency Distribution

Species & SS	Number of Fish (2)			Number of Fish in Year Class ('yy) and Age Class															
				'15	'14	'13	'12	'11	'10	'09	'08	'07	'06	'05	'04	'03	'02	'01	<'01
Type (1)	Aged	Keyed	Unaged	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
Rainbow Trout																			
GN	13	0	0	0	9	3	1	0	0	0	0	0	0	0	0	0	0	0	0
TN	33	0	0	0	25	6	1	1	0	0	0	0	0	0	0	0	0	0	0
Totals:	46	0	0	0	34	9	2	1	0	0	0	0	0	0	0	0	0	0	0
Smallmouth Bass																			
TN	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0

(1) Key to Sampling Station (SS) Type abbreviations:

GN = Standard gill net sets
 TN = Standard 3/4-in mesh, double frame trap net sets

(2) Notes:

Number of Fish Aged: Fish that were aged from bony parts.
 Number of Fish Keyed: Fish assigned an age with an age-length key or by expansion of mesh or station age distributions.
 Number of Fish Unaged: Fish that were not aged and were not assigned an age.

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Survey Crew Notes

null

Region Signed by user 'jomix' on 04/14/2016

Field Notes - General Field

Recent stocking:

Year - Species - Strain - Size - Number - Rate (number/lb)

2015 - RBT - KAM - Yrl - 2,855 - 2.3
2015 - RBT - ARL - Yrl - 2,145 - 2.7
2014 - RBT - KAM - Yrl - 5,024 - 3.1
2014 - RBT - KAM - Yrl - 712 - 8.3 (Adipose fin clipped)
2013 - RBT - KAM - Yrl - 5,009 - 3.3
2012 - RBT - ARL - Yrl - 5,000 - 3.1
2011 - RBT - ARL - Yrl - 5,000 - 2.9
2010 - RBT - ARL - Yrl - 4,997 - 2.9
2009 - RBT - ARL - Yrl - 5,000 - 2.7
2008 - RBT - ARL - Yrl - 5,000 - 3.1
2007 - RBT - ARL - Yrl - 5,000 - 2.8
2006 - RBT - ARL - Yrl - 5,000 - 2.7
2006 - BKT - SCF - Fgl - 4,056 - 33.6

Leo Lake has been managed for stream trout since at least 1929. It has been stocked annually with rainbow trout yearlings since 1975.

Discussion

Leo Lake has been managed for stream trout since at least the 1930s, and has been rehabilitated with fish toxicants twice during that time (1961 and 1974). Since 2007 it has been stocked exclusively with rainbow trout, of several strains. The 2015 survey was the first of two scheduled in the 2011 lake management plan to determine whether a switch to kamloop-strain yearlings, begun in 2013, would result in better attainment of management goals in the lake, particularly better survival of fish to age 2 and older. Current goals for rainbow trout in Leo Lake are minimum catches in gill nets and trap nets of 2.5 and 0.8 fish/set, respectively, with some age-2 or older fish present in fall survey catches.

Gill and trap net rainbow trout catches in 2015 easily exceeded goals in the 2011 LMP, and several fish age-2 or older were included in the catch. The 2015 trap net catch was well above the third quartile (2.20 fish/set) for fall surveys of stream trout lakes in this area (data through 2014). Although most of the rainbow trout taken were age-1 fish from the 2015 stocking, several fish age-2 or older (up to age 4) were included in the catch, indicating good long term survival in this very accessible trout lake. Growth rates for rainbow trout had been average; age-2 fish reached a mean length of 11.1 in at last annulus formation, compared to an area mean (across all lake classes) of 11.6 in. Growth appeared to have slowed among older fish. Results of the 2015 survey suggest the switch to the kamloop strain may have been successful, in that more fish survived past their first year in the lake.

Leo Lake supports several fish species that are generally considered incompatible with stream trout management, but none appeared excessively abundant in 2015. Walleye have been caught in fair numbers in past surveys of Leo Lake; however, none were found in 2015. Smallmouth bass were still present in Leo Lake in 2015, but only two fish were taken. White sucker, which can compete with trout for invertebrate forage, have been found in low numbers in Leo Lake in the past but were not caught in 2015. Green sunfish, which may also compete with trout, have been present in Leo Lake since at least 1981. The green sunfish trap net catch in this survey was within the normal range (0.50 - 3.27 fish/set) for stream trout lakes in this area.

Status Of The Fishery

Leo Lake has been managed for stream trout since at least the 1930s, and has been rehabilitated with fish toxicants twice during that time (1961 and 1974). Since 2007 it has been stocked exclusively with rainbow trout. The 2015 survey was the first of two scheduled in the 2011 lake management plan to determine whether a switch to kamloop-strain yearlings, begun in 2013, would result in better attainment of management goals in the lake, particularly better long-term survival of stocked fish.

Rainbow trout were abundant in Leo Lake in the fall of 2015, and fish up to 16 inches in length were present. The 2015 trap net catch was well above the upper end of the normal range (2.20 fish/set) for fall surveys of stream trout lakes in this area. Although most of the rainbow trout taken were one-year-old fish from the 2015 stocking, several older fish (up to four years old) were included in the catch, indicating good long term survival in this very accessible trout lake. Results of the 2015 survey suggest the switch to the kamloop strain may have been successful, in that more fish survived past their first year in the lake.

Leo Lake supports several fish species that are generally considered incompatible with stream trout management, but none appeared excessively abundant in 2015. Walleye have been caught in fair numbers in past surveys of Leo Lake; however, none were found in 2015. Smallmouth bass were still present in Leo Lake in 2015, but only two fish were taken. White sucker, which can compete with trout for invertebrate forage, have been found in low numbers in Leo Lake in the past but were not caught in 2015. Green sunfish, which may also compete with trout, have been present in Leo Lake since at least 1981. The green sunfish trap net catch in this survey was within the normal range (0.50 - 3.27 fish/set) for stream trout lakes in this area.

Approval Dates And Notices

Date Approved By Grand Marais Area Fisheries Supervisor: 02/08/2016

Date Approved By Northeast Region Fisheries Manager: 04/14/2016



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Lake Survey Report revision: 20160309-RJE. Data Date: 04/26/2016 at 10:00 am .