



2021 Data Report for Otter Lake, Benzie County

Site ID: 100272

44.74021°N, 86.0611°W

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Michigan Clean
Water Corps

EGLE

MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

MICHIGAN STATE
UNIVERSITY



About this report:

This report is a summary of the data that have been collected through the Cooperative Lakes Monitoring Program. The contents have been customized for your lake. The first page is a summary of the Trophic Status Indicators of your lake (Secchi Disk Transparency, Chlorophyll-a, Spring Total Phosphorus, and Summer Total Phosphorus). Where data are available, they have been summarized for the most recent field season, five years prior to the most recent field season, and since the first year your lake has been enrolled in the program.

If you did not take 8 or more Secchi disk measurements or 4 or more chlorophyll measurements, there will not be summary data calculated for these parameters. These numbers of measurements are required to ensure that the results are indicative of overall summer conditions.

If you enrolled in Dissolved Oxygen/Temperature, the summary page will have a graph of one of the profiles taken during the late summer (typically August or September). If your lake stratifies, we will use a graph showing the earliest time of stratification, because identifying the timing of this condition and the depth at which it occurs is typically the most important use of dissolved oxygen measurements.

The back of the summary page will be an explanation of the Trophic Status Index and where your lake fits on that scale.

The rest of the report will be aquatic plant summaries, Score the Shore results, and larger graphs, including all Dissolved Oxygen/Temperature Profiles that you recorded. For Secchi Disk, Chlorophyll, and Phosphorus parameters, you need to have two years of data for a graph to make logical sense. Therefore if this is the first year you have enrolled in the CLMP, you will not receive a graph for these parameters.

Remember that some lakes see a lot of fluctuation in these parameters from year to year. Until you have eight years worth of data, consider all trends to be preliminary.

To learn more about the CLMP monitoring parameters or get definitions to unknown terms, check out the CLMP Manual, found at: https://micorps.net/wp-content/uploads/2021/03/CLMP-Manual-2019update2_2021.pdf

Thank you!

The CLMP leadership team would like to thank you for all of your efforts over the past year. The CLMP would not exist without dedicated and hardworking volunteers!

The CLMP Leadership Team is made of: Jo Latimore, Erick Elgin, Jean Roth, Tamara Lipsey, Mike Gallagher, Melissa DeSimone, and Paul Steen

Questions?

If you have questions on this report or believe that the tabulated data for your lake in this report are in error please contact:

Paul Steen (psteen@hrwc.org), CLMP Data Analyst

Otter Lake, Benzie County 2021 CLMP Results



Secchi Disk Transparency (feet)

Year	# Readings	Min	Max	Avg	Std. Dev	Carlson TSI
2021	8	10.5	17.5	13.8	2.8	39
2021 All CLMP Lakes	2817	1.0	50.0	12.7	2.9	42
1974-2015						

No graph: Not enough data

Chlorophyll-a (parts per billion)

Year	# Samples	Min	Max	Med	Std. Dev	Carlson TSI
2021	5	<1.0	3.9	<1.0	1.5	<31
2021 All CLMP Lakes	635	< 1.0	42.0	2.2	3.4	39

No graph: Not enough data

Spring Phosphorus (parts per billion)

Year	# Samples	Min	Max	Avg	Std. Dev
2021	1	8.0	8.0	8.0	NA
2021 All CLMP Lakes	220	<= 3	100.0	14.9	11.0

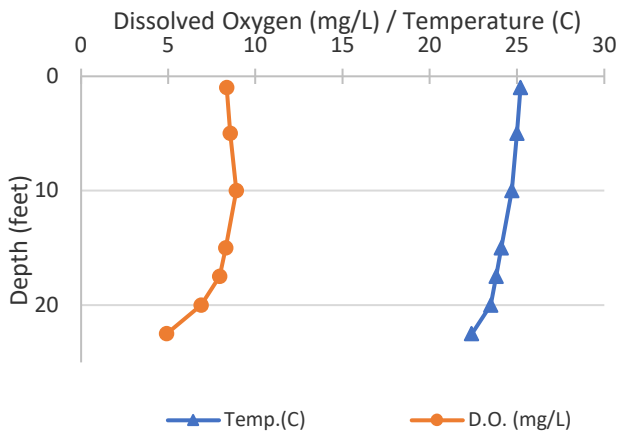
No graph: Not enough data

Summer Phosphorus (parts per billion)

Year	# Samples	Min	Max	Avg	Std. Dev	Carlson TSI
2021	1	11.0	11.0	11.0	NA	39
2021 All CLMP Lakes	281	<= 3	65.0	12.8	9.3	38

No graph: Not enough data

Dissolved Oxygen and Temperature Profile 8/12/2021



Summary

Average TSI	2021	2016-2020	1974-2015
Otter Lake	36	NA	NA
All CLMP Lakes	42	40	43

With an average TSI score of 36 based on 2021 Secchi transparency, chlorophyll-a, and summer total phosphorus data, this lake is rated between the oligotrophic and mesotrophic lake classification. The lake leans slightly more oligotrophic than mesotrophic.

Due to its low depth, the lake is able to maintain dissolved oxygen throughout the water column for the entire summer.

Welcome to the CLMP! The longer you stay in the program and the more parameters you monitor, the more interesting this report will become. Once you have eight years of data there will be enough history to analyze the long-term trend.

* = No sample received W= Value is less than the detection limit (<3 ppb) T= Value reported is less than the reporting limit (5 ppb).
<1.0 = Chlorophyll-a: Sample value is less than limit of quantification (<1 ppb).

Trophic Status Index Explained

In 1977, limnologist Dr. Robert Carlson developed a numerical scale (0-100) where the numbers indicate the level of nutrient enrichment. Using the proper equations, we can convert results from Summer Total Phosphorus, Secchi Depth, and Chlorophyll-a to this Trophic Status Index (TSI). The TSI numbers are furthermore grouped into general categories (oligotrophic, mesotrophic, eutrophic, and hypereutrophic), to quickly give us a way to understand the general nutrient level of any lake.

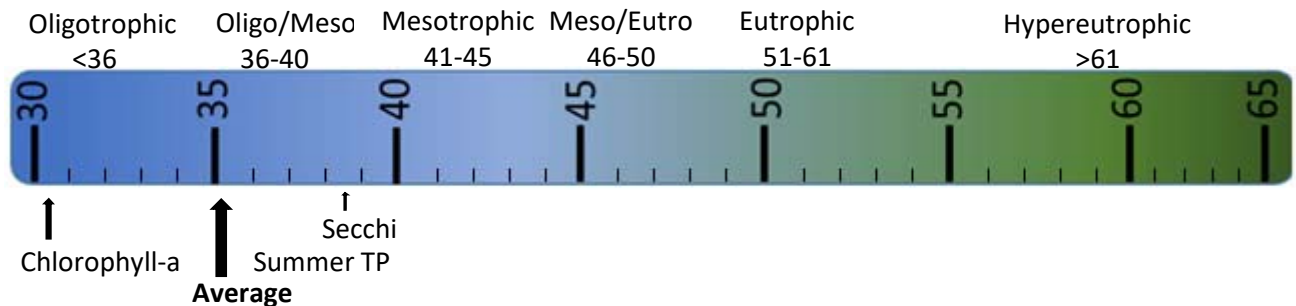
The tables below give the results-to-TSI conversions for the water quality data ranges normally seen in the CLMP. The formulas for this conversion can be found in the CLMP manual (link is on page 2 of this report).

Phosphorus (ppb)	TSI Value
<5	<27
6	30
8	34
10	37
12	40
15	43
18	46
21	48
24	50
32	54
36	56
42	58
48	60
>50	>61

Secchi Depth (ft)	TSI Value
>30	<28
25	31
20	34
15	38
12	42
10	44
7.5	48
6	52
4	57
<3	>61

Chlorophyll-a (ppb)	TSI Value
<1	<31
2	37
3	41
4	44
6	48
8	51
12	55
16	58
22	61
>22	>61

TSI for Otter Lake in 2021	
Average	36
Secchi Disk	39
Summer TP	39
Chlorophyll-a	<31



Oligotrophic: Generally deep and clear lakes with little aquatic plant or algae growth. These lakes maintain sufficient dissolved oxygen in the cool, deep-bottom waters during late summer to support cold water fish, such as trout and whitefish.

Mesotrophic: Lakes that fall between oligotrophic and eutrophic. Mid-ranged amounts of nutrients.

Eutrophic: Highly productive eutrophic lakes are generally shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish, such as bass and pike.

Hypereutrophic: A specialized category of eutrophic lakes. These lakes exhibit extremely high productivity, such as nuisance algae and weed growth.

Otter Lake, Benzie County 2021 CLMP Aquatic Plant Results



The Aquatic Plant Identification and Mapping survey was conducted on Otter Lake in 2021.

This survey involves intensive sampling at multiple locations and depths around the lake produce a complete map of all aquatic plants present in a lake. A great deal of effort is involved both on the lake and back on shore to identify plants, compile data, and develop a detailed plant map, but the result is an extremely valuable record of the plant community of the lake.

Aquatic plants were sampled from a total of 24 locations (8 transects) in Otter Lake in 2021. Below is a list of species reported in order of relative abundance.

Otter Lake, Benzie County		
2021 Aquatic Plant Identification and Mapping: Species Reported		
<u>Common Name</u>	<u>Latin name</u>	<u>Average Density*</u>
Muskgrass	<i>Chara</i> sp.	3.4
Slender naiad	<i>Najas flexilis</i>	1.6
Yellow pond lily	<i>Nuphar</i> spp.	0.6
Water celery	<i>Vallisneria americana</i>	0.4
Clasping-leaf pondweed	<i>Potamogeton richardsonii</i>	0.4
Illinois pondweed	<i>Potamogeton illinoensis</i>	0.3
Globular stonewort	<i>Chara globularis</i>	0.3
Variable pondweed	<i>Potamogeton gramineus</i>	0.3
White water lily	<i>Nymphaea odorata</i>	0.3
Sago pondweed	<i>Stuckenia pectinata</i>	0.3
Water smartweed	<i>Persicaria amphibia</i>	0.3
Stiff pondweed	<i>Potamogeton strictifolius</i>	0.3
Fries' pondweed	<i>Potamogeton friesii</i>	0.3
Bulrush	<i>Scirpus</i> sp.	0.2
White-stem pondweed	<i>Potamogeton praelongus</i>	0.2
Waterweed	<i>Elodea canadensis</i>	0.1
Southern naiad	<i>Najas guadelupensis</i>	0.1
Whorled watermilfoil	<i>Myriophyllum verticillatum</i>	0.1
Flat-stem pondweed	<i>Potamogeton zosteriformis</i>	<0.1

*Lakewide. Scale: 0 (absent) - 5 (dense)

Visit the MiCorps Data Exchange (www.micorps.net) or contact the lead volunteer on your lake for more details on the survey, including sampling locations, maps, and abundance information, and for information on past surveys.

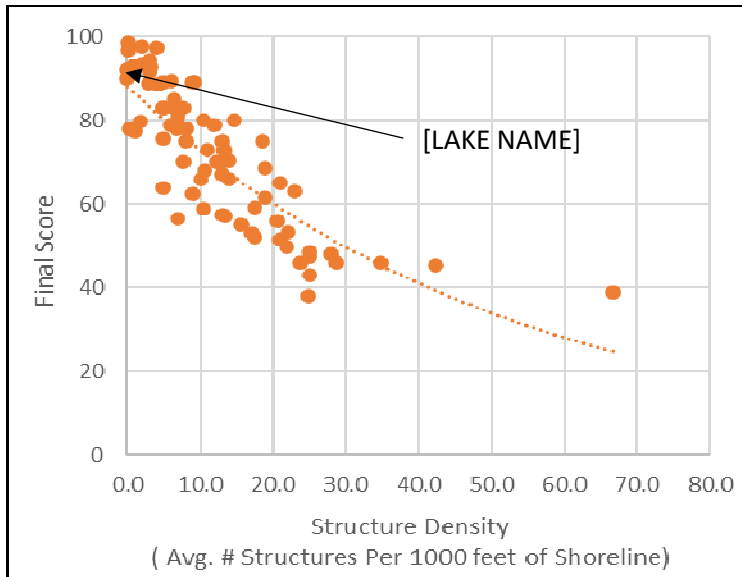
Otter Lake, Benzie County 2021 Score the Shore Results



The Score the Shore Habitat Assessment was conducted on Otter Lake in 2021.

This assessment involves rating 1000 foot sections of shoreline for aquatic vegetation, shoreline vegetation, erosion, and erosion control practices (like sea walls). Each shoreline section is given three scores ranging from 0-100 for the categories of Littoral, Riparian, and Erosion Management. The three scores are averaged to produce a average section score. Then a total score is given to the entire lake by averaging all of the average section scores. A score of 0 indicates a shoreline that has been extremely disturbed by human impacts and no natural shoreline remains. A score of 100 indicates a shoreline that is nearly pristine.

How does your lake compare to others in the program?



Otter Lake:	
Number of Sections:	7
Number of Structures:	6
Structure Density:	0.86
Final Score:	93

All 78 Participating Lakes from 2015-2021:	
Avg. Number of Sections:	16
Avg. Number of Structures:	214
Avg. Structure Density:	12.2
Avg. Final Score:	72

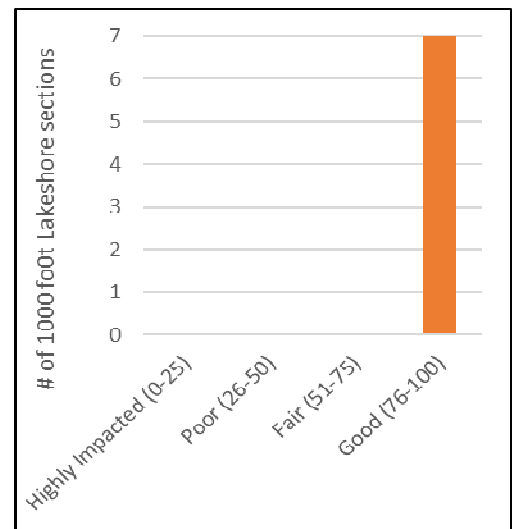
Note about graph to the left: The dotted line sets your average expectation of the score of your lake. If your lake is lower than the dotted line, then your shoreline health is lower than average compared to lakes with similar amount of shoreline development. And vice-versa in regards to a lake above the dotted line.

Analysis specific to Otter Lake:

Overall, the lakeshore habitat of Otter Lake is doing well and scored higher than average when compared to other lakes in the program. All of the 1000 foot sections scored Good.

The lake sections scored perfect for erosion control, meaning that there are no sea walls, rock rip-rap, and other shoreline erosion structures, or significant erosion of any kind. The lake also scored very high in Riparian, meaning that there are plentiful non-mowed areas providing a buffer between houses and structures and roads and the lake.

The littoral zone was the weak point in Otter Lake's habitat (scoring an average of 82). A score of 82 is quite good actually, but if residents want to improve the overall shoreline quality, this is the component to concentrate on. To improve the littoral zone score, leave woody debris in place in the lake, or consider introducing new woody debris in the shallows to serve as habitat, and allow native aquatic vegetation to grow in the shallow waters.



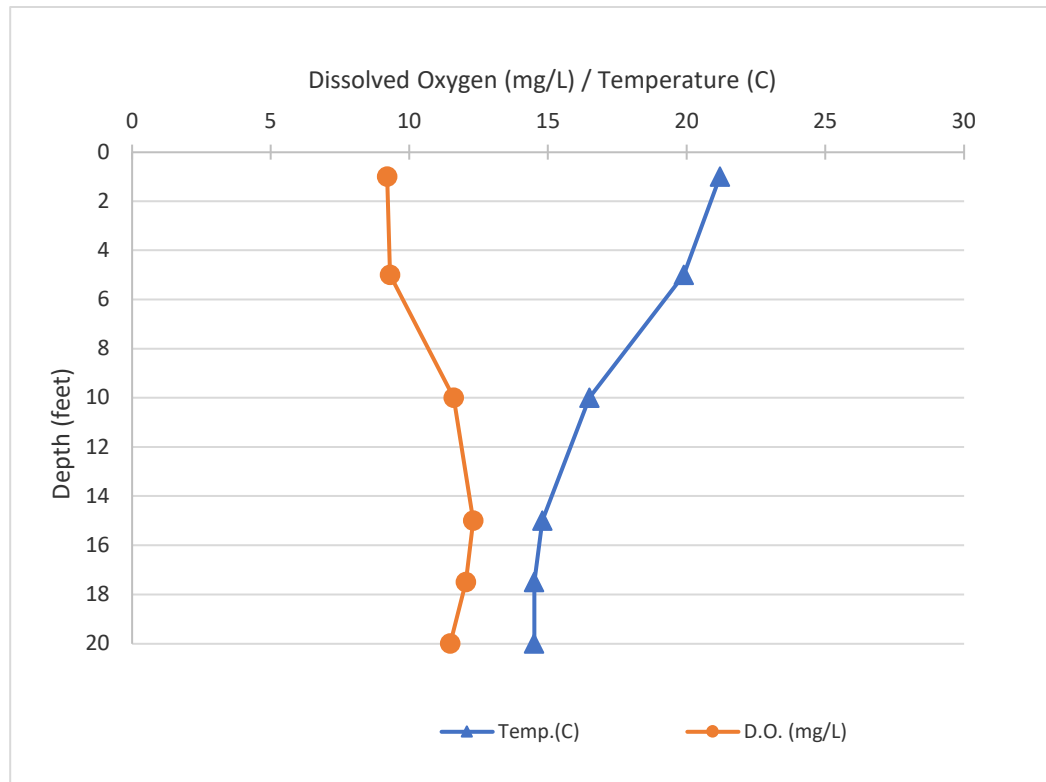
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 5/22/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	21.2	9.2
5	19.9	9.3
10	16.5	11.6
15	14.8	12.3
17.5	14.5	12.04
20	14.5	11.48

Lake: Otter Lake (Benzie Co.)

5/22/2021



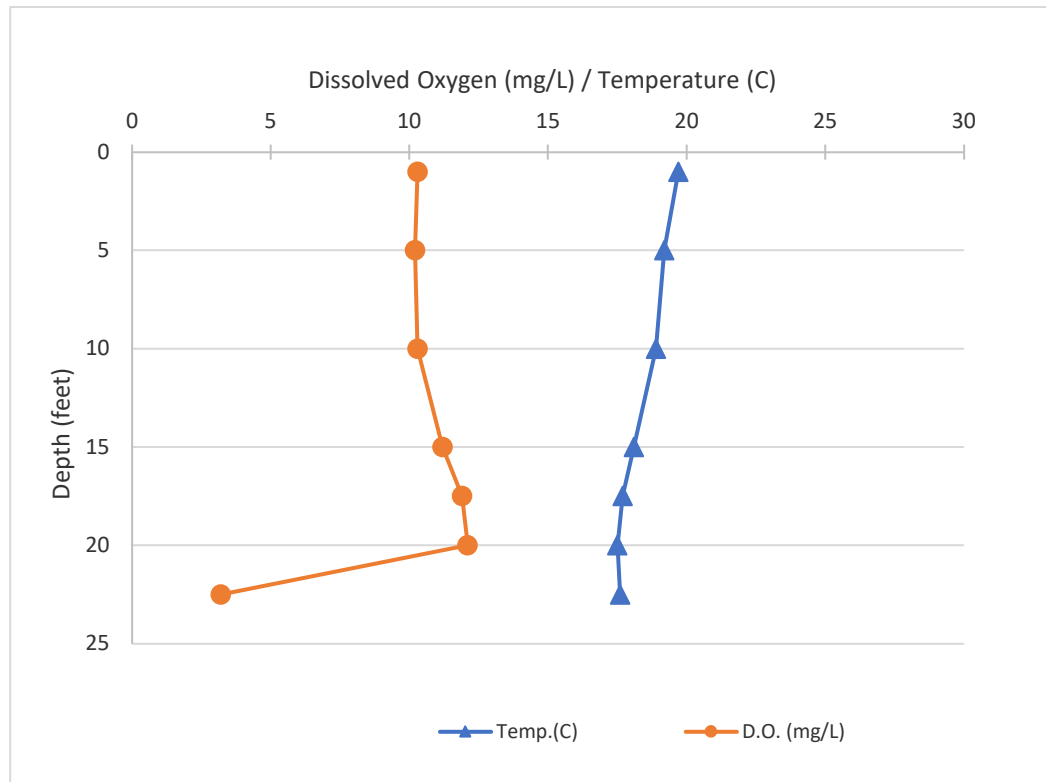
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 6/3/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	19.7	10.3
5	19.2	10.2
10	18.9	10.3
15	18.1	11.2
17.5	17.7	11.9
20	17.5	12.1
22.5	17.6	3.2

Lake: Otter Lake (Benzie Co.)

6/3/2021



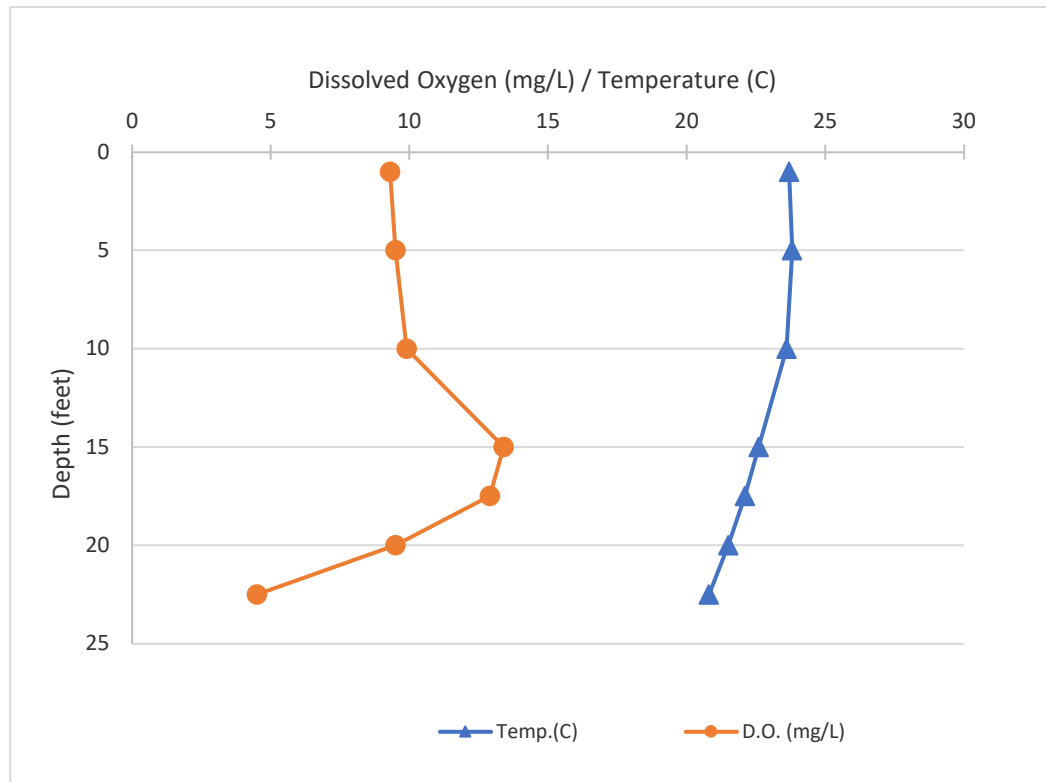
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 6/17/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	23.7	9.3
5	23.8	9.5
10	23.6	9.9
15	22.6	13.4
17.5	22.1	12.9
20	21.5	9.5
22.5	20.8	4.5

Lake: Otter Lake (Benzie Co.)

6/17/2021



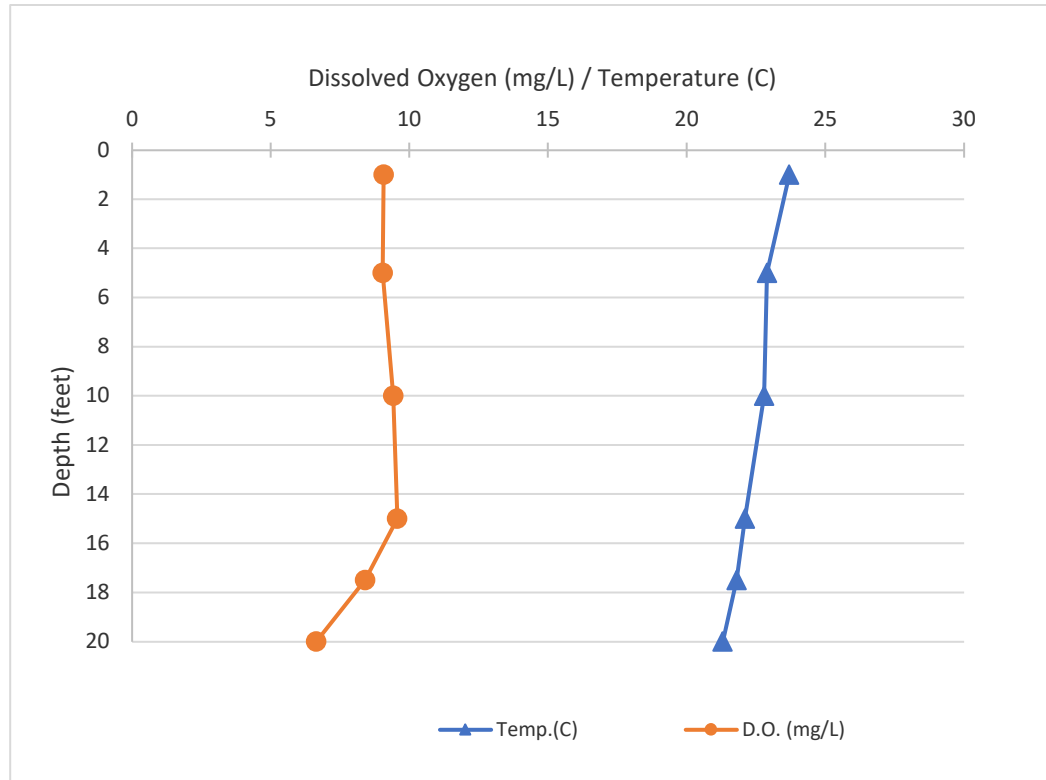
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 7/3/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	23.7	9.08
5	22.9	9.04
10	22.8	9.42
15	22.1	9.56
17.5	21.8	8.41
20	21.3	6.64

Lake: Otter Lake (Benzie Co.)

7/3/2021



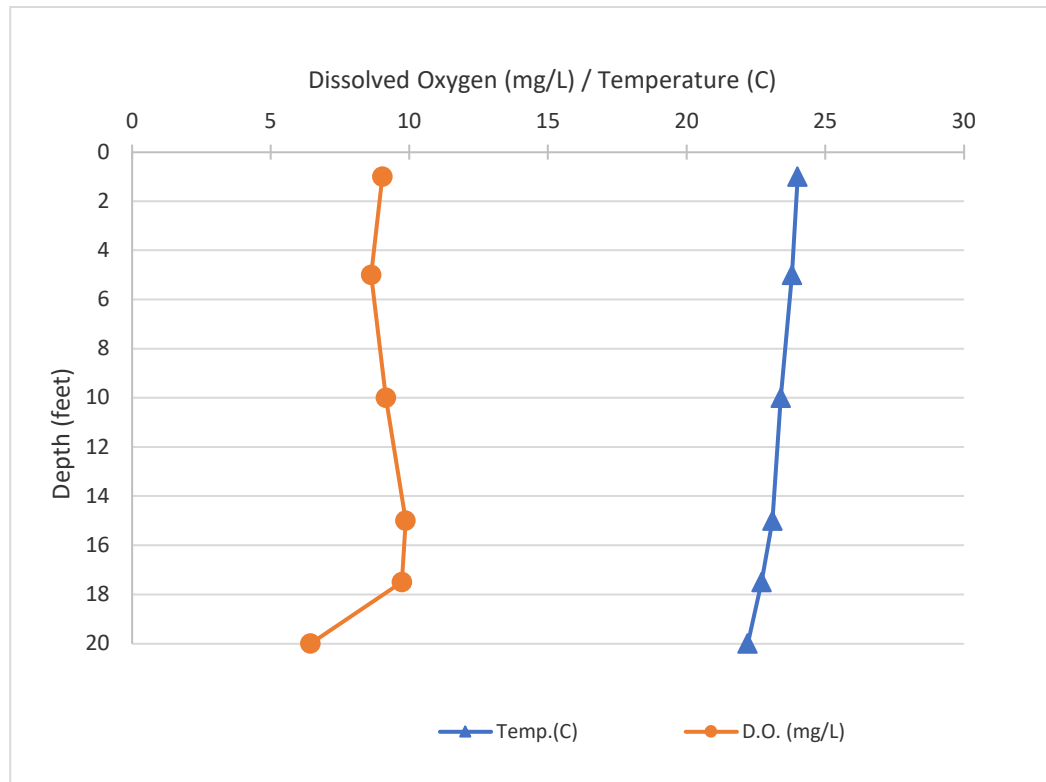
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 7/14/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	24	9.03
5	23.8	8.62
10	23.4	9.16
15	23.1	9.86
17.5	22.7	9.73
20	22.2	6.43

Lake: Otter Lake (Benzie Co.)

7/14/2021



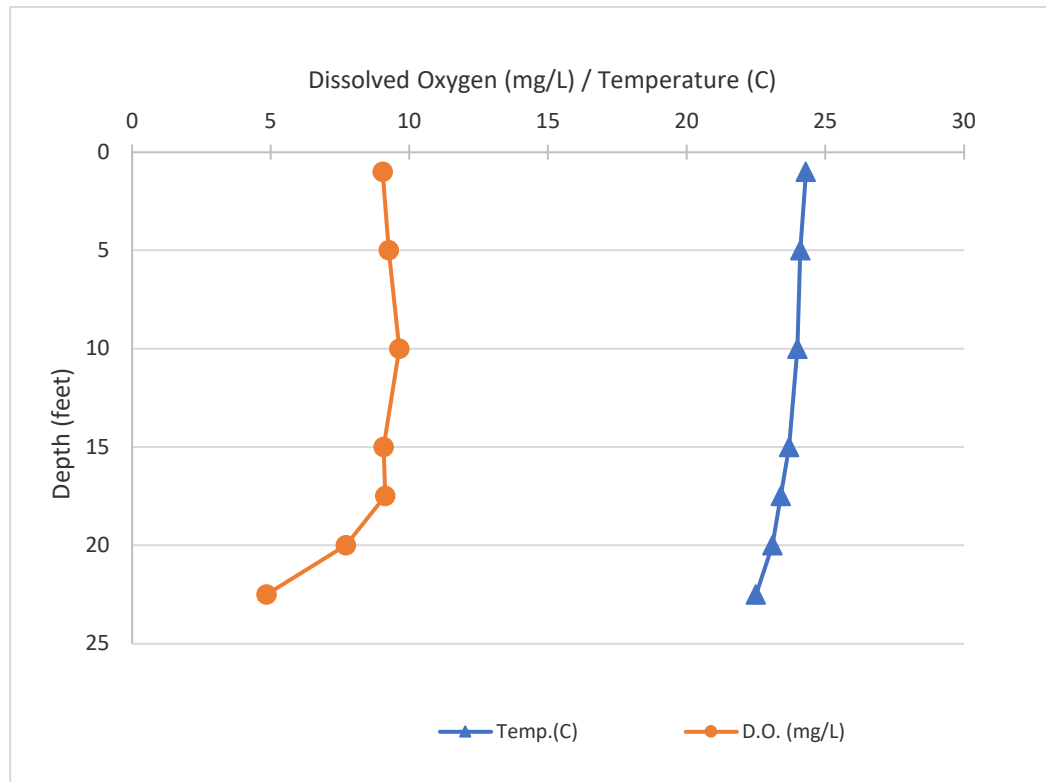
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 8/3/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	24.3	9.04
5	24.1	9.26
10	24	9.64
15	23.7	9.07
17.5	23.4	9.13
20	23.1	7.71
22.5	22.5	4.85

Lake: Otter Lake (Benzie Co.)

8/3/2021



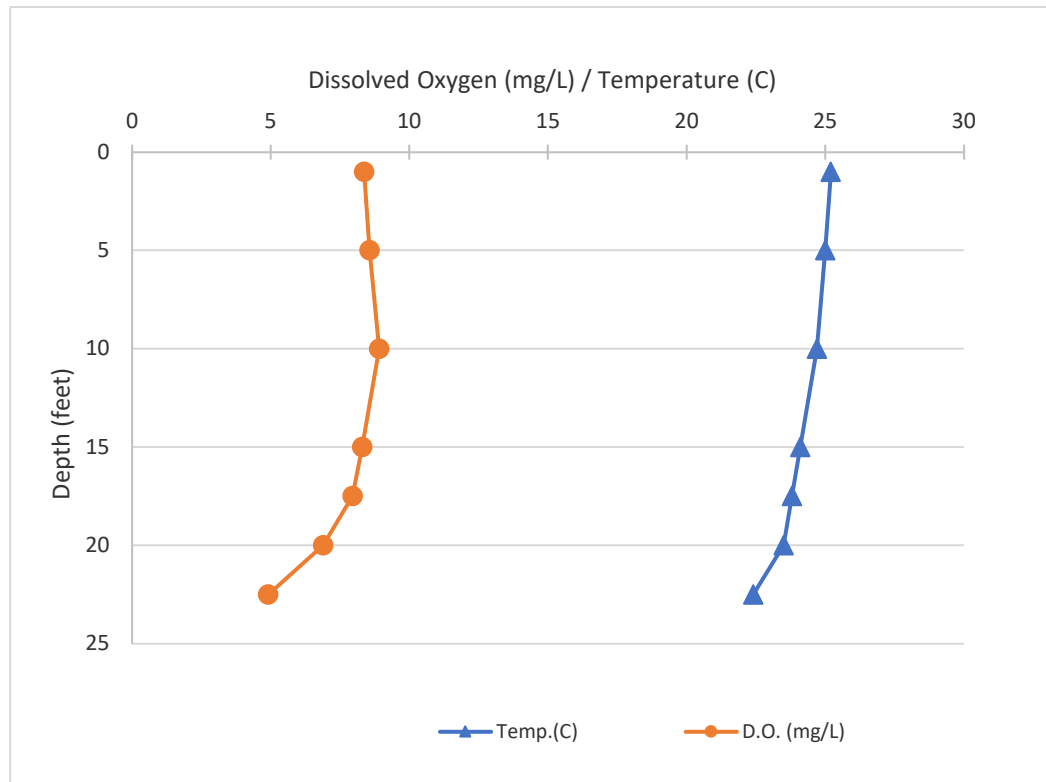
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 8/12/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	25.2	8.37
5	25	8.57
10	24.7	8.91
15	24.1	8.3
17.5	23.8	7.95
20	23.5	6.89
22.5	22.4	4.91

Lake: Otter Lake (Benzie Co.)

8/12/2021



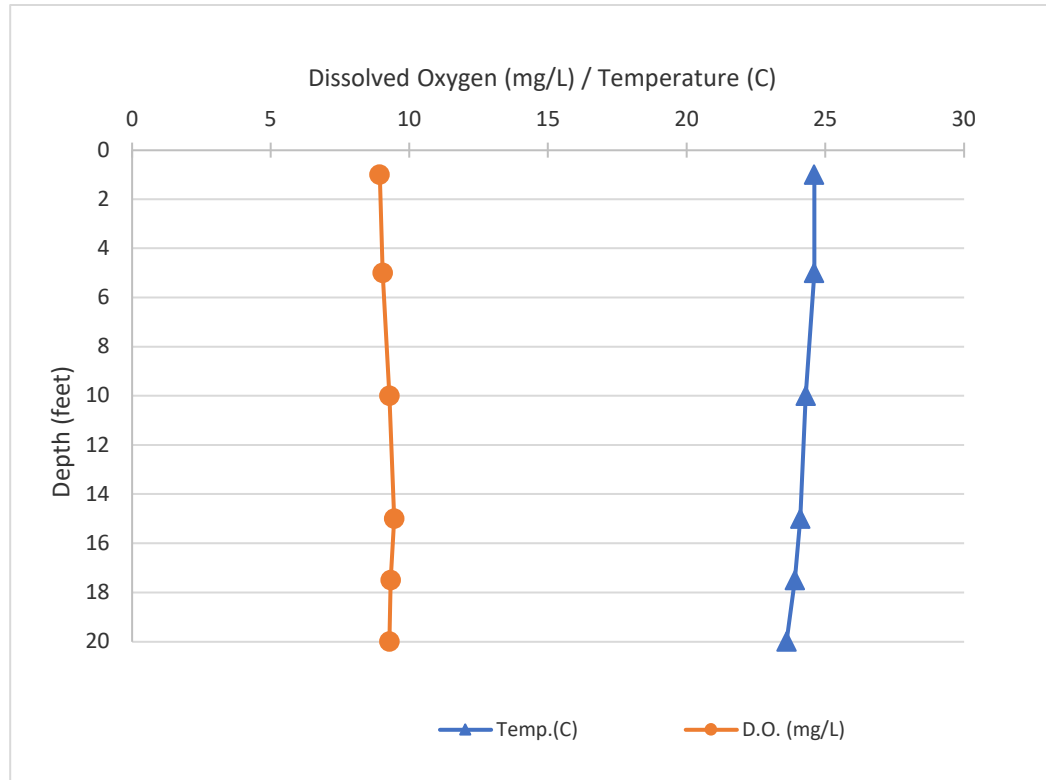
Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 9/2/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	24.6	8.93
5	24.6	9.04
10	24.3	9.28
15	24.1	9.45
17.5	23.9	9.33
20	23.6	9.28

Lake: Otter Lake (Benzie Co.)

9/2/2021



Name: Otter Lake
County: Benzie
Site ID: 100272
Date: 9/9/2021

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	21.3	8.24
5	21.2	8.13
10	21.1	7.9
15	21.1	7.88
17.5	21	8.04
20	20.8	7.99
22.5	20.8	6.85

Lake: Otter Lake (Benzie Co.)

9/9/2021

