



2018 Data Report for

Lake Angelus, Oakland County

Site ID: 631227

42.69387°N, 83.32965°W

The CLMP is brought to you by:



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://cdn.cloud1.cemah.net/wp-content/uploads/sites/63/2018/03/CLMP_Manual_2018.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: Marcy Knoll Wilmes, Jean Roth, Jo Latimore, Paul Steen, Mike Gallagher, Laura Kaminski, and Erick Elgin

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:

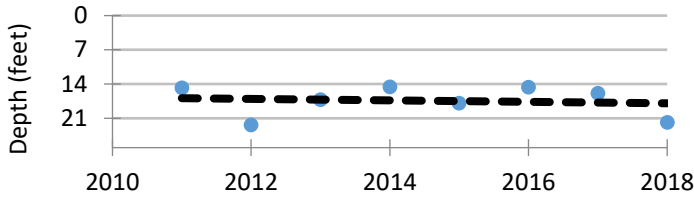
Paul Steen (psteen@hrwc.org), MiCorps Program Manager

Lake Angelus, Oakland County 2018 CLMP Results



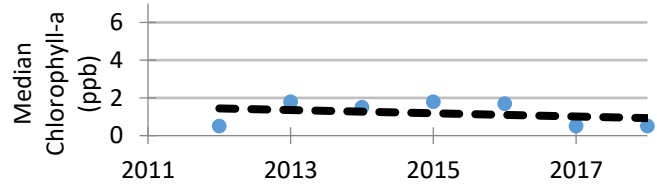
Secchi Disk Transparency (feet)

Year	# Readings	Min	Max	Average	Std. Dev	Carlson TSI
2018	9	7.5	94.0	21.8	27.5	33
2013-2017	50	8.5	25.0	21.8	3.8	37
2011-2012	33	11.5	30.0	18.6	3.0	35
2018 All CLMP Lakes	3392	0.5	94.0	12.6	2.7	42



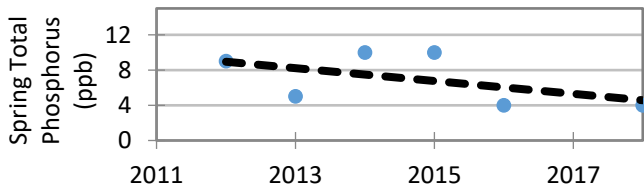
Chlorophyll-a (parts per billion)

Year	# Samples	Min	Max	Median	Std. Dev	Carlson TSI
2018	5	<1.0	1.5	<1.0	0.5	<31
2013-2017	25	<1.0	2.4	1.7	0.5	36
2012-2012	5	<1.0	1.4	1.7	0.4	<31
2018 All CLMP Lakes	628	< 1.0	28.0	1.8	4.3	36



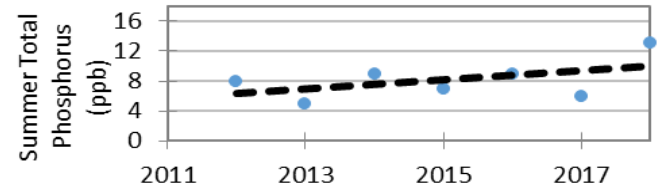
Spring Phosphorus (parts per billion)

Year	# Samples	Min	Max	Average	Std. Dev	Carlson TSI
2018	1	<5 T	<5	<5	NA	
2013-2017	4	<5 T	10.0	7.3	3.2	
2012-2012	1	9.0	9.0	9.0	NA	
2018 All CLMP Lakes	193	<= 3	110.0	12.8	12.5	



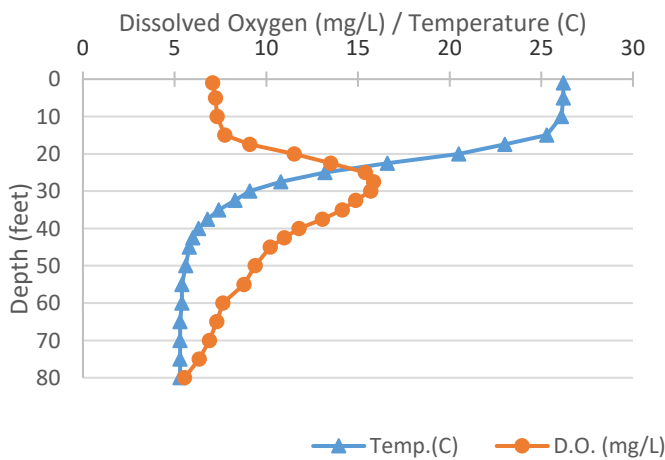
Summer Phosphorus (parts per billion)

Year	# Samples	Min	Max	Average	Std. Dev	Carlson TSI
2018	1	13.0	13.0	13.0	NA	41
2013-2017	5	5.0	9.0	7.2	1.8	32
2012	1	8.0	8.0	8.0	NA	34
2018 All CLMP Lakes	248	<= 3	84.0	14.1	10.4	42



Dissolved Oxygen and Temperature Profile

8/11/2018



Summary

Average TSI	2018	2013-2017	2011-2012
Lake Angelus	35	35	33
All CLMP Lakes	41	40	40

With an average TSI score of 35 based on 2018 Secchi transparency, chlorophyll-a, and summer total phosphorus data, this lake is rated as an oligotrophic lake.

The low level of nutrients in the lake results in dissolved oxygen being available throughout the water column for the entire summer.

While the trends for individual parameters are mixed, the overall nutrient levels in the lake are largely unchanged since monitoring began.

* = 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.

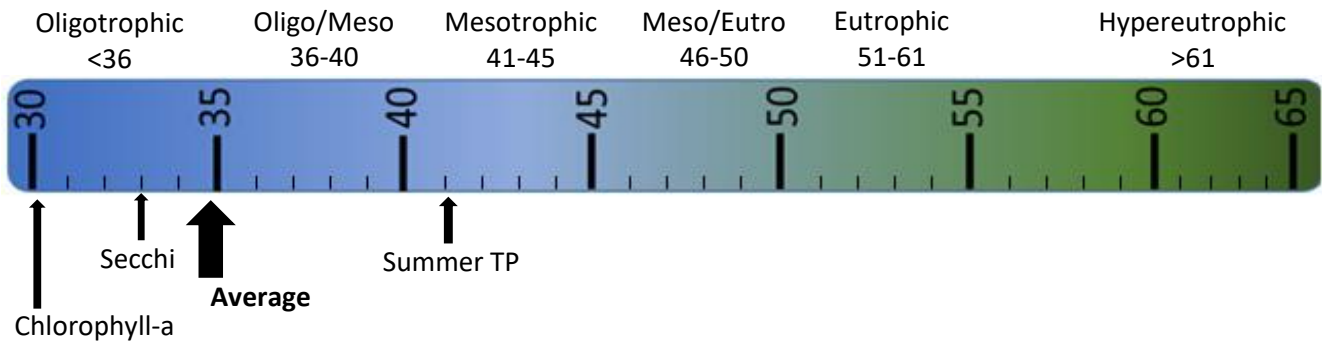
The tables below give the results-to-TSI conversions for the water quality data ranges normally seen in the CLMP. The formulas for this conversion can be found in the CLMP manual: https://cdn.cloud1.cemah.net/wp-content/uploads/sites/63/2018/03/CLMP_Manual_2018.pdf

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 Lake Angelus in 2018	
Average	35
Secchi Disk	33
Summer TP	41
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.

Lake Angelus, Oakland County 2018 CLMP Aquatic Plant Results



Lake Angelus does not have aquatic plant data available for 2018. Consider enrolling in an aquatic plant parameter next year.

Why is monitoring aquatic plants important?

A major component of the plant community in lakes is the large, leafy, rooted plants. Compared to the microscopic algae the rooted plants are large. Sometimes they are collectively called the “macrophytes” (“macro” meaning large and “phyte” meaning plant). These macrophytes are the plants that people sometimes complain about and refer to as lake weeds.

Far from being weeds, macrophytes or rooted aquatic plants are a natural and essential part of the lake, just as grasses, shrubs and trees are a natural part of the land. Their roots are a fabric for holding sediments in place, reducing erosion and maintaining bottom stability. They provide habitat for fish, including structure for food organisms, nursery areas, foraging and predator avoidance. Waterfowl, shore birds and aquatic mammals use plants to forage on and within, and as nesting materials and cover.

Though plants are important to the lake, overabundant plants can negatively affect fish populations, fishing and other recreational activities. Rooted plant populations increase in abundance as nutrient concentrations increase in the lake. As lakes become more eutrophic rooted plant populations increase. They are rarely a problem in oligotrophic lakes, only occasionally a problem in mesotrophic lakes, sometimes a problem in eutrophic lakes, and often a problem in hypereutrophic lakes.

However, sometimes a lake is invaded by an aquatic plant species that is not native to Michigan. In these cases, even nutrient poor oligotrophic lakes can be threatened. Some of these exotic plants, like Curly-leaf Pondweed, Eurasian Milfoil, Starry Stonewort, and Hydrilla can be extremely disruptive to the lake’s ecosystem and recreational activities.

To avoid a takeover by exotic plants, it is necessary to use Integrated Pest Management (IPM) strategies: monitoring, early detection, rapid response, maintenance control, and preventive management. For more information on these strategies, check out Integrated Pest Management for Nuisance Exotics in Michigan Inland Lakes (MSU Extension Water Quality Publication WQ-56, available at <https://micorps.net/lake-monitoring/clmp-documents/>)

The CLMP offers two parameters on aquatic plants. In the Exotic Aquatic Plant Watch, volunteers concentrate on monitoring and early detection of exotic invasive plants only. In Aquatic Plant Identification and Mapping, volunteers identify all native and non-native plants. In both parameters, volunteers create lake maps or use digital tools to georeference where the plants are found.

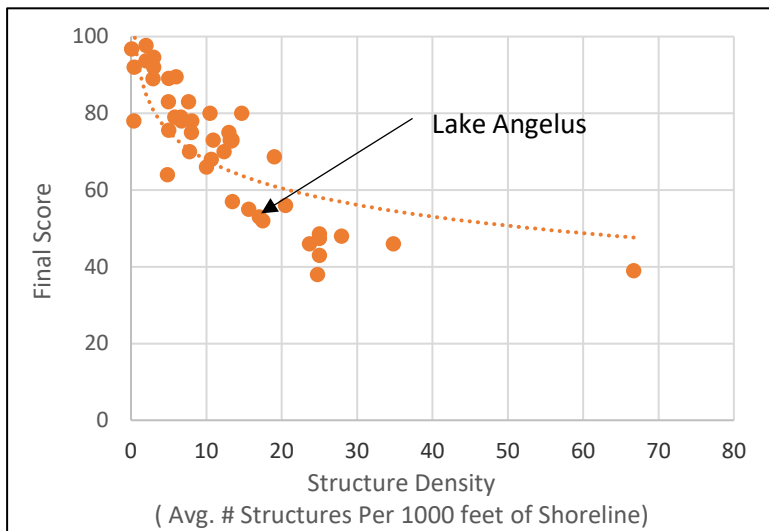
Lake Angelus, Oakland County 2016 Score the Shore Results



The Score the Shore Habitat Assessment was conducted on Lake Angelus in 2016.

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?



Lake Angelus:	
Number of Sections:	19
Number of Structures:	332
Structure Density:	17.5
Final Score:	52

All 42 Participating Lakes from 2015-2018:	
Avg. Number of Sections:	16.3
Avg. Number of Structures:	248.5
Avg. Structure Density:	15.2
Avg. Final Score:	70.5

There is a very tight relationship between Final Score and Structure Density. It will be interesting to see if and how this changes as more lakes go through this scoring process.

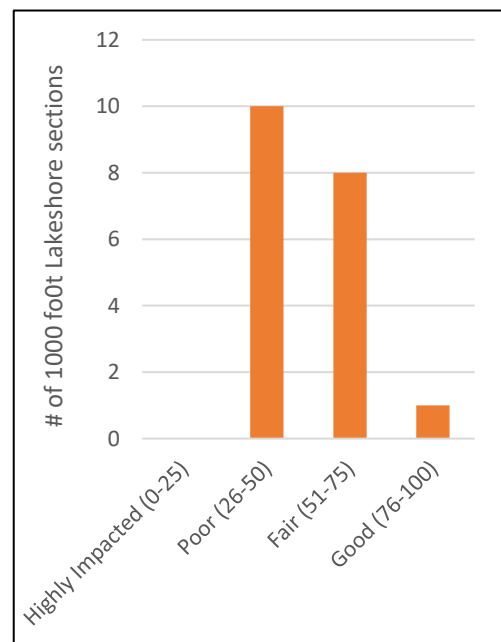
Analysis specific to Lake Angelus:

The majority of 1000 foot sections in Lake Angelus scored either Poor or Fair, but there was one section scored as Good.

One of the worst sections was section 12, which scored a 0 for the riparian zone. This means that there are no unmowed vegetation areas at all here.

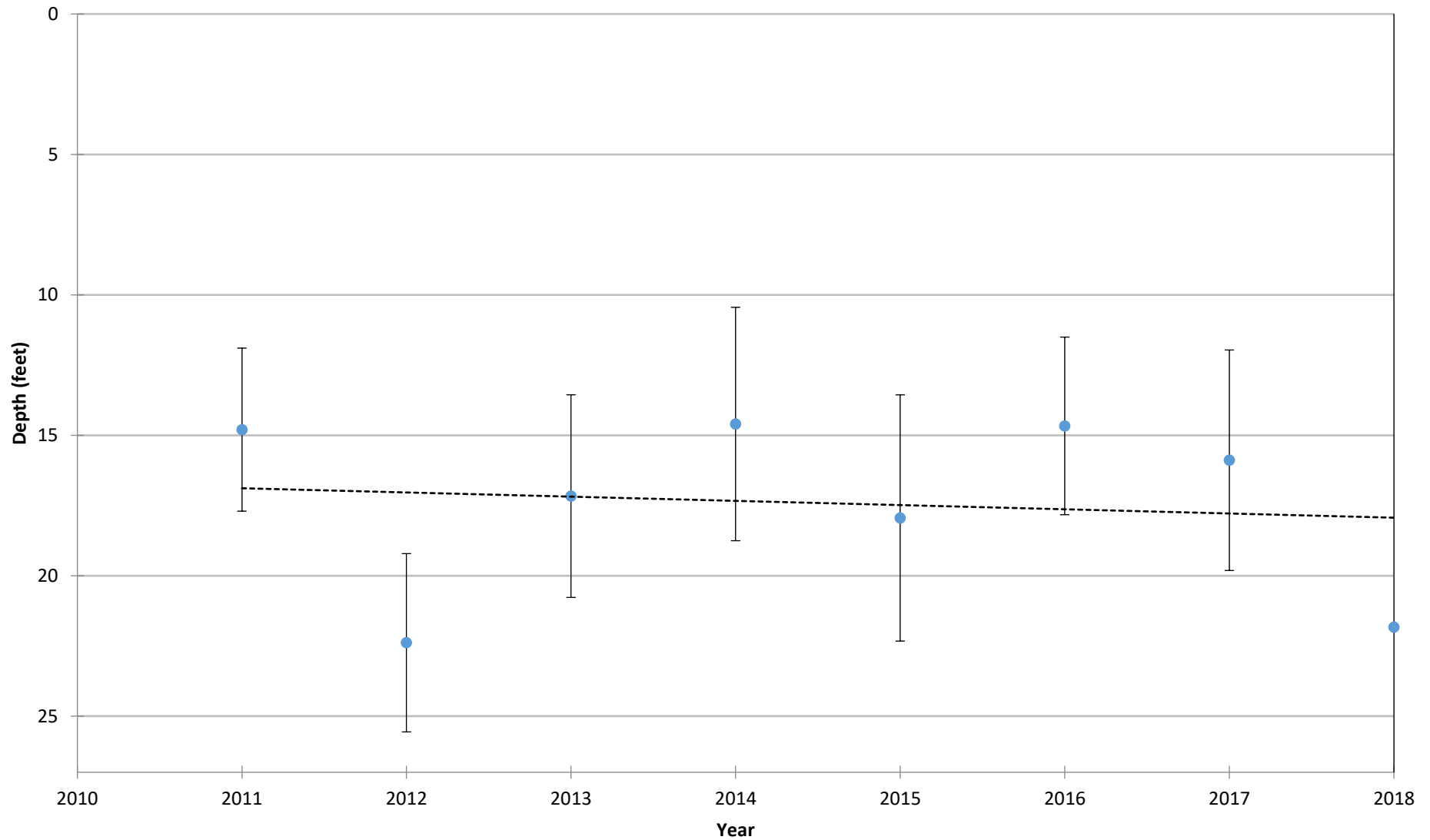
The healthiest habitat on Lake Angelus lies on Section 19, where there are no erosion controls in place and where the vegetated riparian zone is wide and deep.

Both the littoral zone and the riparian zone were weak points in Lake Angelus' habitat. To improve the littoral zone, leave woody debris in place and allow native aquatic vegetation to grow in the shallow waters. To improve the riparian zone score, reduce the amount of mowed grass and increase the amount of unmowed vegetation along the lakeshore.



COOPERATIVE LAKES MONITORING PROGRAM
SUMMER MEAN TRANSPARENCY

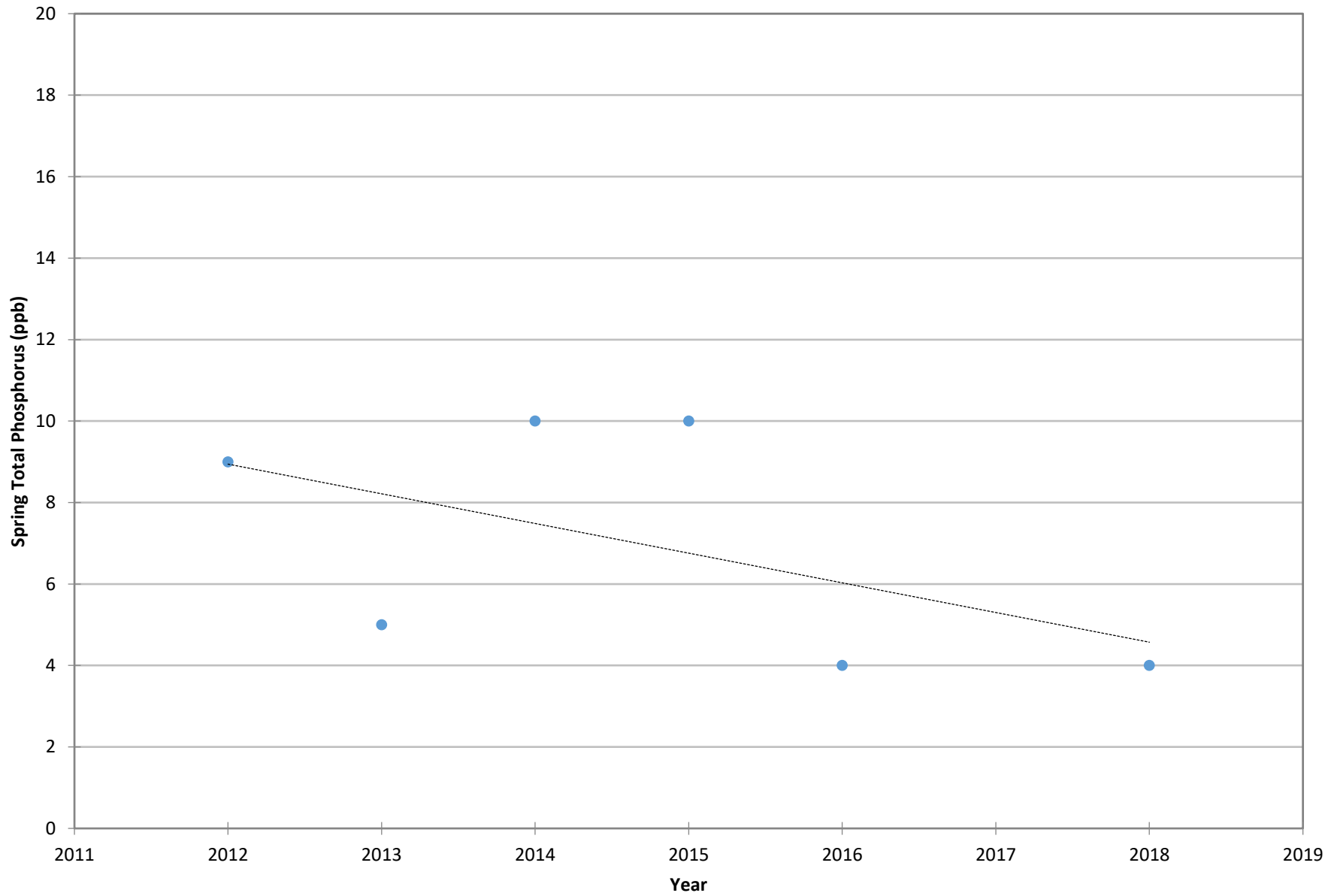
Lake Angelus (Oakland Co.), 631227



Vertical bars indicate standard deviation

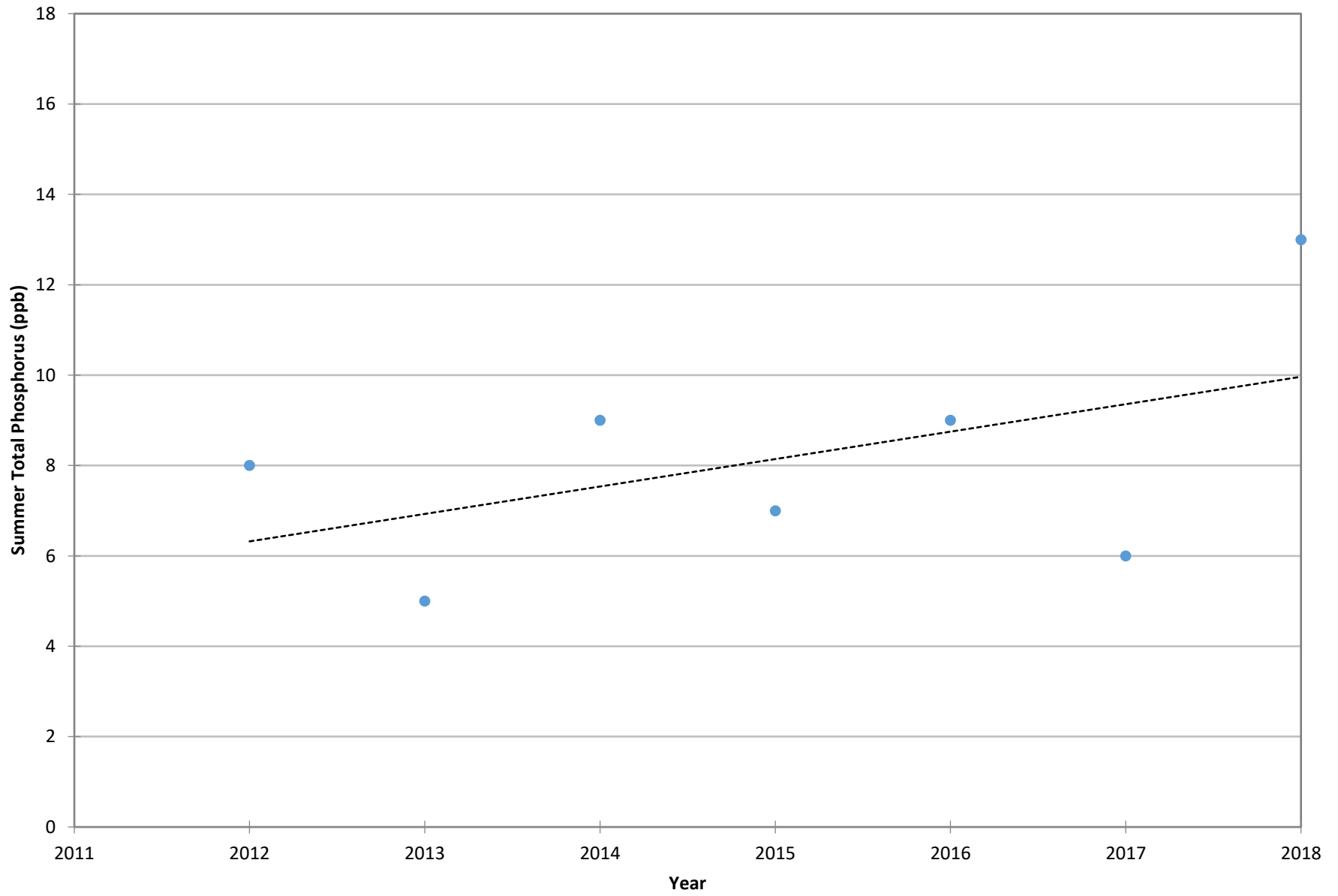
COOPERATIVE LAKES MONITORING PROGRAM
SPRING TOTAL PHOSPHORUS

Lake Angelus (Oakland Co.), 631227



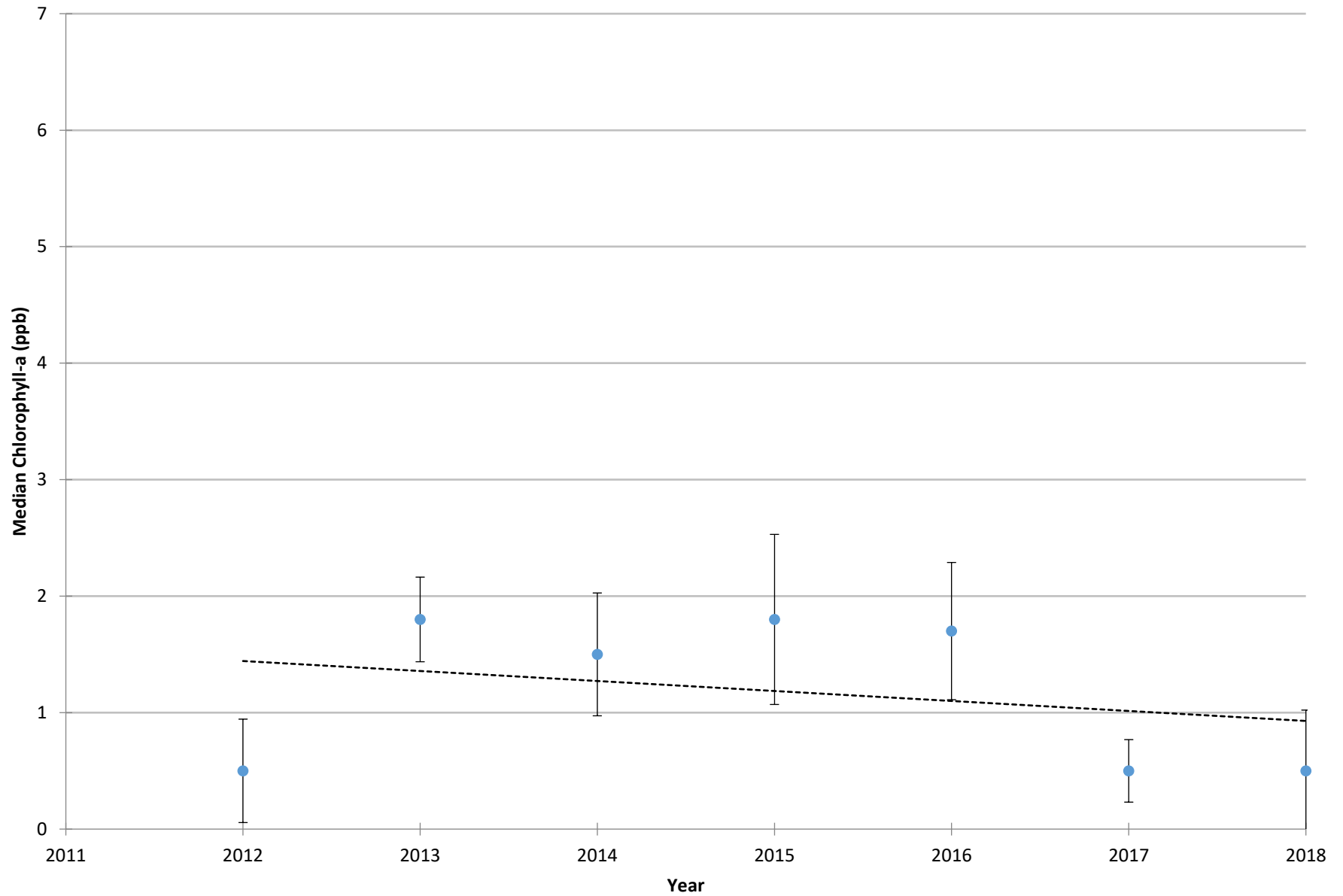
COOPERATIVE LAKES MONITORING PROGRAM
SUMMER TOTAL PHOSPHORUS

Lake Angelus (Oakland Co.), 631227



COOPERATIVE LAKES MONITORING PROGRAM
SUMMER MEDIAN CHLOROPHYLL-A

Lake Angelus (Oakland Co.), 631227



Vertical bars indicate standard deviation

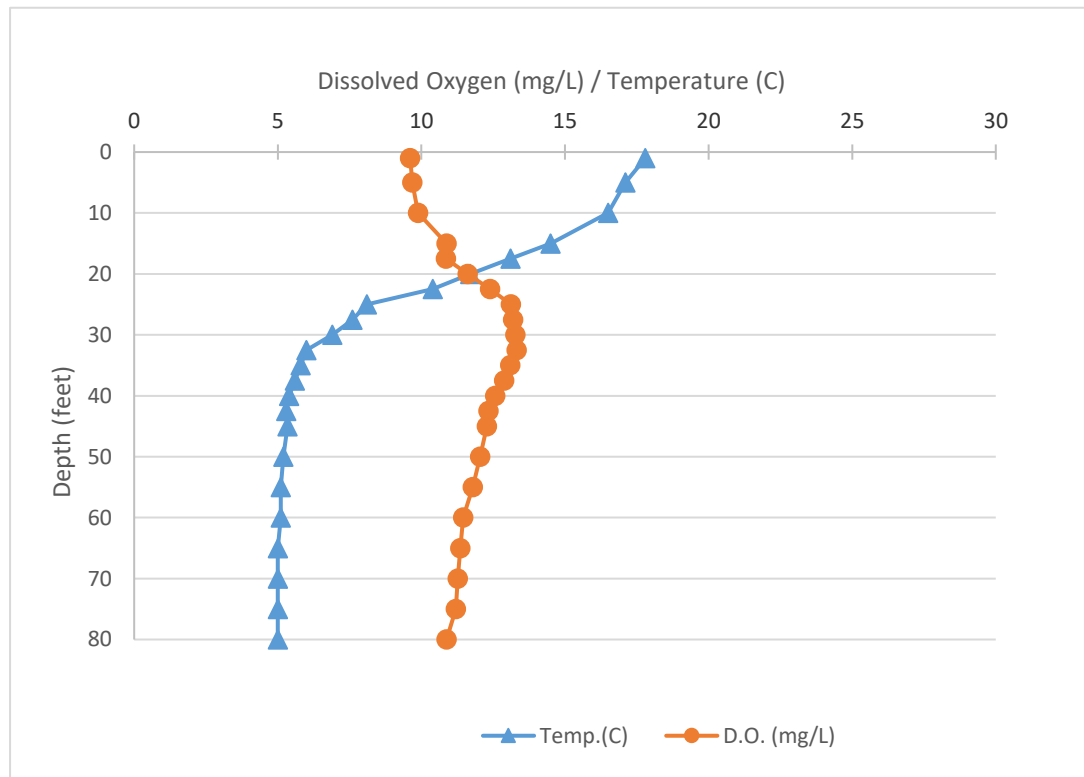
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 5/16/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	17.8	9.61
5	17.1	9.68
10	16.5	9.88
15	14.5	10.88
17.5	13.1	10.85
20	11.7	11.61
22.5	10.4	12.39
25	8.1	13.12
27.5	7.6	13.19
30	6.9	13.27
32.5	6	13.32
35	5.8	13.09
37.5	5.6	12.88
40	5.4	12.57
42.5	5.3	12.34
45	5.34	12.28
50	5.2	12.05
55	5.1	11.79
60	5.1	11.46
65	5	11.36
70	5	11.27
75	5	11.2
80	5	10.88

Lake: Lake Angelus (Oakland Co.)

5/16/2018



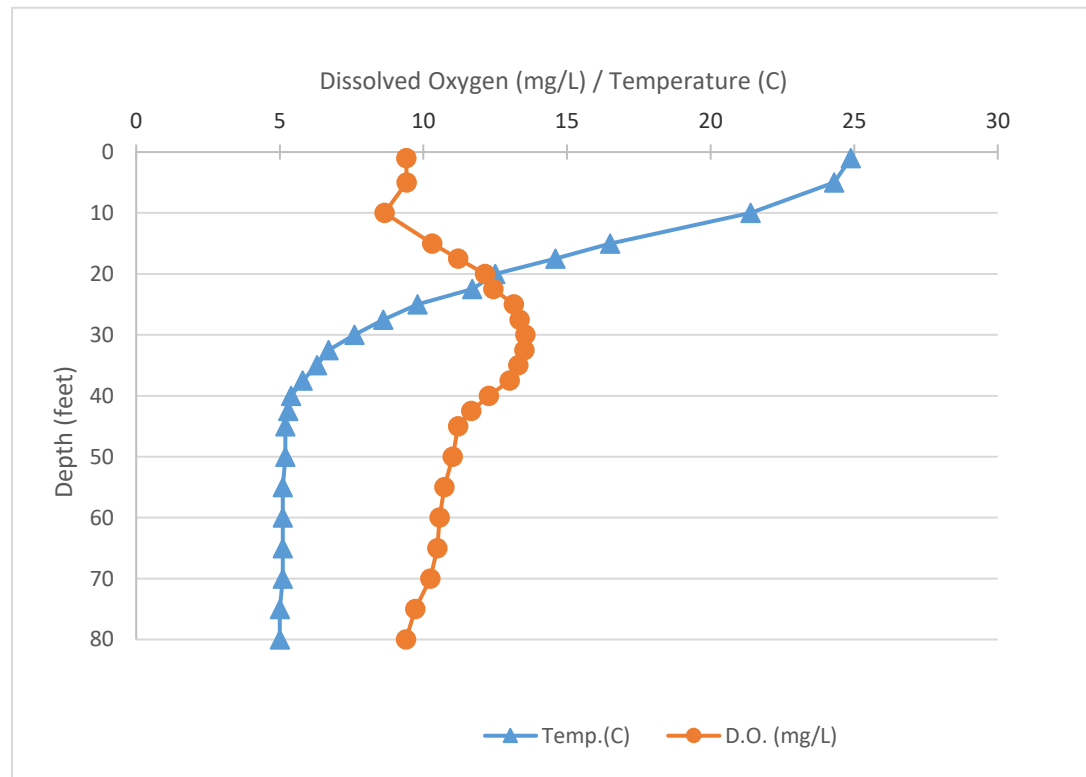
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 5/29/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	24.88	9.41
5	24.3	9.42
10	21.4	8.65
15	16.5	10.31
17.5	14.6	11.21
20	12.5	12.15
22.5	11.7	12.44
25	9.8	13.15
27.5	8.6	13.35
30	7.6	13.55
32.5	6.7	13.52
35	6.3	13.31
37.5	5.8	13
40	5.4	12.28
42.5	5.3	11.67
45	5.2	11.21
50	5.2	11.02
55	5.1	10.73
60	5.1	10.57
65	5.1	10.49
70	5.1	10.24
75	5	9.72
80	5	9.39

Lake: Lake Angelus (Oakland Co.)

5/29/2018



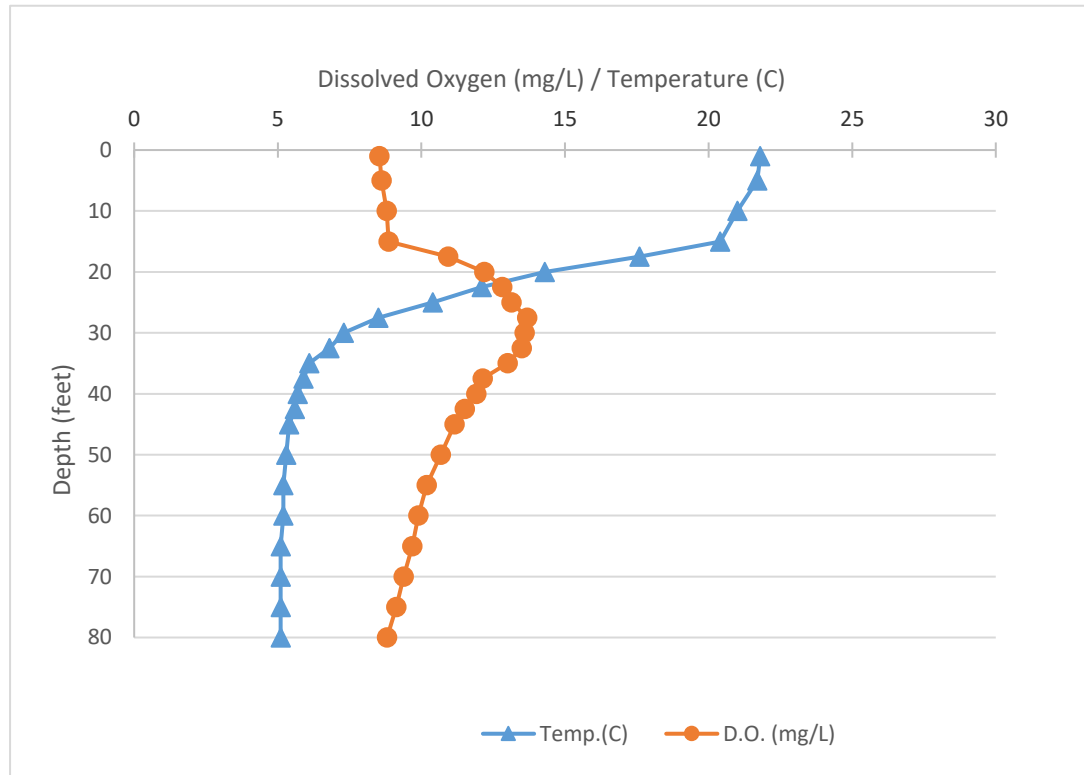
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 6/13/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	21.8	8.54
5	21.7	8.62
10	21	8.79
15	20.4	8.86
17.5	17.6	10.93
20	14.3	12.19
22.5	12.1	12.82
25	10.4	13.14
27.5	8.5	13.69
30	7.3	13.59
32.5	6.8	13.5
35	6.1	13.01
37.5	5.9	12.14
40	5.7	11.91
42.5	5.6	11.51
45	5.4	11.15
50	5.3	10.68
55	5.2	10.19
60	5.2	9.9
65	5.1	9.68
70	5.1	9.38
75	5.1	9.13
80	5.1	8.81

Lake: Lake Angelus (Oakland Co.)

6/13/2018



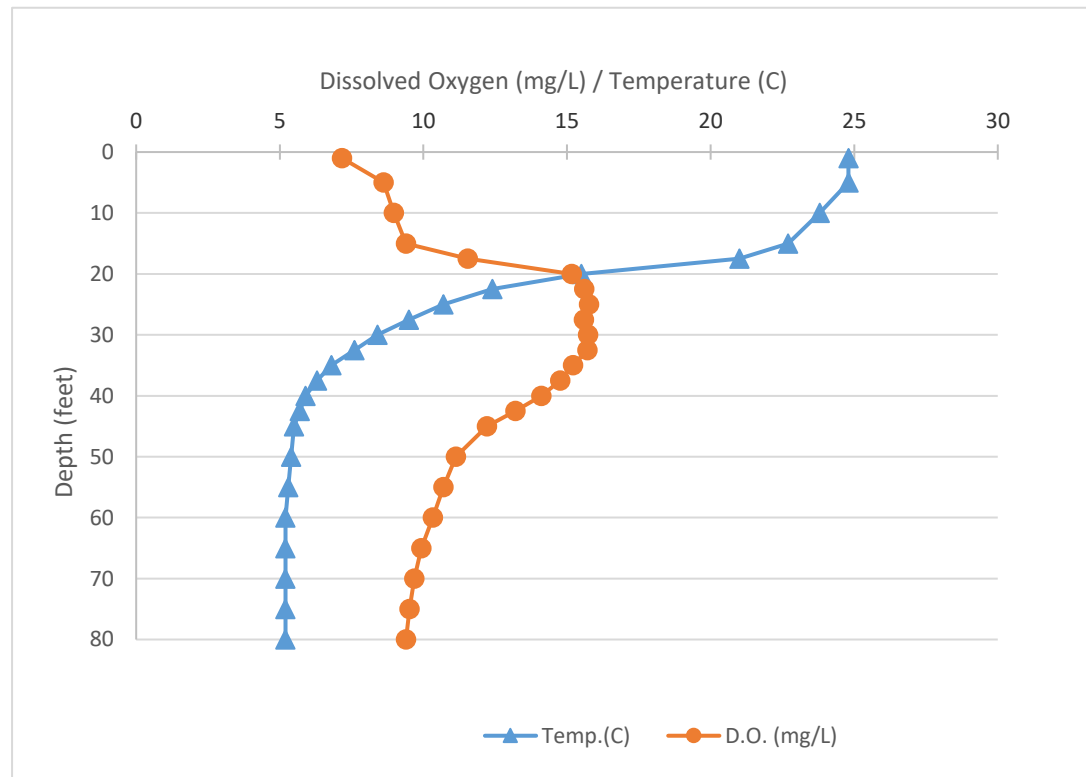
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 6/29/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	24.8	7.17
5	24.8	8.62
10	23.8	8.97
15	22.7	9.39
17.5	21	11.55
20	15.5	15.17
22.5	12.4	15.6
25	10.7	15.77
27.5	9.5	15.59
30	8.4	15.74
32.5	7.6	15.71
35	6.8	15.21
37.5	6.3	14.76
40	5.9	14.11
42.5	5.7	13.2
45	5.5	12.21
50	5.4	11.13
55	5.3	10.7
60	5.2	10.33
65	5.2	9.93
70	5.2	9.68
75	5.2	9.52
80	5.2	9.39

Lake: Lake Angelus (Oakland Co.)

6/29/2018



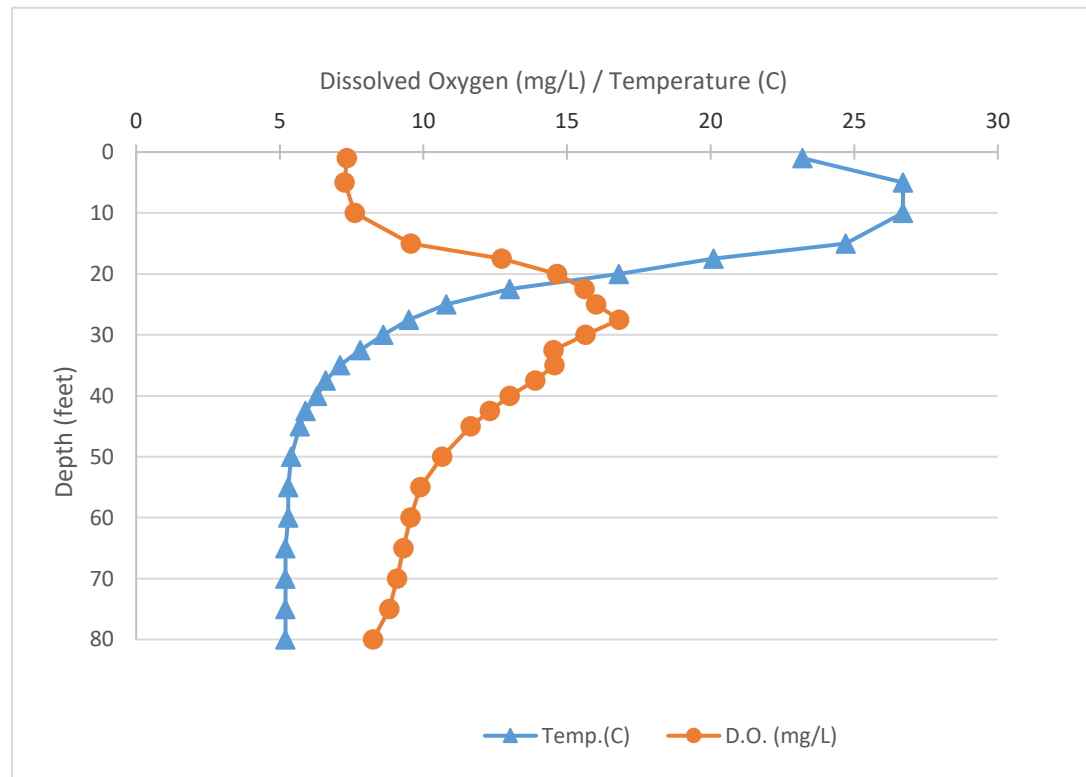
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 7/10/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	23.2	7.33
5	26.7	7.26
10	26.7	7.61
15	24.7	9.56
17.5	20.1	12.73
20	16.8	14.65
22.5	13	15.61
25	10.8	16.01
27.5	9.5	16.82
30	8.6	15.65
32.5	7.8	14.53
35	7.1	14.56
37.5	6.6	13.9
40	6.3	13.01
42.5	5.9	12.31
45	5.7	11.65
50	5.4	10.65
55	5.3	9.9
60	5.3	9.55
65	5.2	9.31
70	5.2	9.08
75	5.2	8.82
80	5.2	8.25

Lake: Lake Angelus (Oakland Co.)

7/10/2018



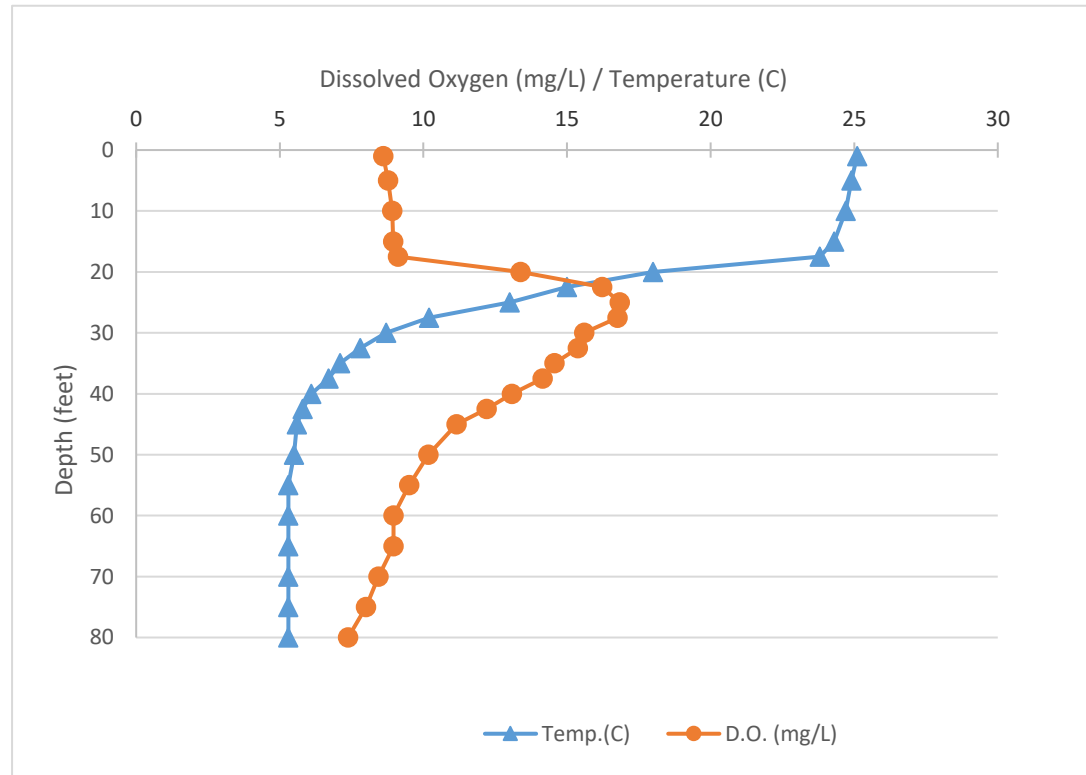
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 7/24/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	25.1	8.6
5	24.9	8.77
10	24.7	8.92
15	24.3	8.95
17.5	23.8	9.12
20	18	13.38
22.5	15	16.23
25	13	16.84
27.5	10.2	16.76
30	8.7	15.6
32.5	7.8	15.38
35	7.1	14.57
37.5	6.7	14.15
40	6.1	13.08
42.5	5.8	12.2
45	5.6	11.16
50	5.5	10.18
55	5.3	9.51
60	5.3	8.96
65	5.3	8.96
70	5.3	8.44
75	5.3	8
80	5.3	7.38

Lake: Lake Angelus (Oakland Co.)

7/24/2018



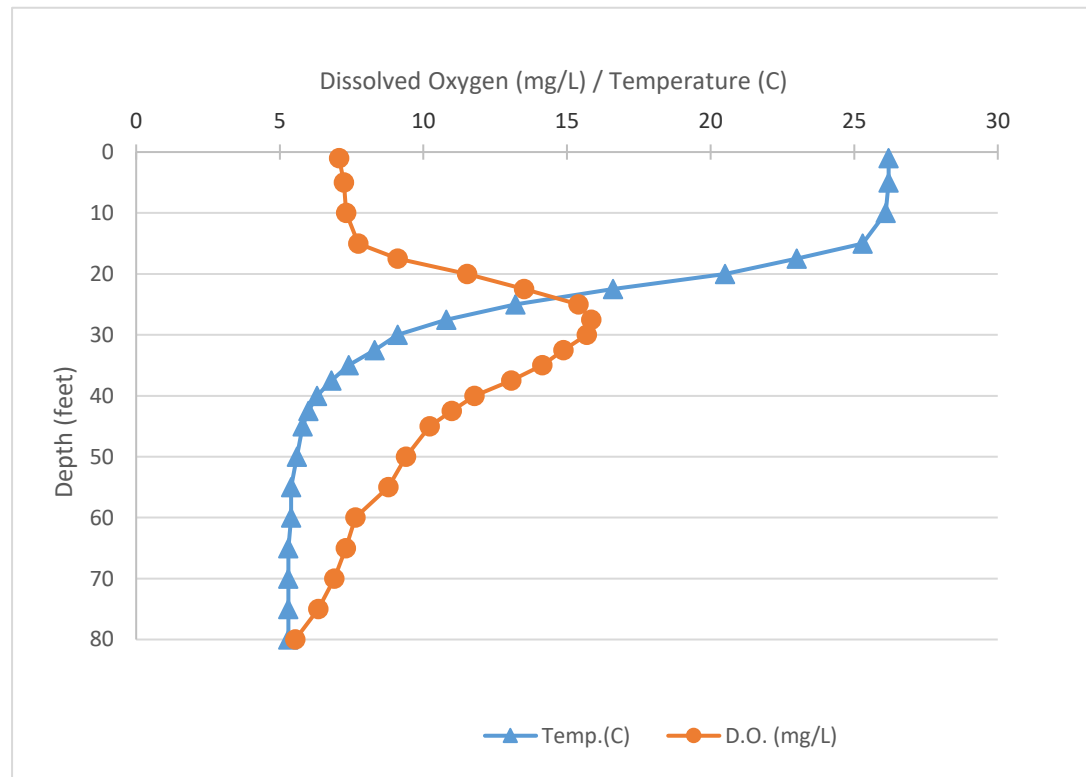
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 8/11/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	26.2	7.07
5	26.2	7.23
10	26.1	7.31
15	25.3	7.73
17.5	23	9.1
20	20.5	11.52
22.5	16.6	13.51
25	13.2	15.4
27.5	10.8	15.85
30	9.1	15.69
32.5	8.3	14.88
35	7.4	14.14
37.5	6.8	13.06
40	6.3	11.78
42.5	6	10.99
45	5.8	10.22
50	5.6	9.39
55	5.4	8.78
60	5.4	7.64
65	5.3	7.3
70	5.3	6.9
75	5.3	6.34
80	5.3	5.54

Lake: Lake Angelus (Oakland Co.)

8/11/2018



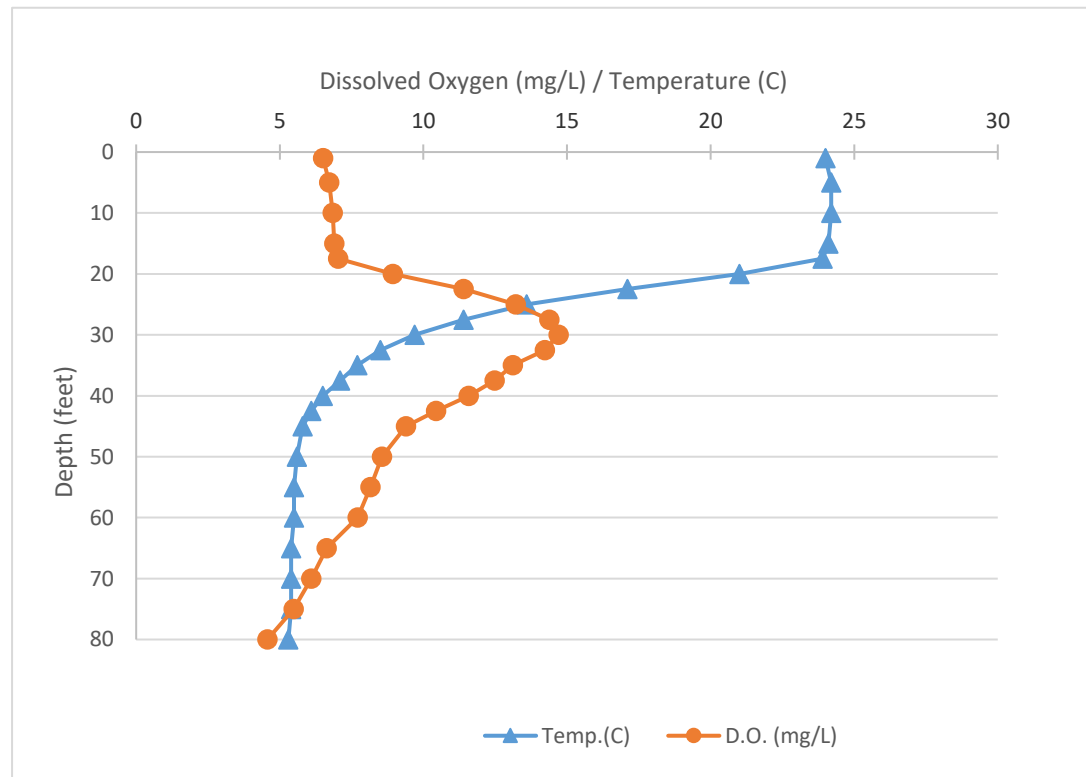
Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 8/23/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	24	6.51
5	24.2	6.72
10	24.2	6.84
15	24.1	6.9
17.5	23.9	7.03
20	21	8.94
22.5	17.1	11.4
25	13.6	13.22
27.5	11.4	14.39
30	9.7	14.71
32.5	8.5	14.23
35	7.7	13.12
37.5	7.1	12.48
40	6.5	11.58
42.5	6.1	10.44
45	5.8	9.39
50	5.6	8.56
55	5.5	8.16
60	5.5	7.71
65	5.4	6.63
70	5.4	6.1
75	5.4	5.48
80	5.3	4.57

Lake: Lake Angelus (Oakland Co.)

8/23/2018



Name: Lake Angelus
 County: Oakland
 Site ID: 631227
 Date: 9/4/2018

Dissolved Oxygen and Temperature Profile

Depth (ft)	Temp.(C)	D.O. (mg/L)
1	25.3	5.5
5	25.3	5.6
10	25.3	5.7
15	24.5	5.99
17.5	23.7	6.3
20	22.2	6.97
22.5	18.3	9.02
25	14.6	10.87
27.5	11.9	12.25
30	10	12.86
32.5	8.9	12.29
35	7.9	11.45
37.5	7.2	10.55
40	6.6	10.12
42.5	6.2	9
45	5.9	8.12
50	5.6	7.25
55	5.3	6.55
60	5.4	5.05
65	5.4	4.93
70	5.3	4.6
75	5.3	3.73
80	5.3	3

Lake: Lake Angelus (Oakland Co.)

9/4/2018

