Lake Monitoring in the Clearwater Watershed 2020

2020 Progress Report

Clearwater Resource Council

Seeley Lake, Montana

June 2021

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1. ACKNOWLEDGEMENTS

The summer of 2020 was the 12th full season of data collection. We could not accomplish programs like this without a team of dedicated volunteers.

We'd like to express our utmost appreciation and gratitude to our 2020 volunteers, who helped to make this program possible:

- Cathy and Jeff Harrits: Big Sky Lake
- Roger Marshall: Lake Alva
- Chris and Carol Hunter: Salmon Lake
- George Leighton: Salmon Lake
- Clyde and Sherry Sterling: Placid Lake
- Fred Fleming: Placid Lake
- Joann and David Wallenburn: Seeley Lake
- Jessica Kimmel: Seeley Lake
- Tom Dauenhauer: Lake Inez
- Jeff Holm: Lake Inez and Seeley Lake
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- Cathy Harrits: pre-season preparation and training guidance
- Bruce Rieman: continues to review the data, provide an experienced second pair of eyes, and contribute to the summary.

2. INTRODUCTION

Degradation of water quality associated with growing communities and increasing watershed development has been common across the country and around the world. Negative impacts on aquatic ecosystems can have a profound effect on the environmental, aesthetic, and economic benefits to surrounding communities. Water quality in the Clearwater chain of lakes is integral to all forms of life. These lakes, which dominate the local landscape, form the basis for both a healthy ecosystem and economy.

Since 2008, the Clearwater Resource Council (CRC) has facilitated efforts to enhance, conserve, sustain, and protect the aquatic resources of the Clearwater Valley for present and future generations. Citizen science monitoring can help CRC work with community members to build a foundational knowledge of the conditions of our lakes, how they function, and their vulnerability to change. In late summer of 2008, CRC initiated a community-based lake-monitoring program, which was continued and expanded in subsequent years. Major lakes in the Clearwater Basin have been sampled over the years from roughly June through September. 2020 was the 12th full season of sampling, and six lakes were monitored: Lake Alva, Big Sky Lake, Lake Inez, Placid Lake, Salmon Lake, and Seeley Lake (Figure 1). Clearwater and Rainy Lakes were included in previous years, but monitoring on these two lakes was discontinued after 2019.

Two primary measures used to determine lake health are Secchi transparency and surface temperature. These parameters have been measured the most consistently in the past decade on the major lakes in the basin. Secchi transparency is a simple metric widely used in both community-based monitoring and higher-level scientific research. Because water transparency is directly influenced by the amount of phytoplankton (microscopic plants or algae in open water), it can be a good index of the amount of plant growth in the lake. Plant growth can be positive because it indicates productivity within the aquatic system. However, once such growth exceeds a certain threshold, it can be a sign of nutrient pollution and precede eutrophic conditions.

Temperature is an important parameter to study in correspondence with Secchi transparency because dramatic changes in temperature can affect plant growth, thus affecting other aspects of aquatic health. In addition, many native fish like the threatened bull trout rely on consistently cold water to survive. Water temperature fluctuations, whether due to anthropogenic or natural reasons, can lead to declines in native fish populations. Temperature is also correlated with oxygen levels in aquatic systems, as cold water holds more oxygen than warm water. Identifying temperature trends can help predict or prepare for other changes within the lake systems in the Clearwater Watershed.

Although Secchi transparency can be a good measure of overall primary productivity in a lake, it is limited in the scope of what it can tell us. Additionally, when observation conditions (cloud cover, time of day, person observing, etc.) are not held constant, measurements can be variable and inconsistent, making it difficult to derive quantitatively sound trends from the data. Although protocols were used to control these factors to an extent, citizen science monitoring is never perfect. To fill in the knowledge gaps about the conditions of our lakes, we returned to dissolved oxygen and temperature profiling (as has been done previously on Seeley and Salmon lakes).

Simply stated, dissolved oxygen (DO) refers to the amount of oxygen that is present in water. DO is an important measure of the health of an aquatic system, as all aquatic animals require DO to survive. Water bodies receive oxygen from two main sources: the atmosphere (through aeration or rapid movement) and aquatic plants or algae (through photosynthesis).

Dissolved oxygen profiles have been recorded consistently on Salmon and Seeley lakes in previous years, which has provided valuable baseline knowledge regarding the oxygen conditions and trends of those two lakes. For a full discussion and analysis of these historical data, visit crcmt.org/adoptalake-program. Dissolved oxygen profiles have not been recorded consistently on any of the other lakes in the watershed in recent years. Oxygen is a key component to the functioning of lakes and their ability to support diverse aquatic life, and a solid foundational knowledge of oxygen levels is important to be able to understand the condition and health of our lakes.

Different types of aquatic organisms require different levels of oxygen, depending on how large or complex the animal is and where it lives in the water column. Benthic or bottom-dwelling creatures are often more adapted to lower oxygen levels, while larger fish require a higher amount of oxygen. For example, the invasive Northern Pike cannot survive in less than approximately 6 mg/L of oxygen. Salmonids, which include bull trout, brook trout, and kokanee salmon (among other species), have varying optimal oxygen levels throughout their life stages, ranging from 7 to 15 mg/L.

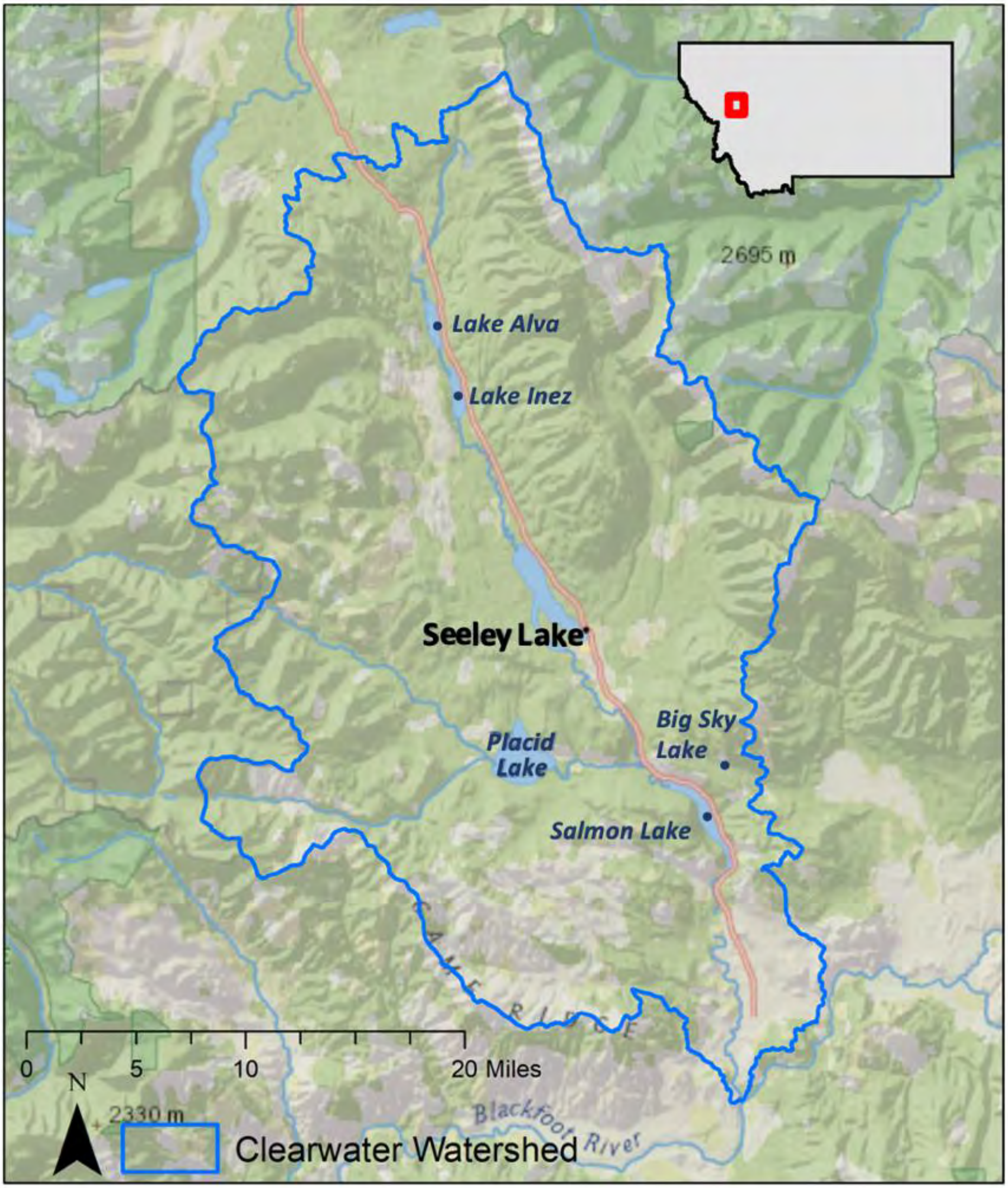

Figure 1. The Clearwater Watershed, encompassing a succession of lakes, which from north to south include Alva, Inez, Seeley, Placid, Big Sky, and Salmon Lake.

Low levels of oxygen (hypoxia) or no oxygen (anoxia) can occur when excess organic materials, such as large algal blooms, are decomposed by microorganisms. During this decomposition process, DO in the water is consumed. Low oxygen levels often occur at the bottom of the water column and affect organisms that live in the sediments. In some water bodies, DO levels fluctuate periodically, seasonally, and even as part of the natural daily ecology of the aquatic system. As DO levels drop, some sensitive animals may relocate, decline in health, or even die.

Under some conditions associated with low oxygen near the lake bottom, stored nutrients can be released, making the lake a source of nutrients for itself and other lakes downstream. This change in conditions has been called a "tipping point" and is associated with eutrophication, a condition where an excess of nutrients can cause a dense growth of plant life and death of animal life from lack of oxygen. It can be extremely difficult to reverse these conditions once they occur.

Natural factors can influence the amount of dissolved oxygen in a lake, including but not limited to:

- aquatic organisms (animals living in the water use up DO);
- aquatic vegetation (vegetation and algae directly release oxygen into the water through photosynthesis); and
- temperature (cold water holds more DO than warm water).

On the other hand, human activities can cause excess organic matter to enter the water, which can influence oxygen levels. Whether through agricultural practices, sewage effluent, or clearing land (e.g. logging or construction), when excess nutrients enter a body of water, an overgrowth of algae and plant life can occur. Once these organisms die, this organic matter is decomposed by microorganisms, which deplete oxygen levels as they respire. In extreme cases, human influence can cause algae blooms and anoxic conditions, which can kill lake life. In 2020, potentially toxic algae blooms were confirmed in both Salmon and Placid Lakes. Learning more about our lakes and how they function is crucial in being able to take the next steps towards environmental protection in the Clearwater Watershed.

3. Methods

Lake monitoring was conducted at the deepest spots on six lakes in the Clearwater Watershed: Lake Alva, Big Sky Lake, Lake Inez, Placid Lake, Salmon Lake, and Seeley Lake (Appendix A, Figure 1). Dissolved oxygen and temperature profiles were recorded monthly from July through September. Surface temperature and Secchi transparency were recorded more often, from roughly June through September; however, monitoring frequencies varied on each lake depending on volunteer availability.

3.1 Secchi Transparency and Surface Temperature

The methods used to measure transparency and surface temperature in 2020 were the same as those outlined in previous reports (e.g., Rieman et al., 2014) and included volunteer training at the beginning of the season. The methods are detailed further in a sampling and analysis plan (available from CRC) but in summary, the approach is as follows: transparencies were measured with a 20 cm black and white quadrant Secchi disk suspended on a fiberglass tape measure. The disk was lowered into the water until it disappeared from view. This was performed twice, and the two readings were averaged. The following measures were followed in an attempt to control some of the limiting factors associated with Secchi readings: data were recorded between 11 am and 3 pm, without sunglasses, on the shady side of the boat, two times at each site.

The surface temperature was measured with a mercury thermometer attached to a floating bottle so that it read the temperature approximately 18 inches below the lake's surface. Once the floating thermometer was placed in the water, it was left submerged for a few minutes until the temperature stabilized. After stabilization, volunteers recorded the temperature in degrees centigrade.

3.2 Dissolved Oxygen and Temperature Profiles

A YSI Pro20 dissolved oxygen meter with a polarographic sensor was used to collect the dissolved oxygen and temperature profiles on each lake. The profiles were taken once a month from July through September. The instrument provides measurements of DO in mg/L and % saturation, along with temperature in degrees centigrade. Prior to each set of measurements at each lake, the instrument was calibrated using a self-calibration capability designed into the instrument. Measurements were then taken at the surface and through the water column at each site.

4. Figures

4.1 Secchi Transparency and Surface Temperature

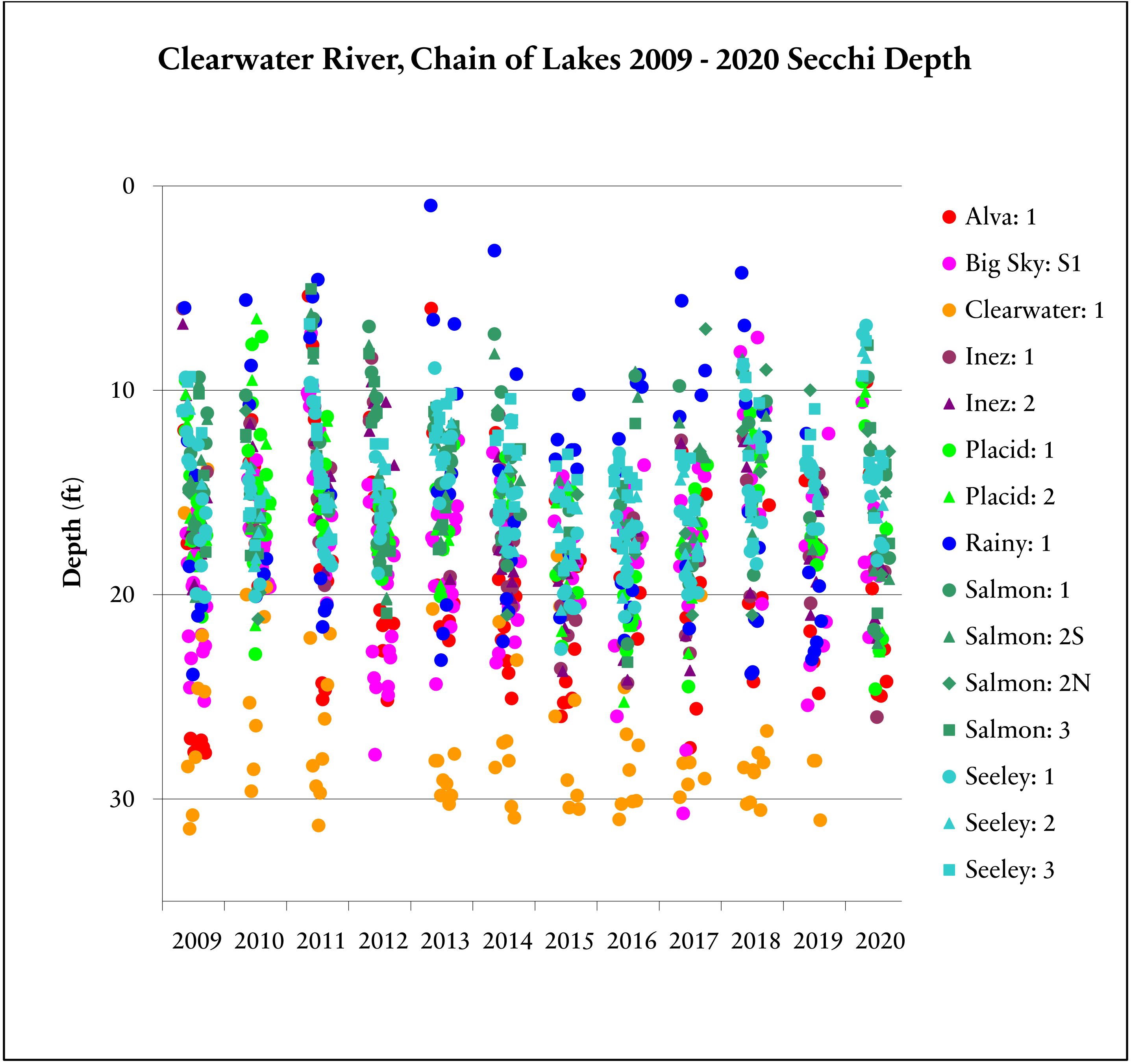

Figure 2. Secchi transparencies (depths) recorded at one or more sites in eight lakes in the Clearwater Watershed, 2009 through 2020. Note that as of 2020, Clearwater and Rainy Lakes were omitted from monitoring.

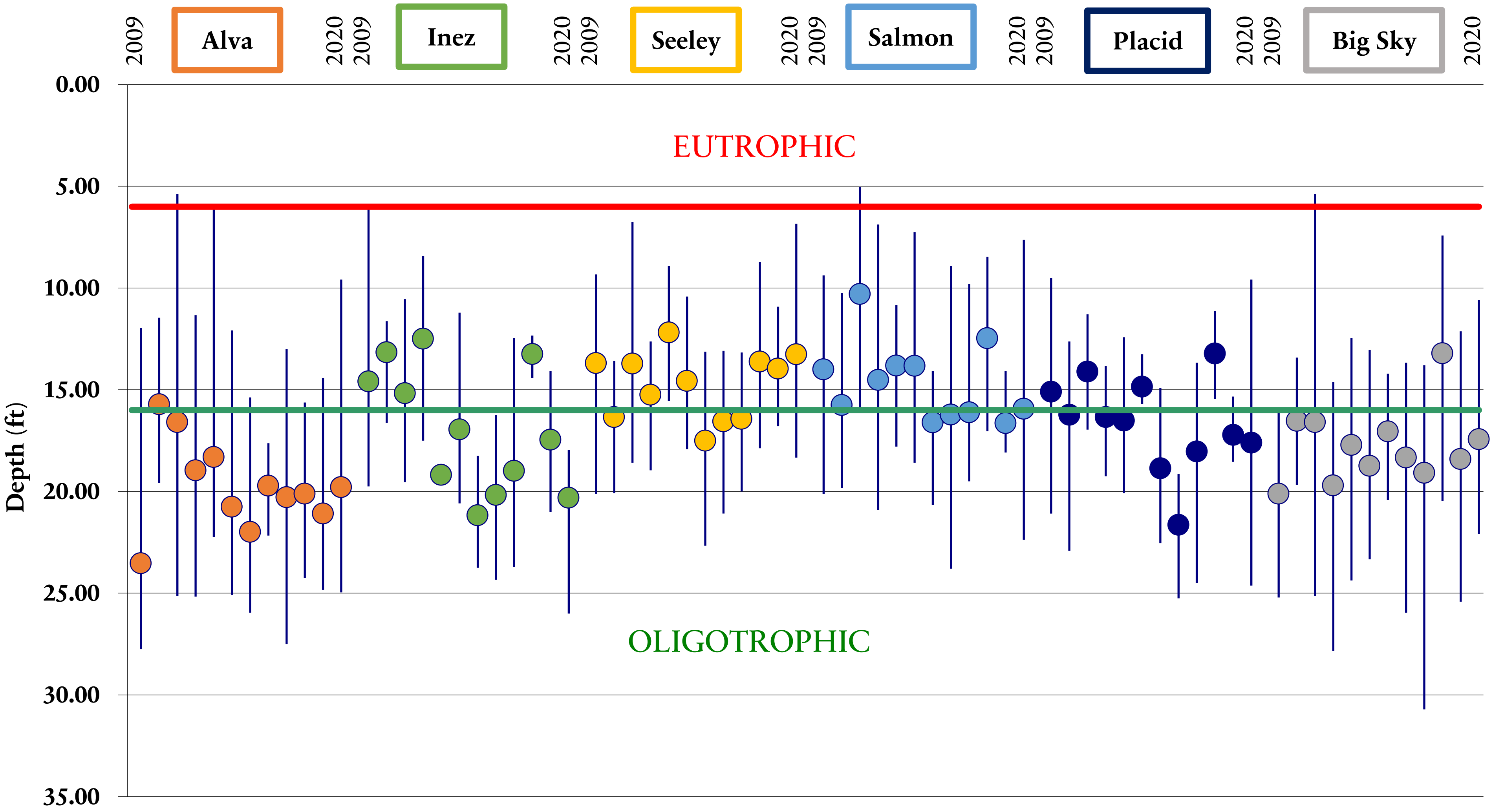

Figure 3. Continued mean (solid point) and range (vertical line) of Secchi transparencies recorded in six lakes in the Clearwater River Basin, 2009 through 2020. The red and green lines represent the bounds for transparencies considered indicative of eutrophic and oligotrophic conditions, respectively.

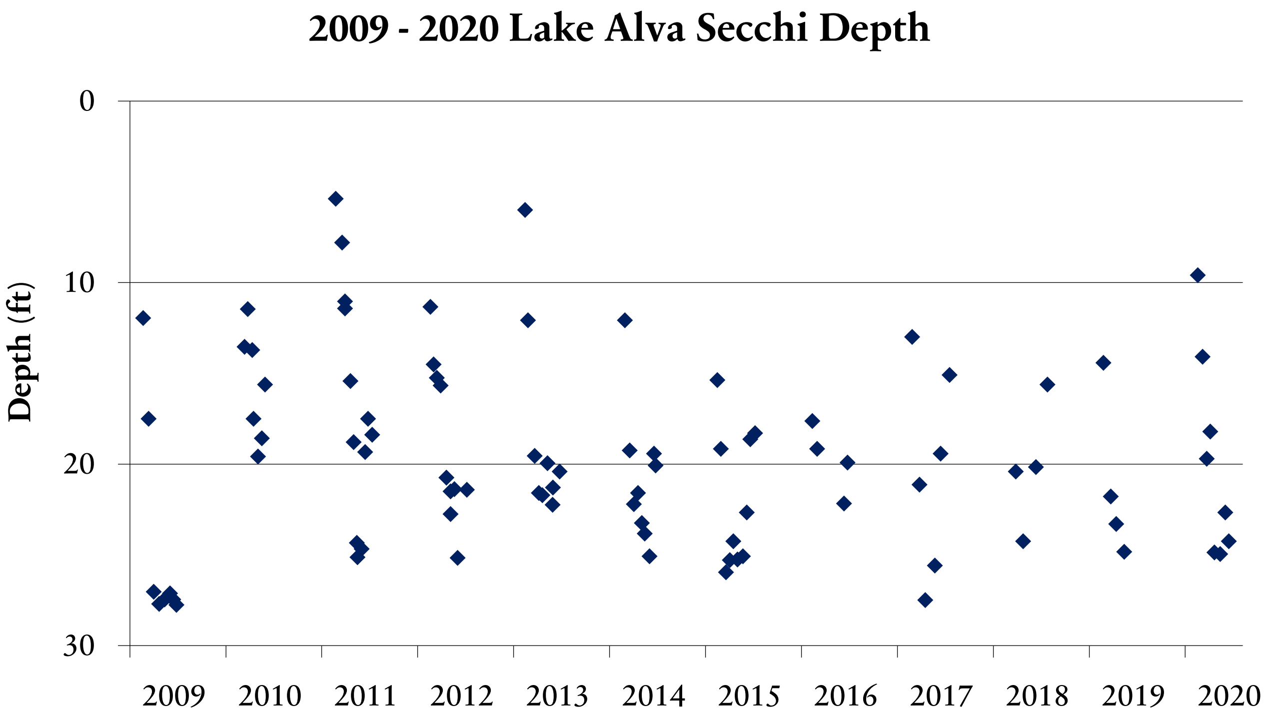

Figure 4. Secchi transparencies recorded at one site in Lake Alva, 2009 through 2020.

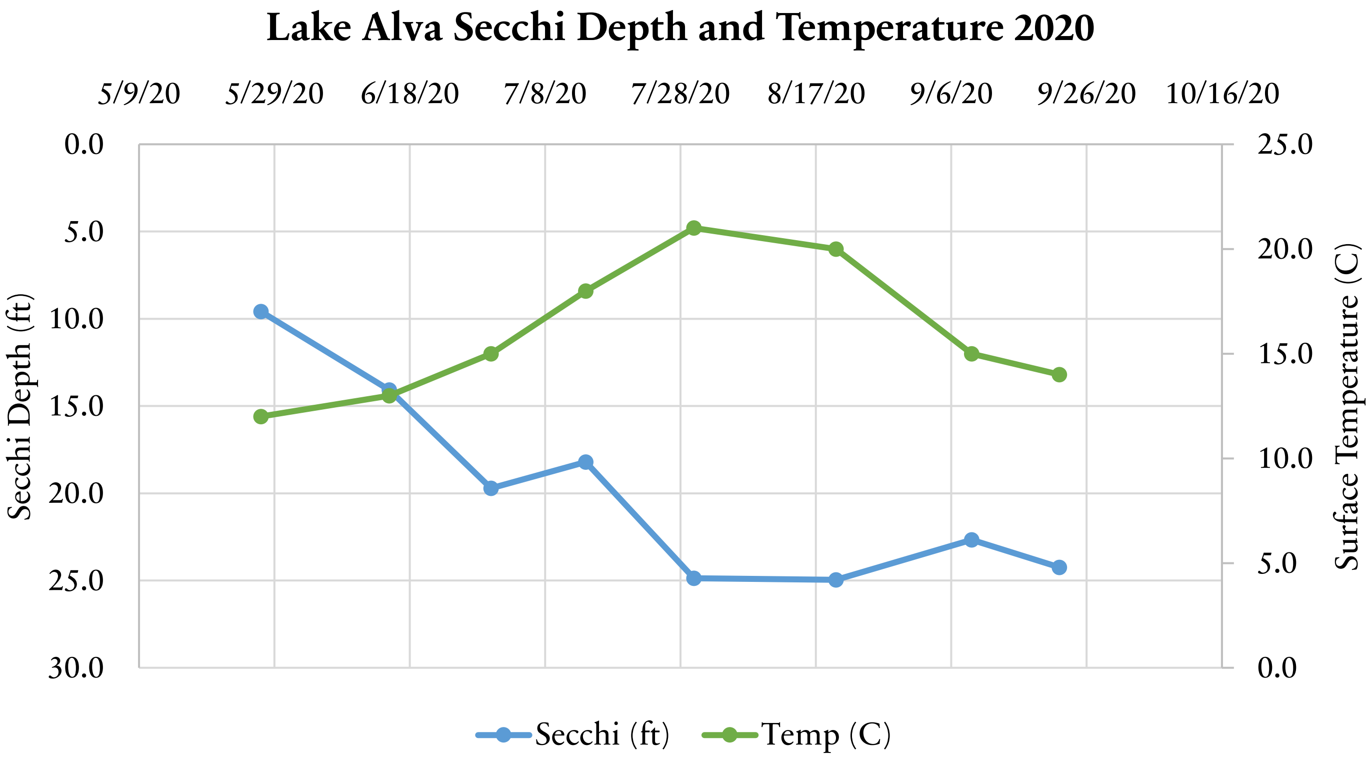

Figure 5. Secchi transparencies and surface temperature recorded at one site in Lake Alva in 2020. Note the two different Y axes.

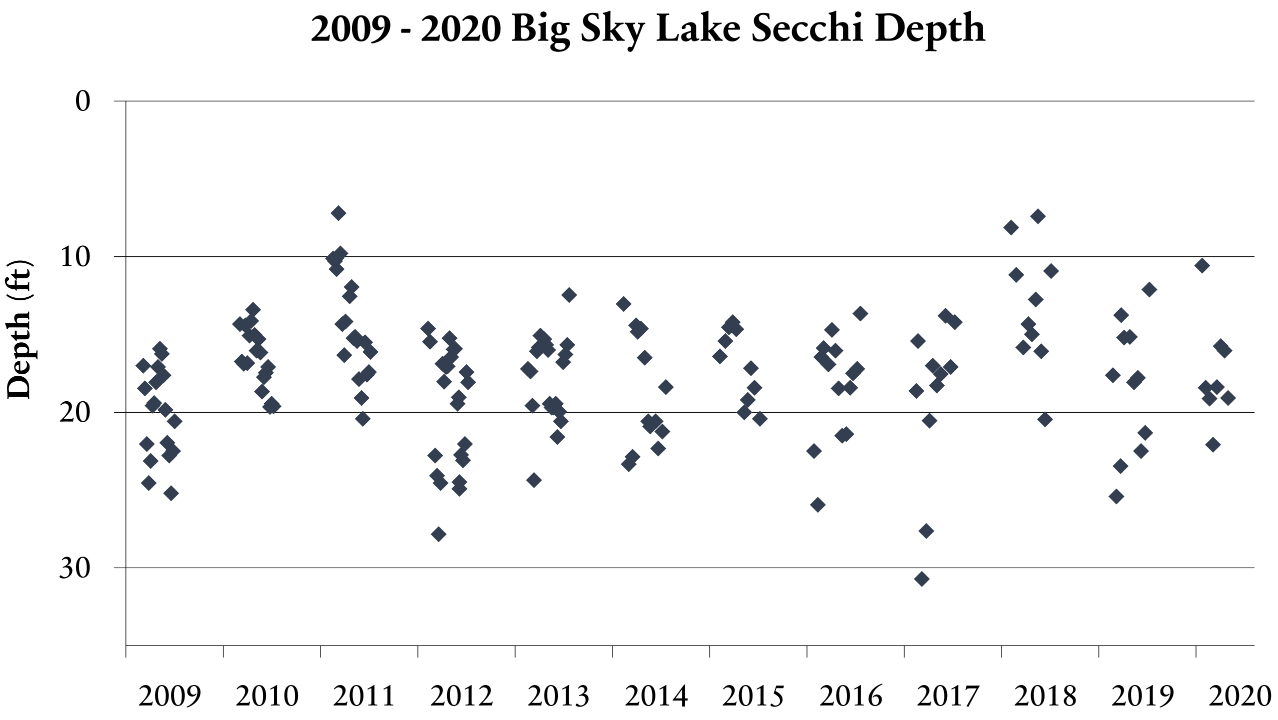

Figure 6. Secchi transparencies recorded at one site in Big Sky Lake, 2009 through 2020.

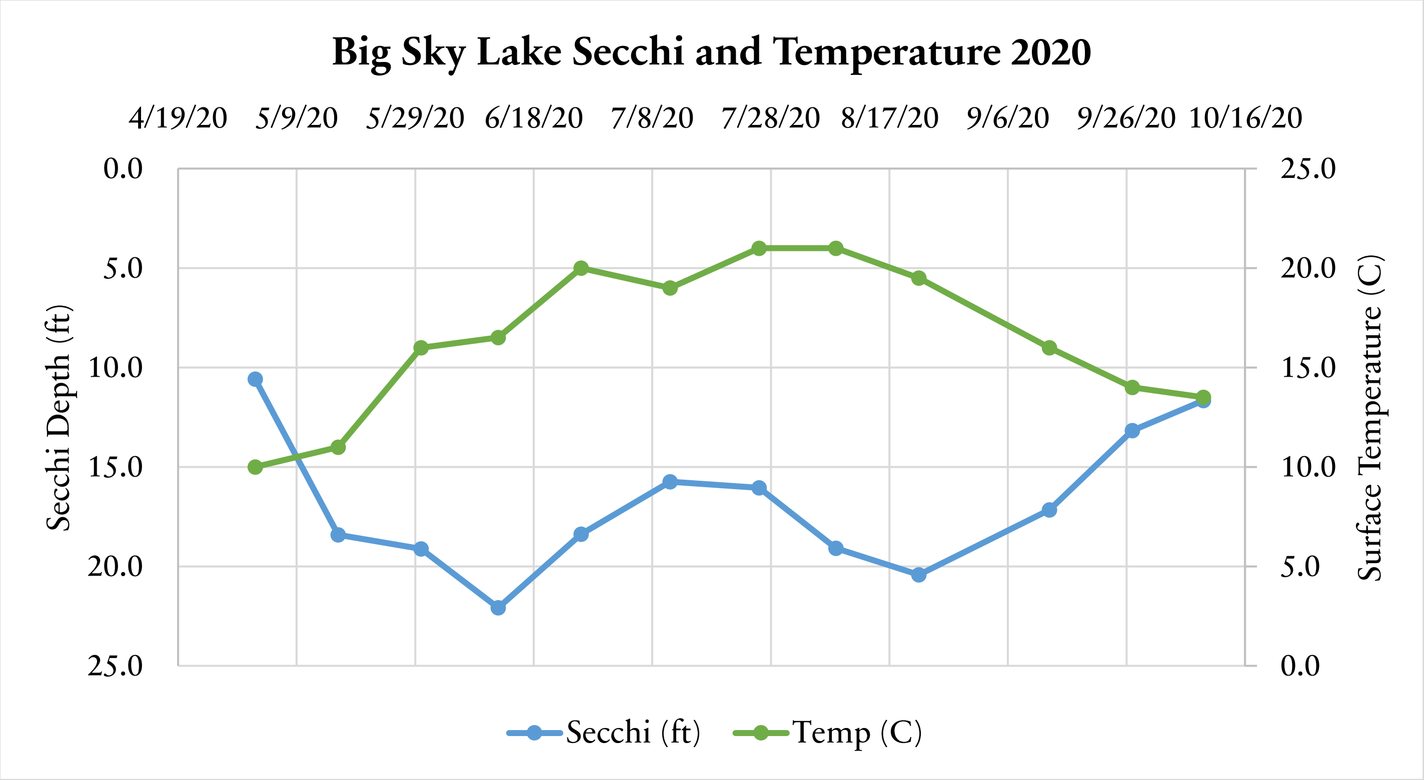

Figure 7. Secchi transparencies and temperature recorded at one site in Big Sky Lake in 2020. Note the two different Y axes.

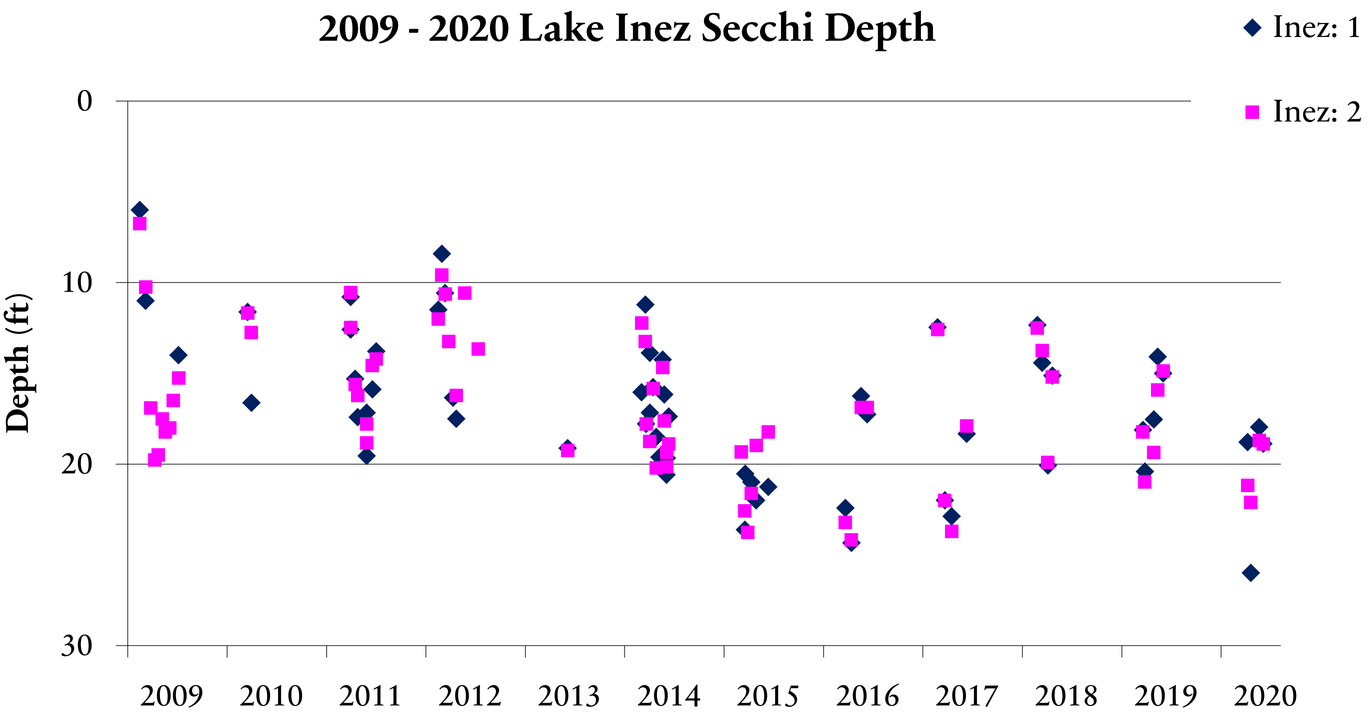

Figure 8. Secchi transparencies recorded at two sites in Lake Inez, 2009 through 2020.

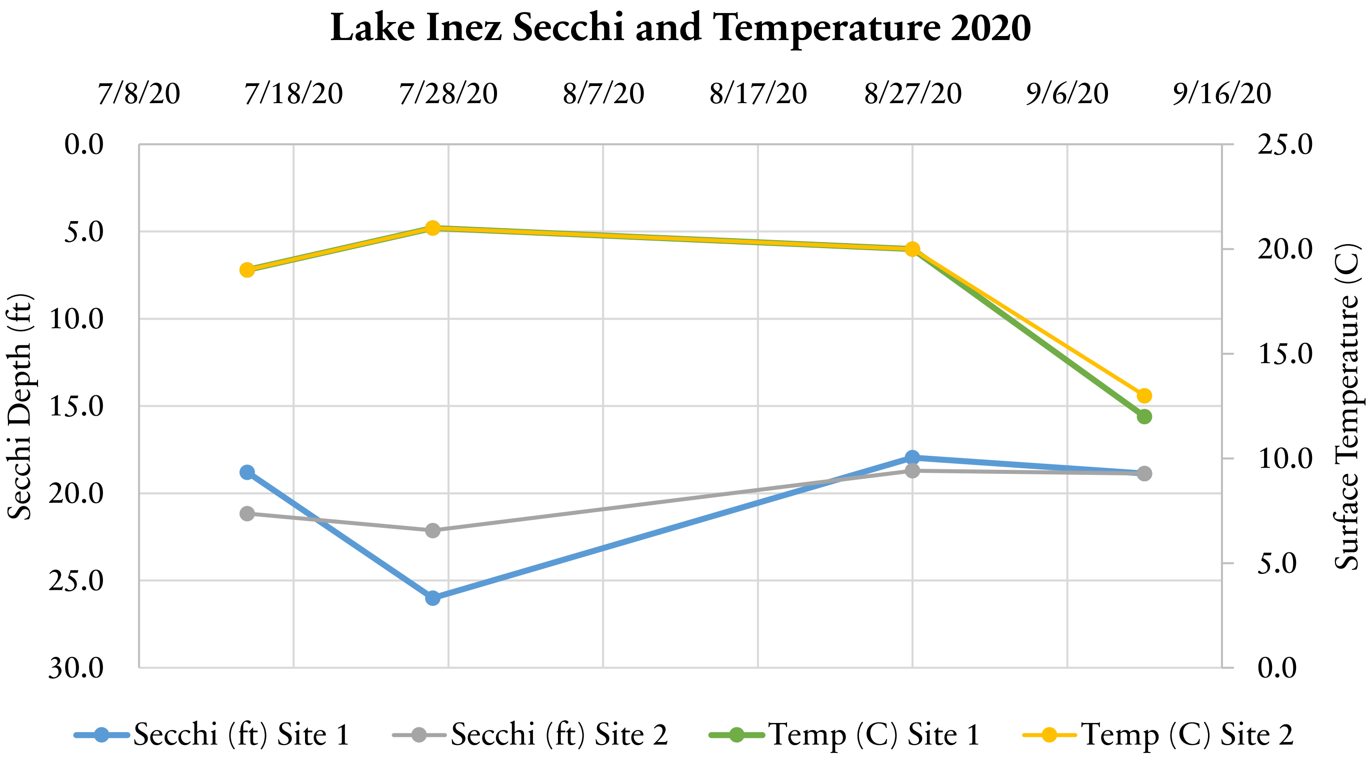

Figure 9. Secchi transparencies and temperature recorded at two sites in Lake Inez in 2020. Note the two different Y axes.

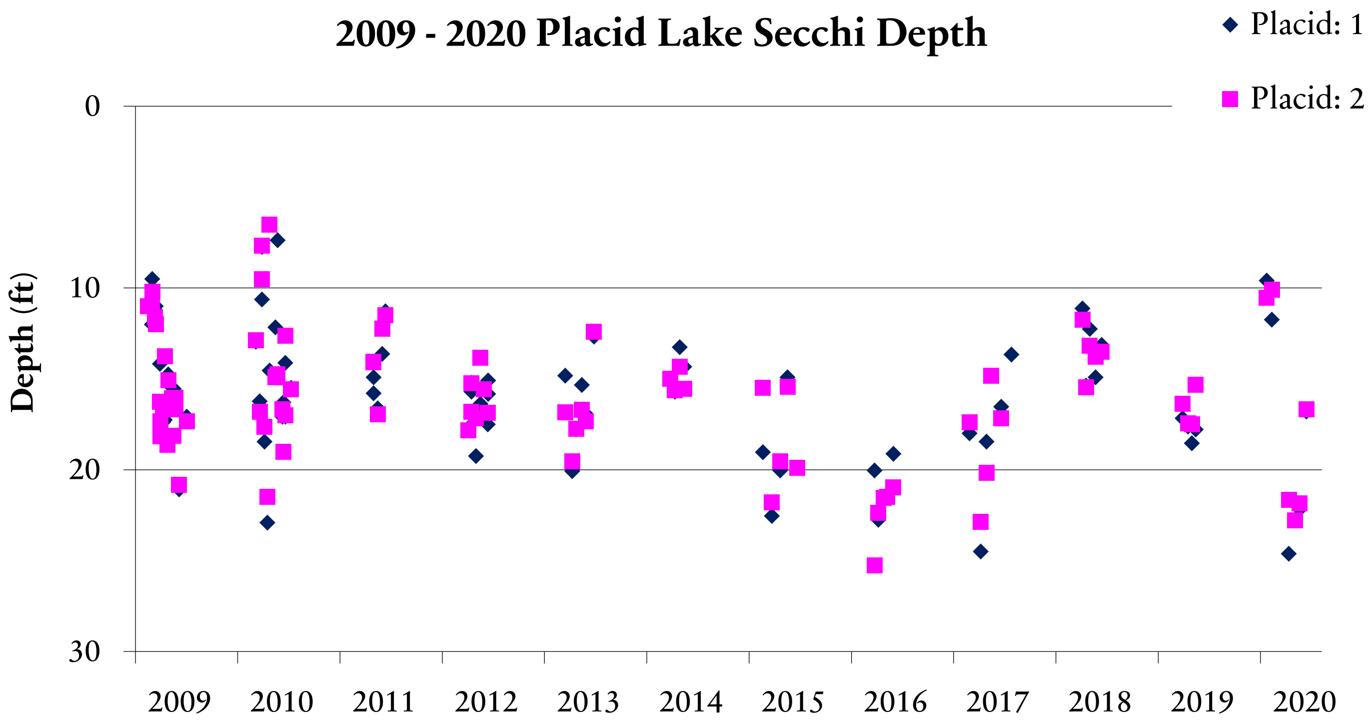

Figure 10. Secchi transparencies recorded at two sites in Placid Lake, 2009 through 2020.

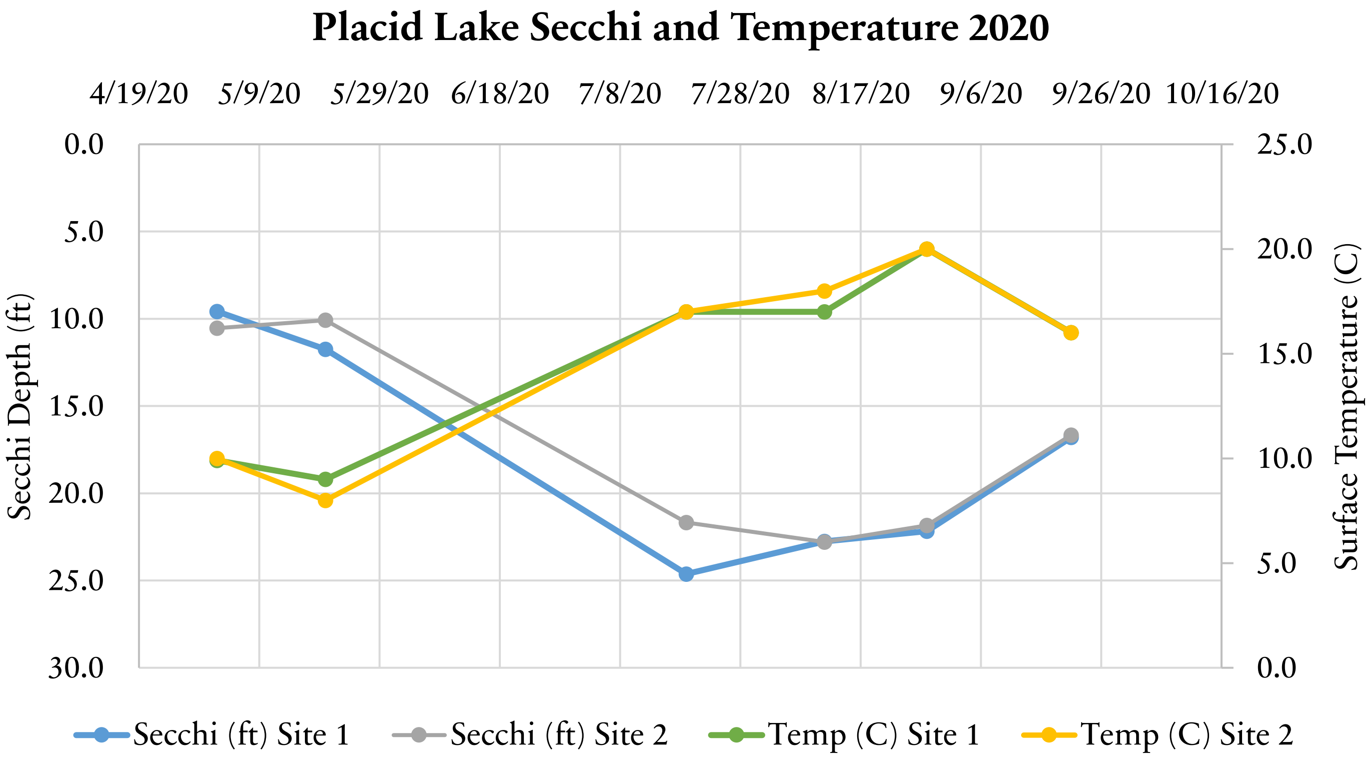

Figure 11. Secchi transparencies and temperature recorded at two sites in Placid Lake in 2020. Note the two different Y axes.

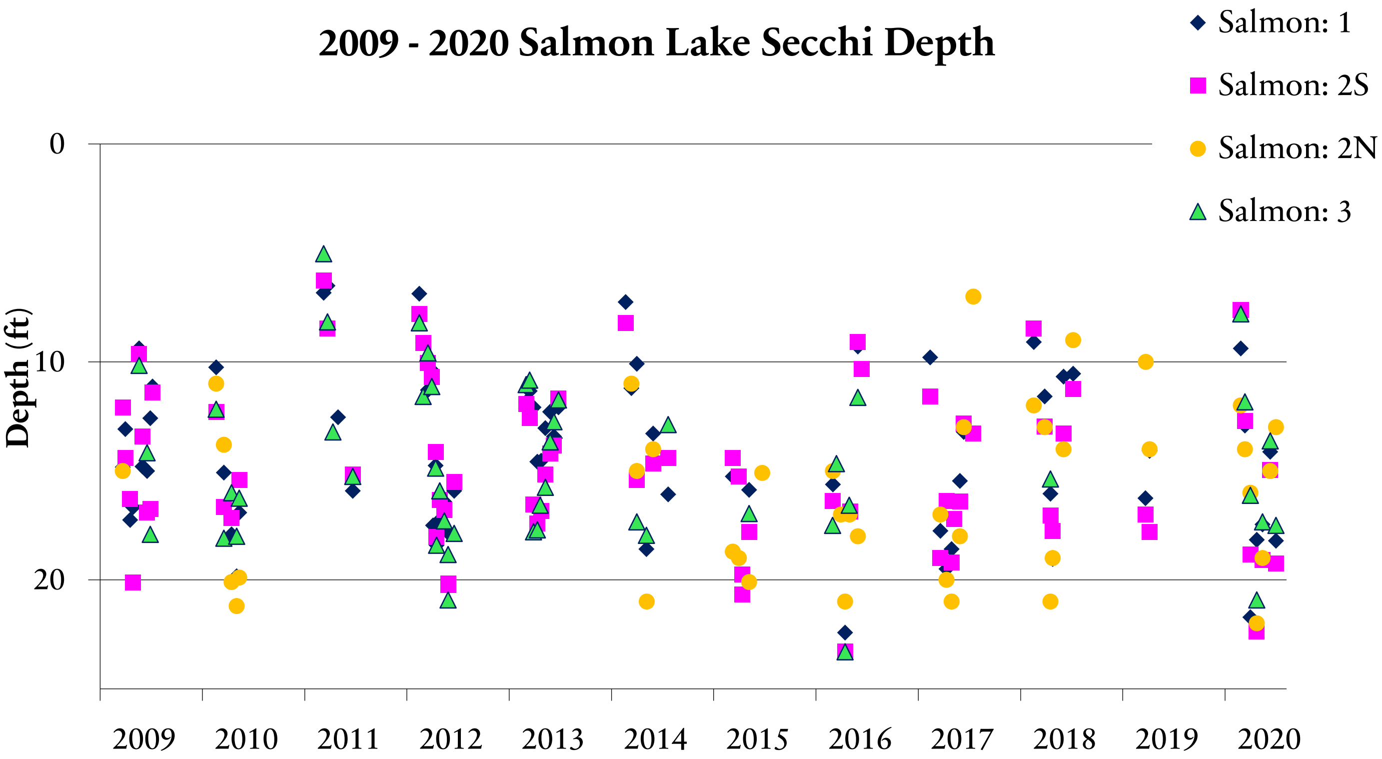

Figure 12. Secchi transparencies recorded at four sites in Salmon Lake, 2009 through 2020.

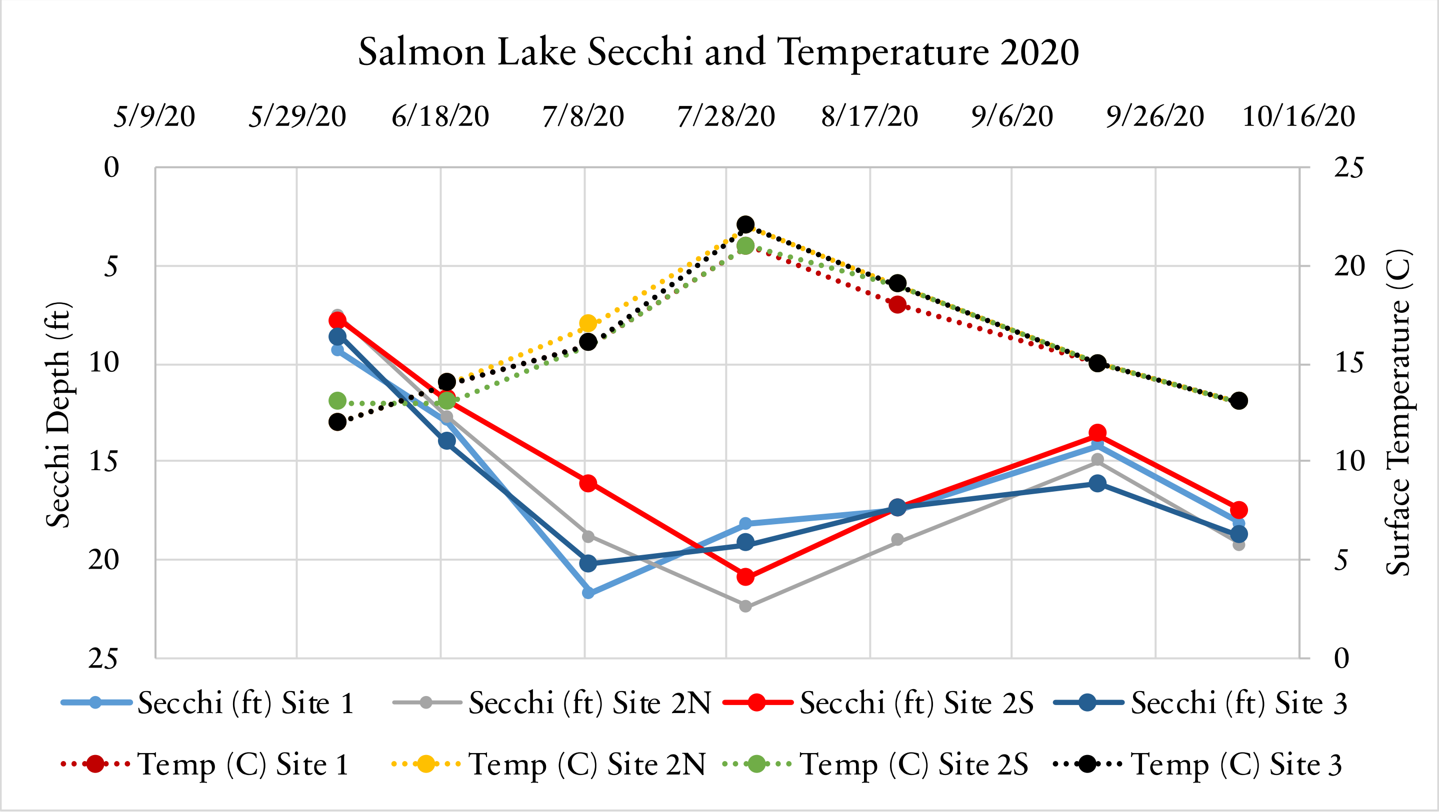

Figure 13. Secchi transparencies and temperature recorded at four sites in Salmon Lake in 2020. Note the two different Y axes.

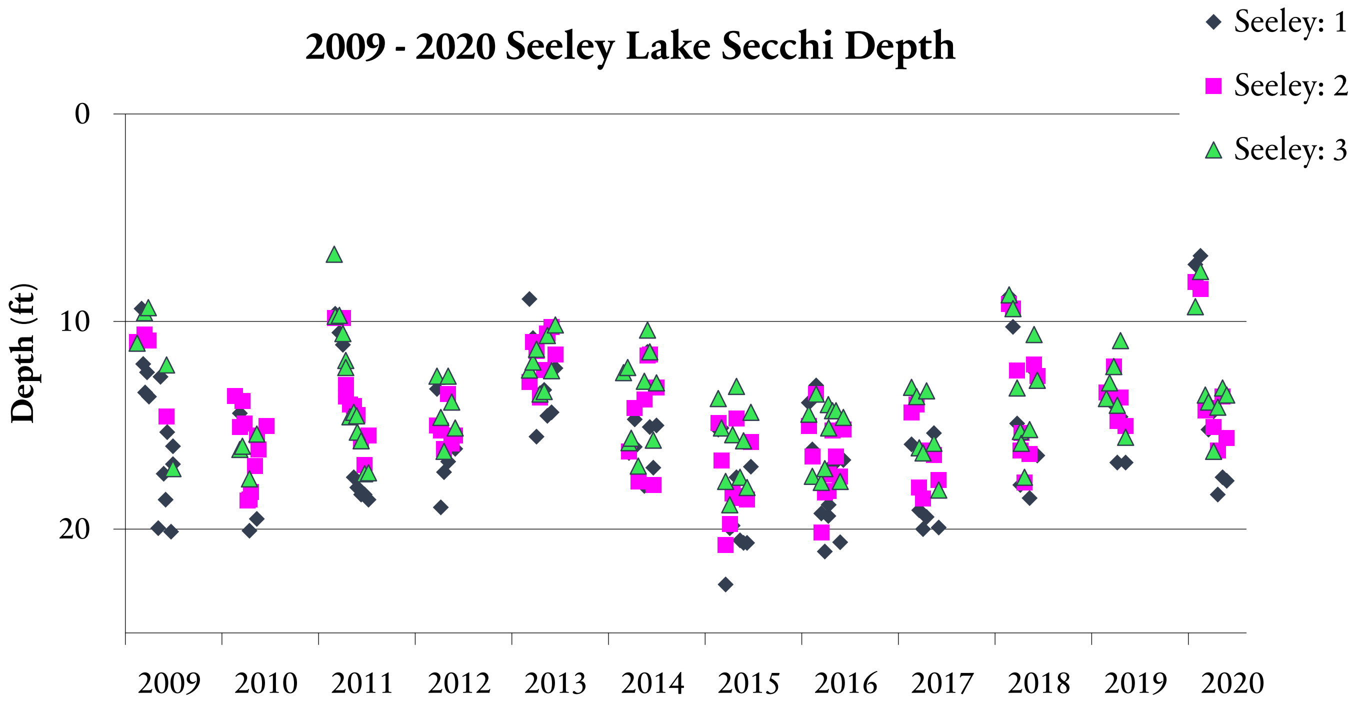

Figure 14. Secchi transparencies (depth) recorded at three sites in Seeley Lake, 2009 through 2020.

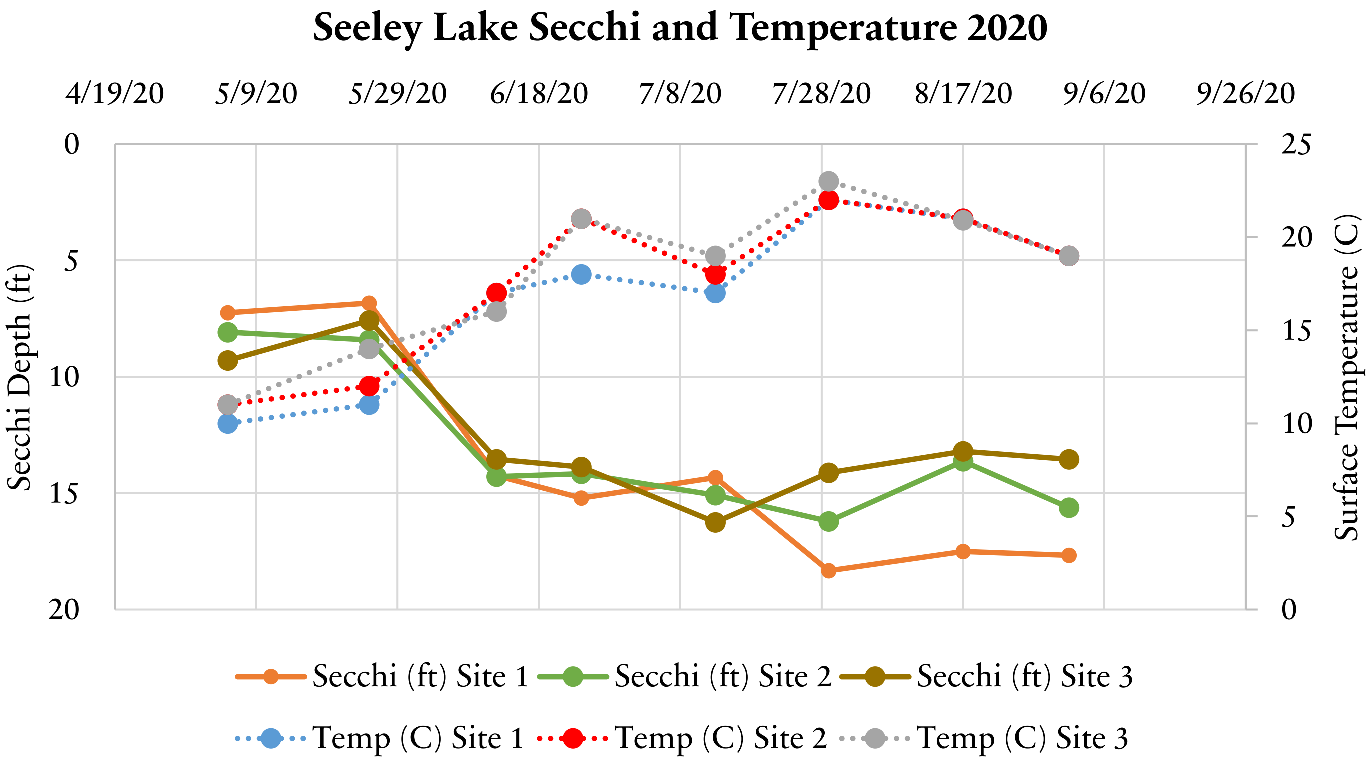

Figure 15. Secchi transparencies and temperature recorded at 3 sites in Seeley Lake in 2020. Note the two different Y axes.

4.2 Dissolved Oxygen and Temperature Profiles

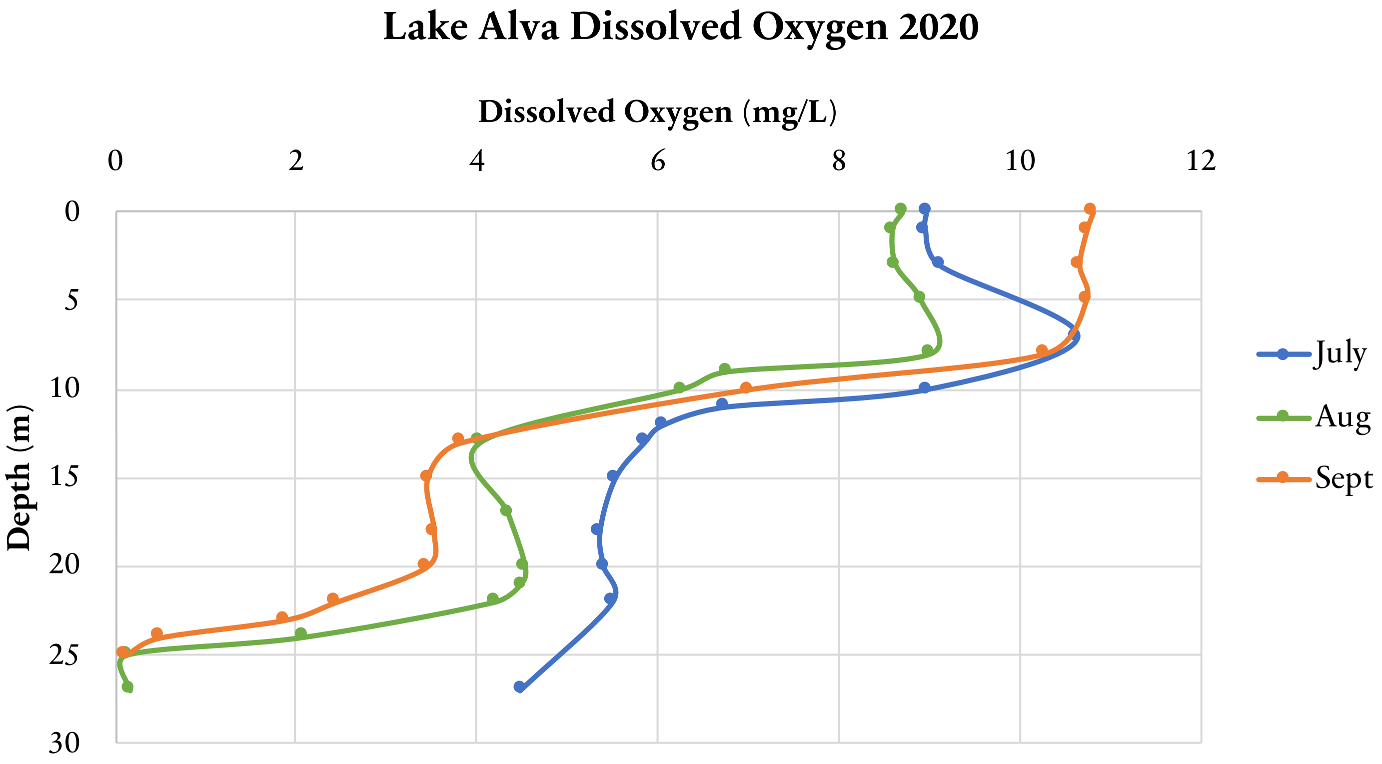

Figure 16. Dissolved oxygen (mg/L) profile recorded at one site in Lake Alva, from July through September 2020.

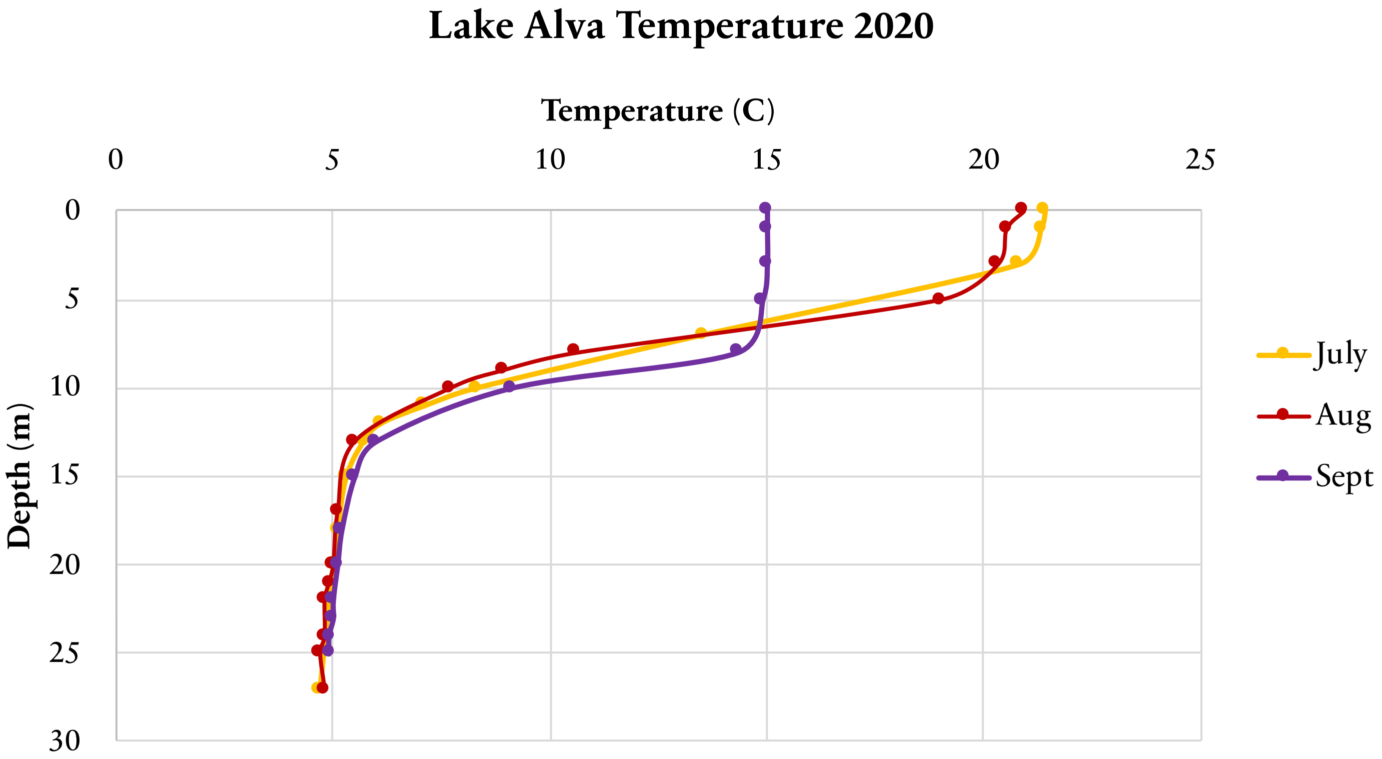

Figure 17. Temperature (°C) profile recorded at one site in Lake Alva, from July through September 2020.

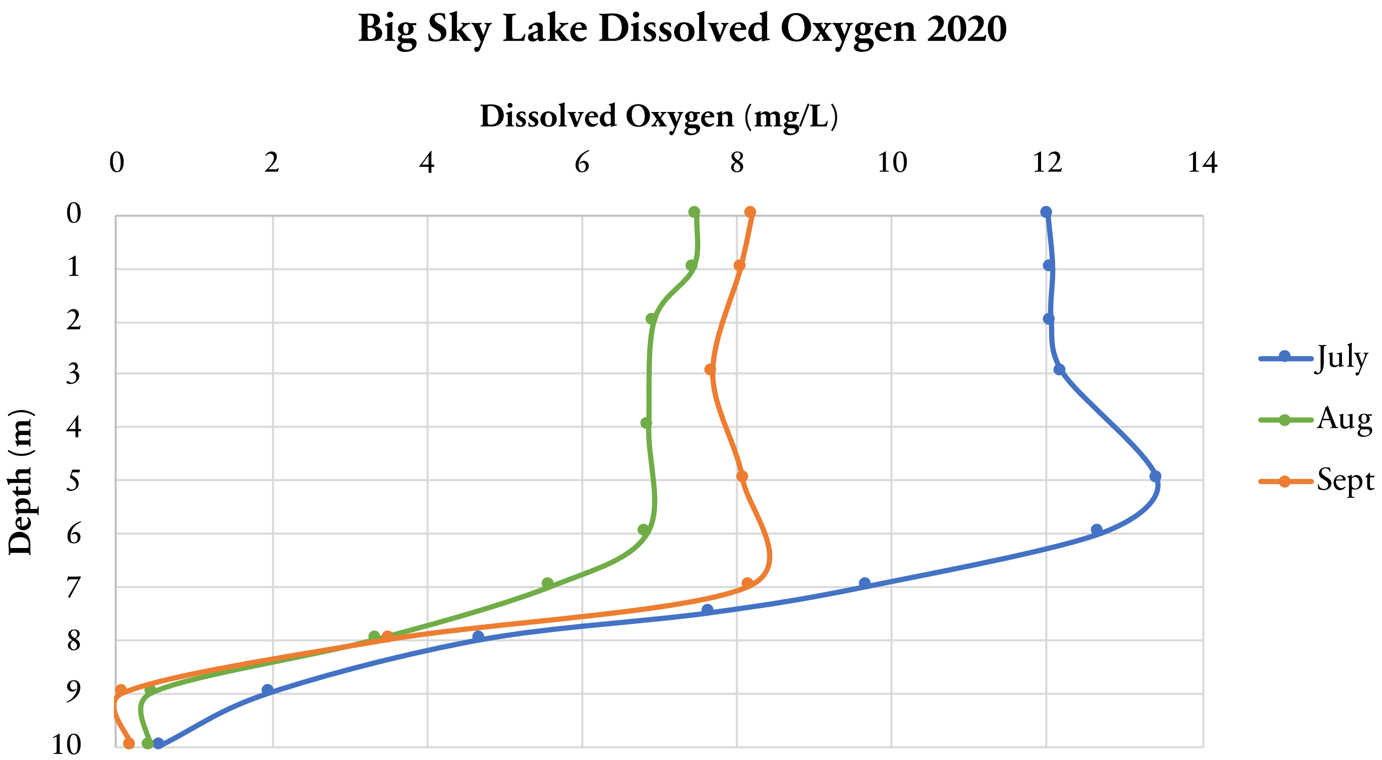

Figure 18. Dissolved oxygen (mg/L) profile recorded at one site in Big Sky Lake, from July through September 2020.

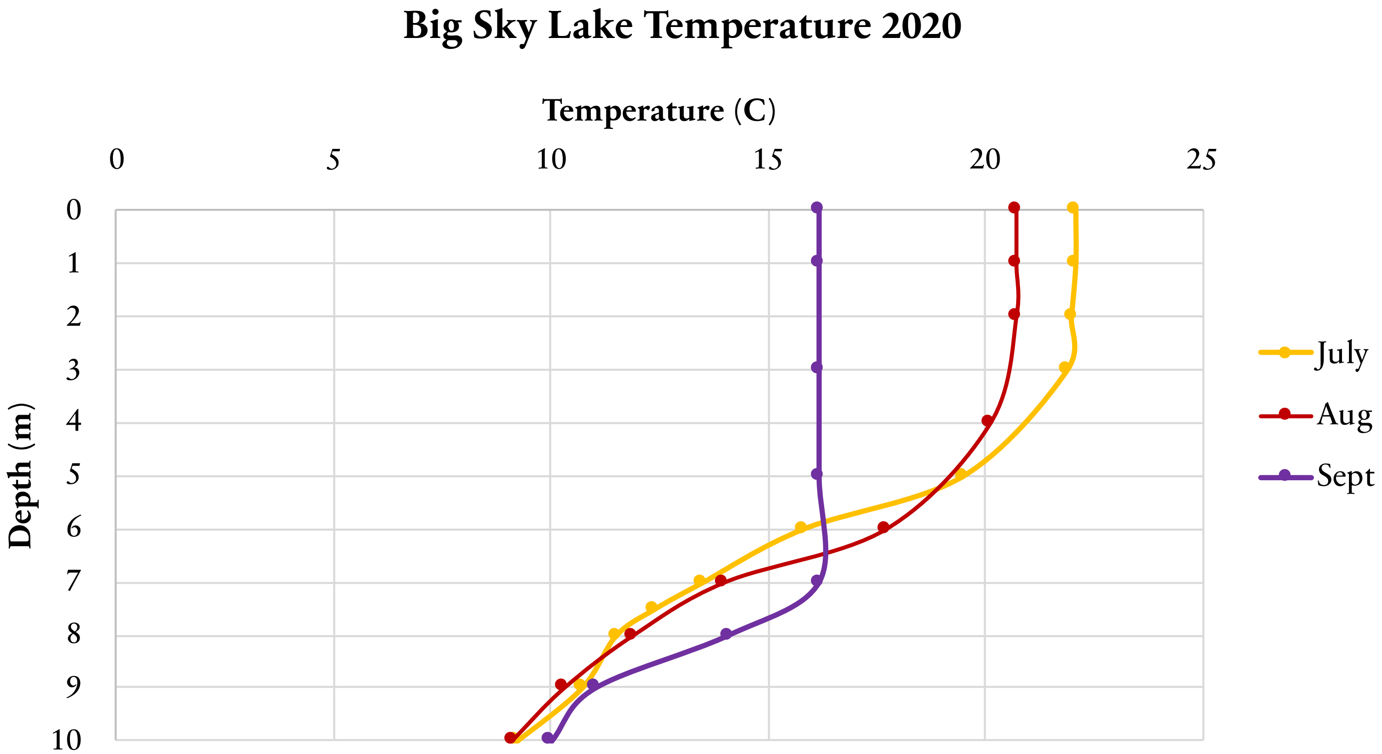

Figure 19. Temperature (°C) profile recorded at one site in Big Sky Lake, from July through September 2020.

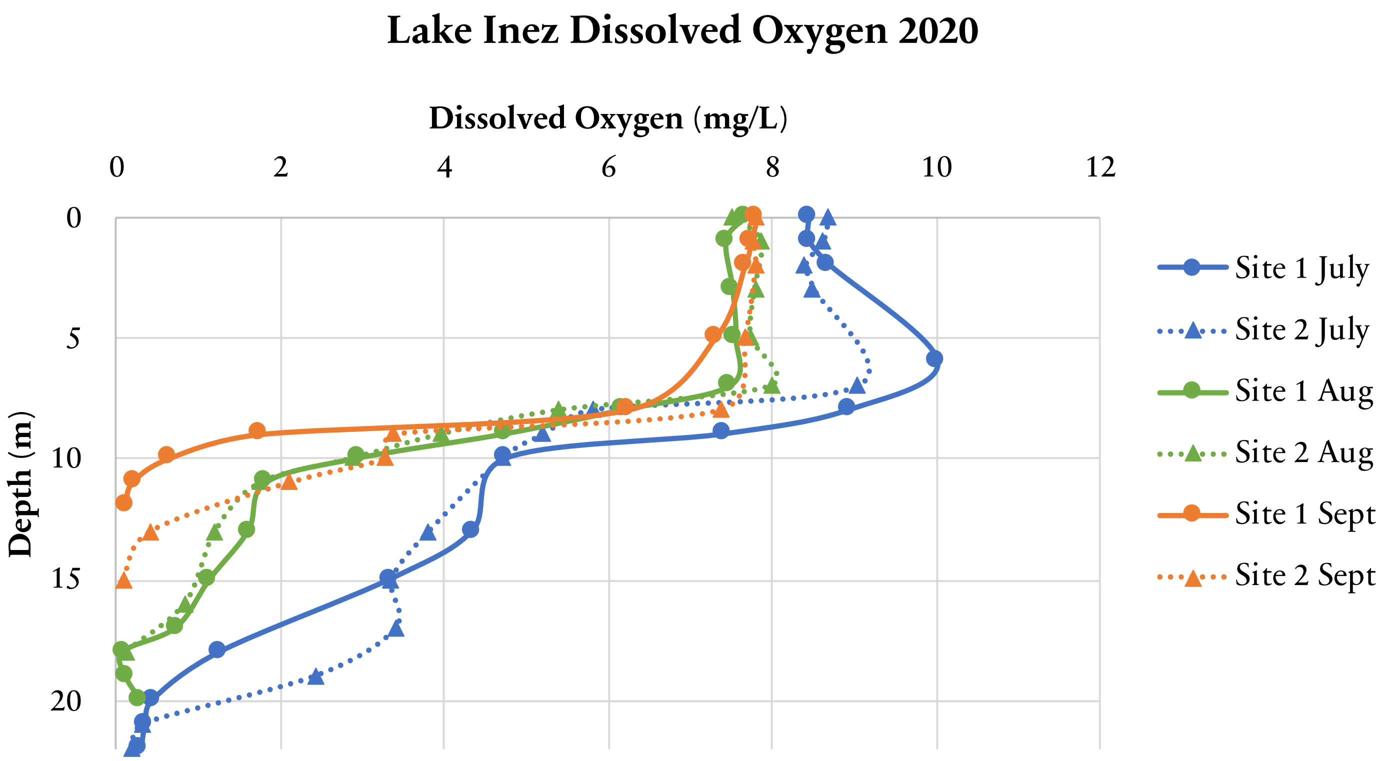

Figure 20. Dissolved oxygen (mg/L) profile recorded at two sites in Lake Inez, from July through September 2020.

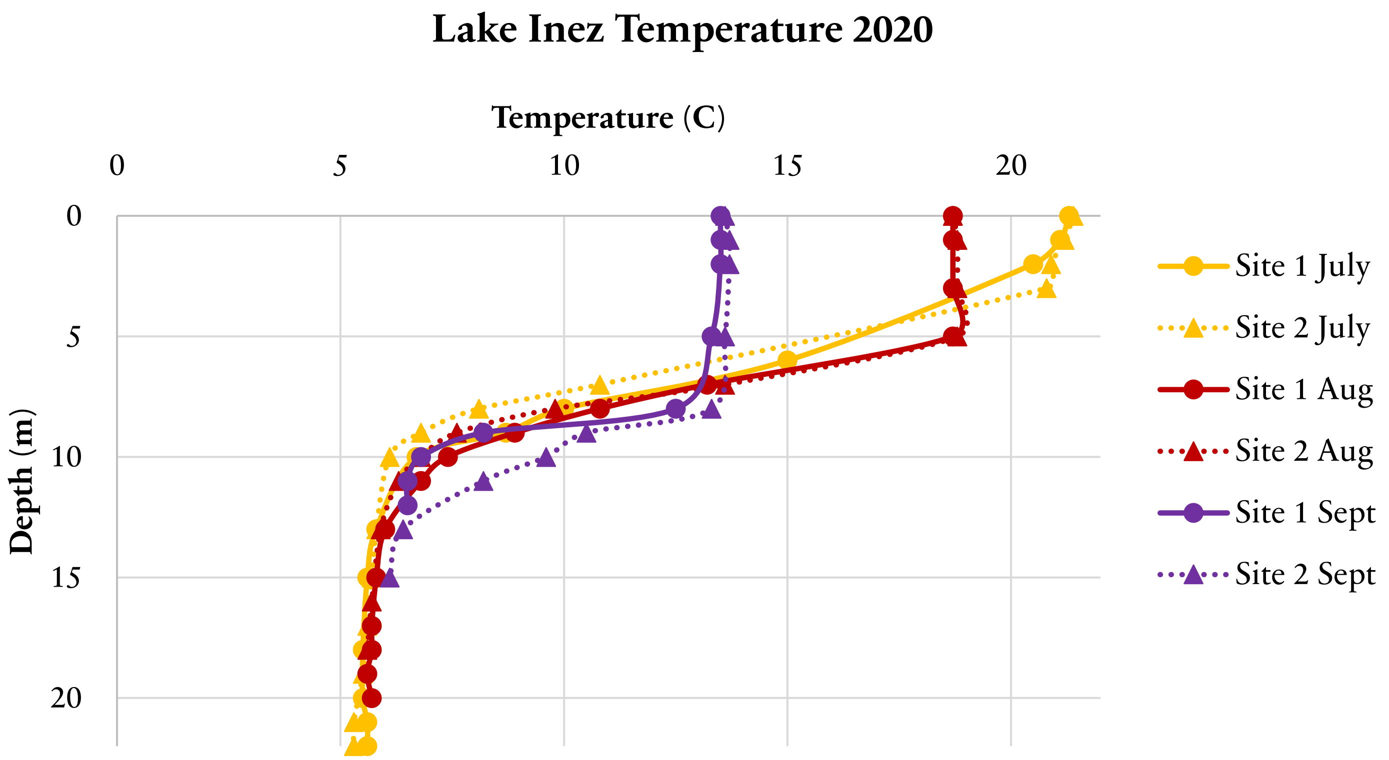

Figure 21. Temperature (°C) profile recorded at two sites in Lake Inez, from July through September 2020.

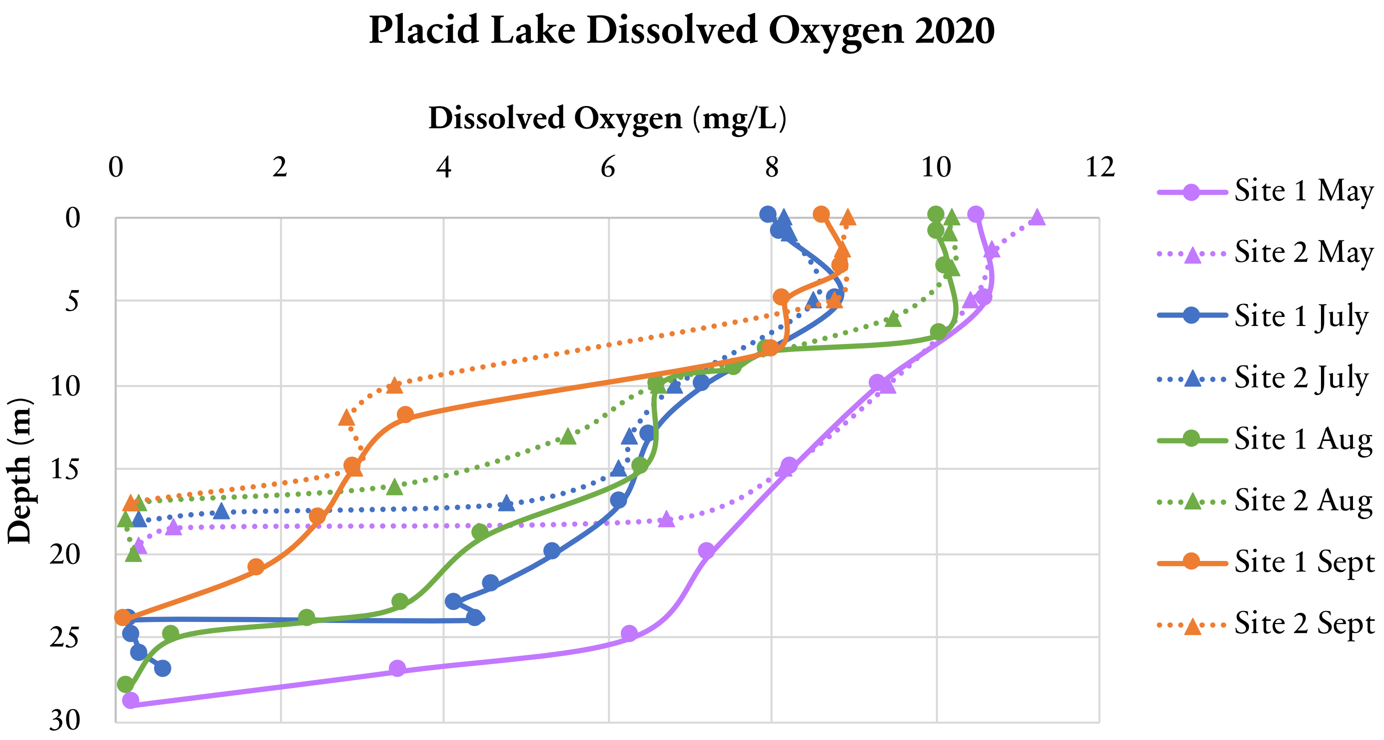

Figure 22. Dissolved oxygen (mg/L) profile recorded at two sites in Placid Lake, from May through September 2020.

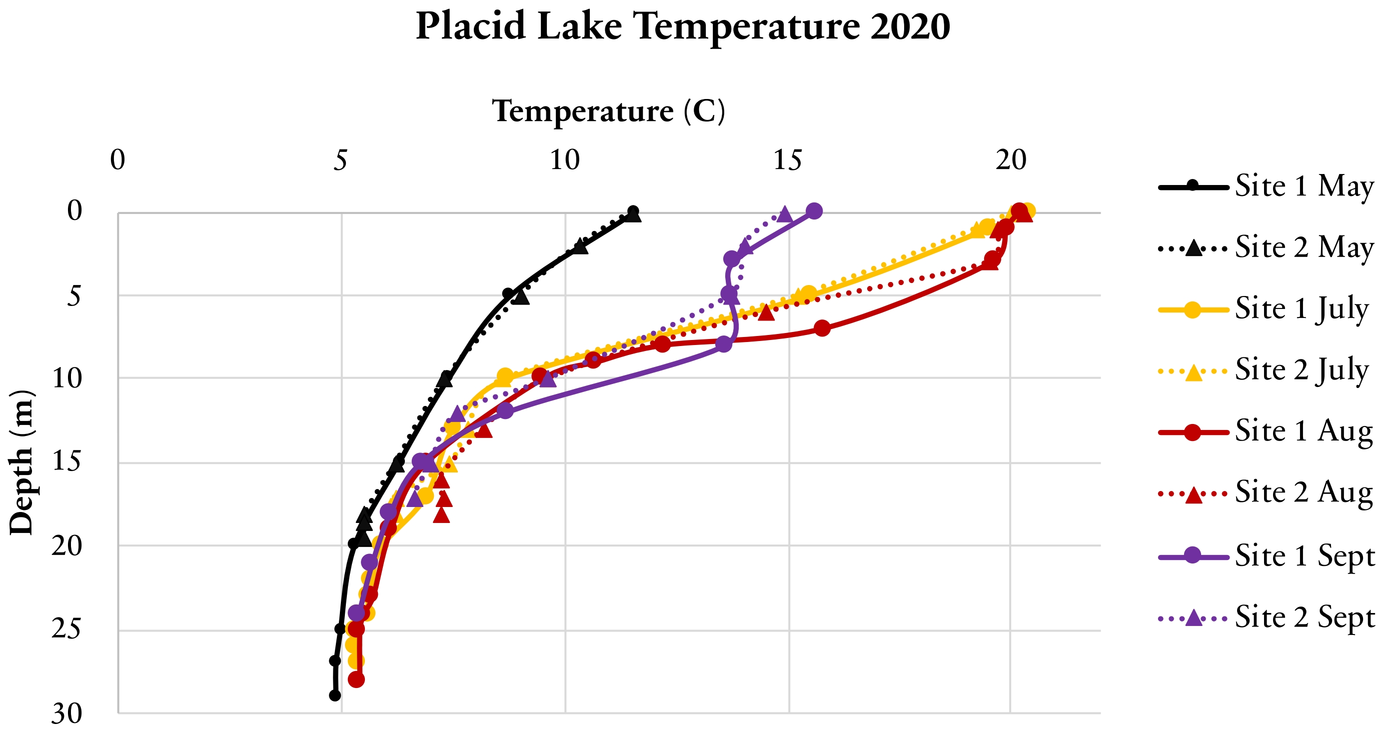

Figure 23. Temperature (°C) profile recorded at two sites in Placid Lake, from May through September 2020.

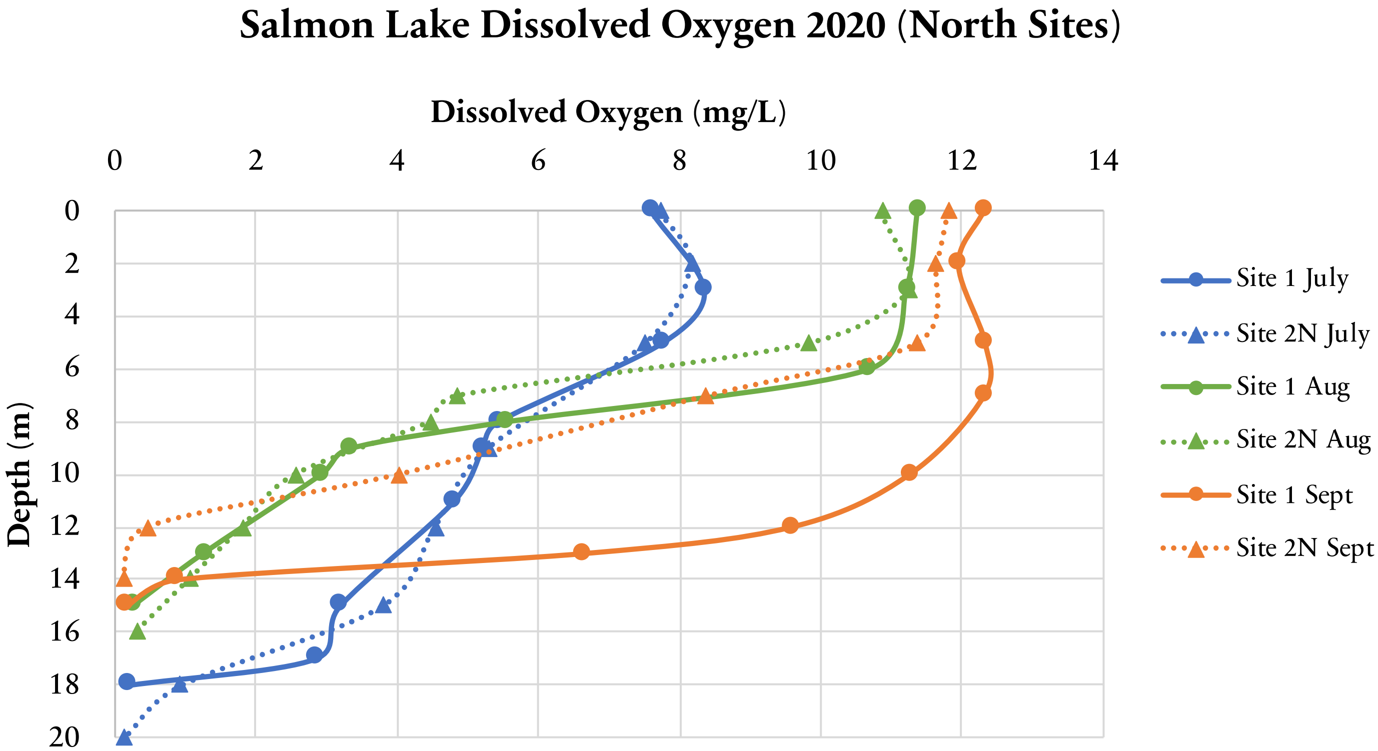

Figure 24. Dissolved oxygen (mg/L) profile recorded at the two northern sites in Salmon Lake, from July through September 2020.

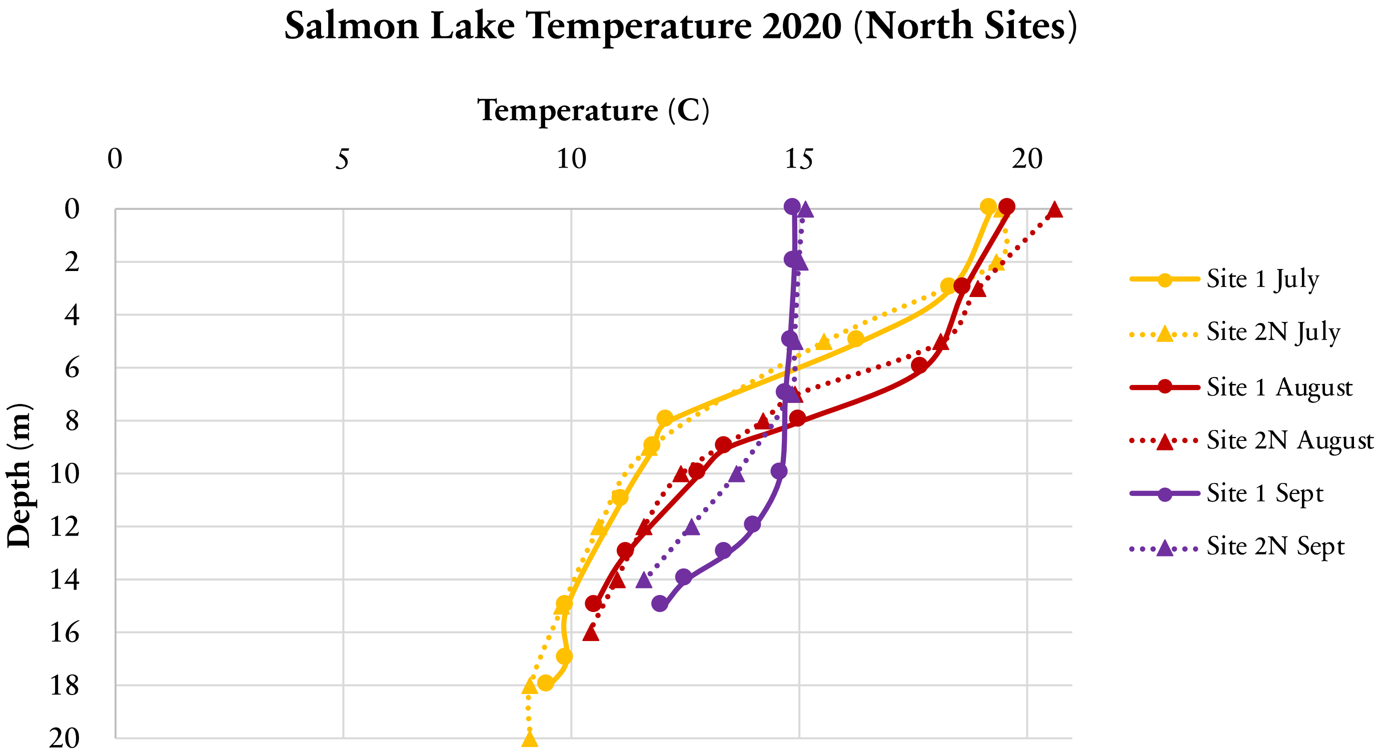

Figure 25. Temperature (°C) profile recorded at the two northern sites in Salmon Lake, from July through September 2020.

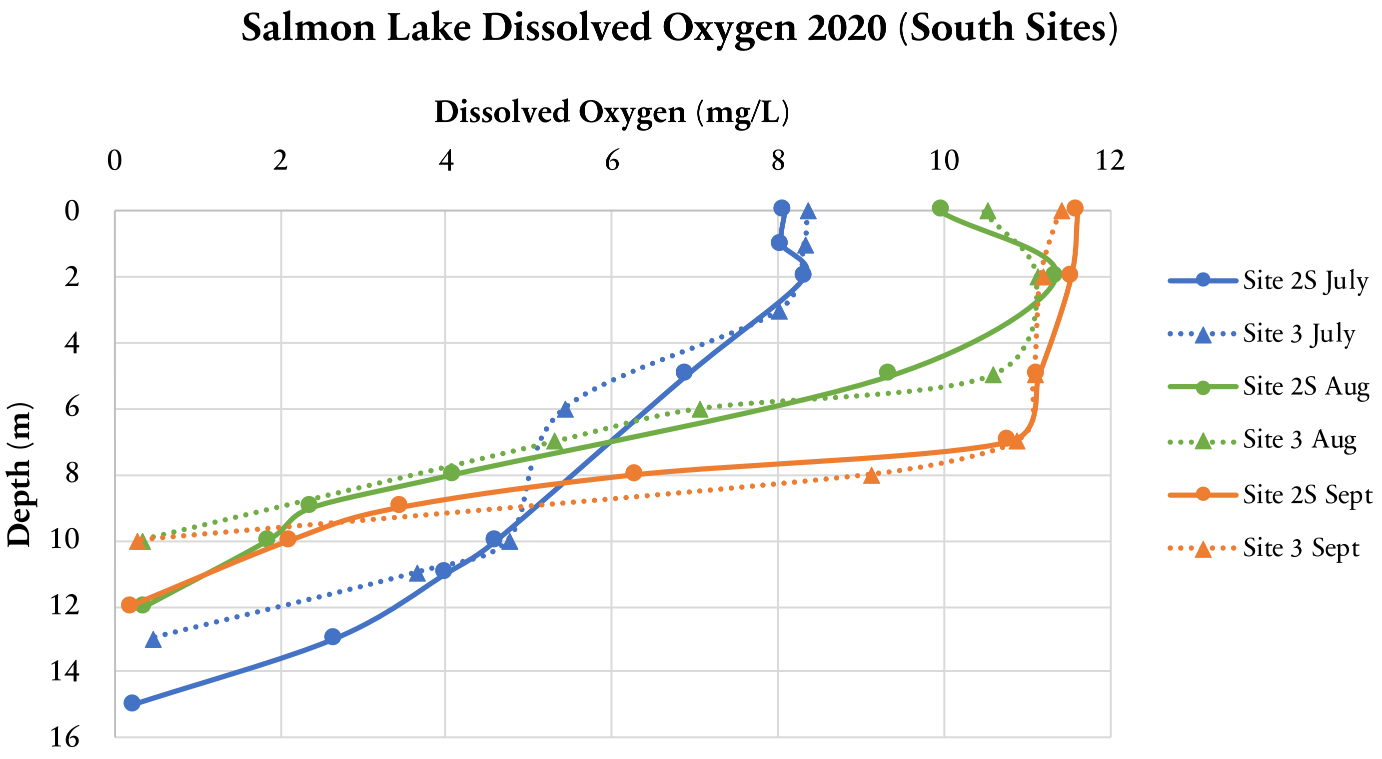

Figure 26. Dissolved oxygen (mg/L) profile recorded at the two southern sites in Salmon Lake, from July through September 2020.

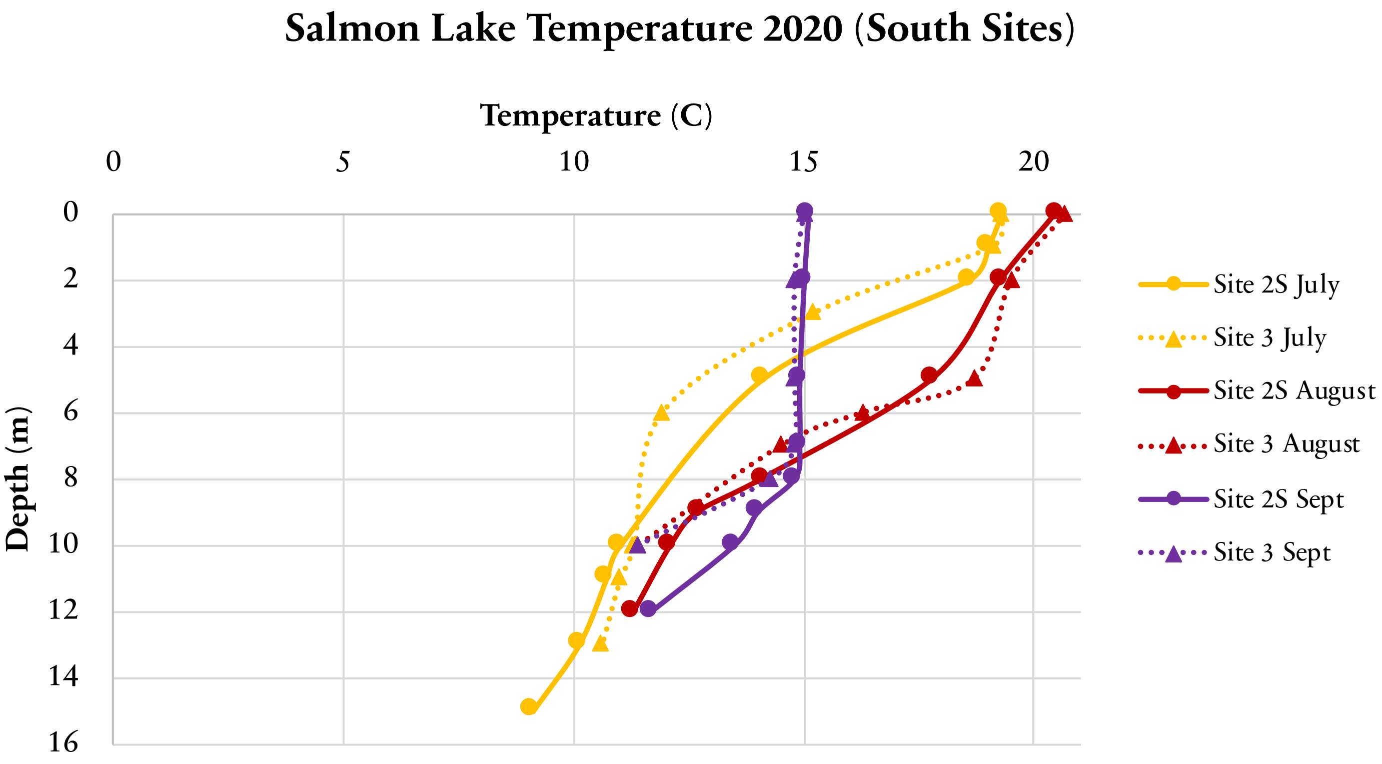

Figure 27. Temperature (°C) profile recorded at the two southern sites in Salmon Lake, from July through September 2020.

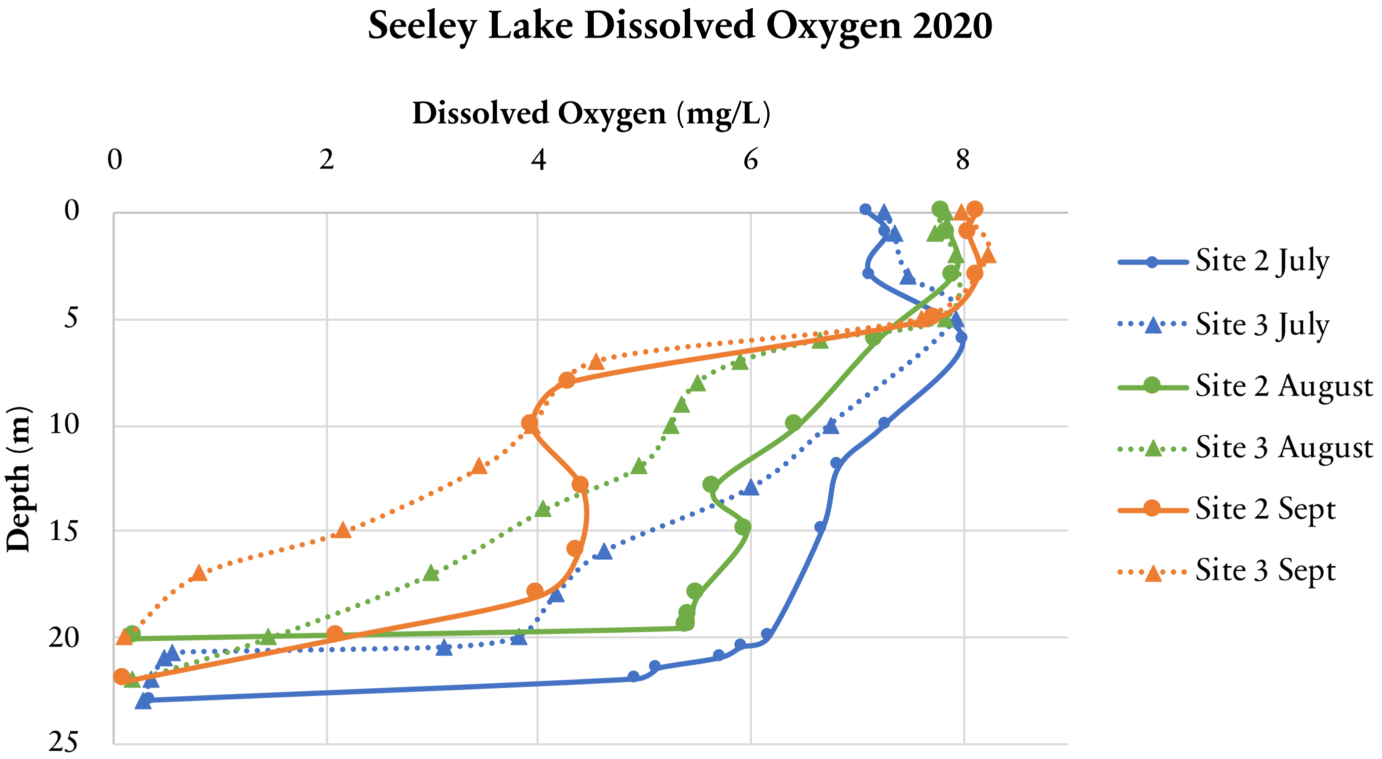

Figure 28. Dissolved oxygen (mg/L) profile recorded at two sites in Seeley Lake, from July through September 2020.

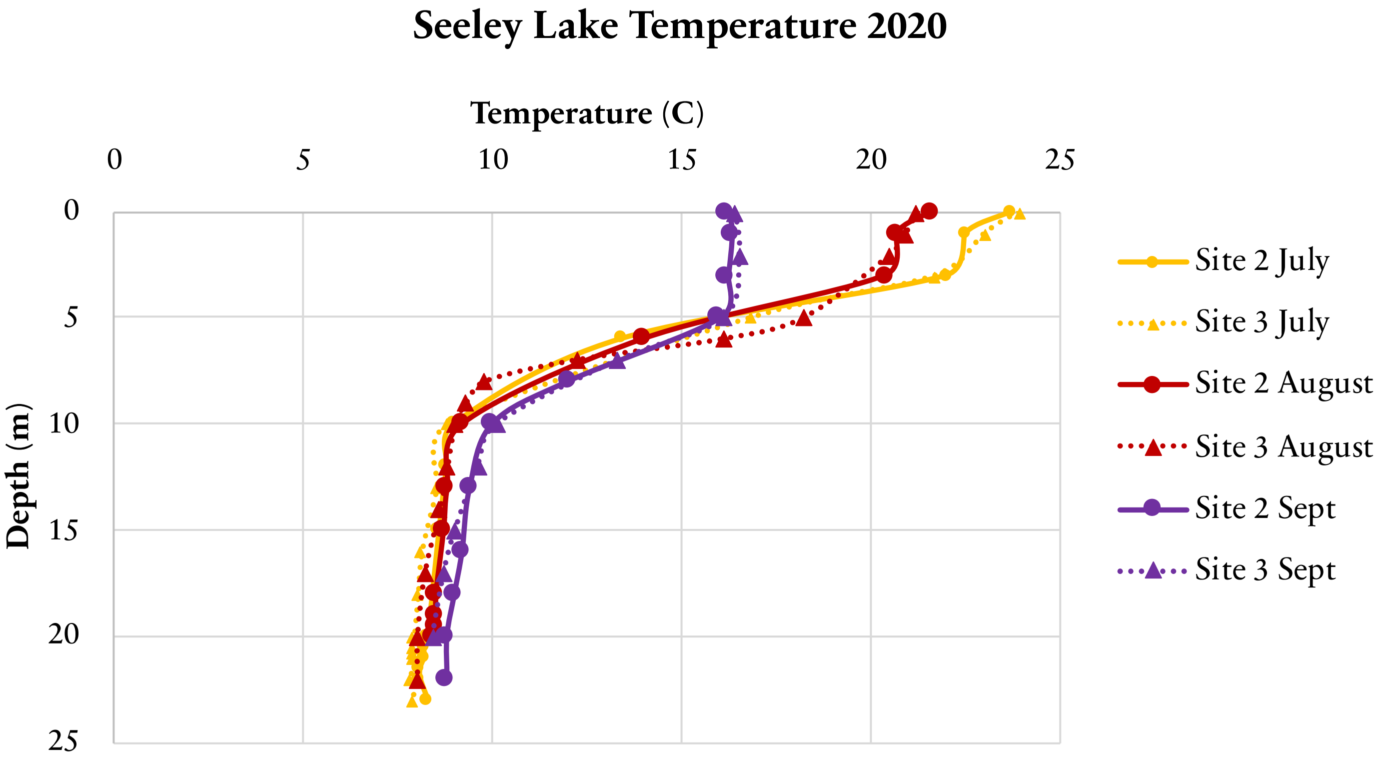

Figure 29. Temperature (°C) profile recorded at two sites in Seeley Lake, from July through September 2020.

5. Results and Discussion

5.1 Secchi Transparency and Surface Temperature

There were no drastic changes or trends apparent with the addition of the transparency and temperature data gathered in 2020. In general, there have been consistent differences among lakes and common patterns within lakes across years (Figure 2). There is year to year variability in each lake's mean transparencies, but overall there have been no consistent declines or improvements in conditions throughout the entire period of monitoring (Figure 3).

Transparencies this field season ranged from a low of approximately 7 feet on Seeley Lake in May to 26 feet on Lake Inez in July (Figure 2, Appendix B). Transparencies were generally the lowest early in the year and increased in depth throughout the summer (with some fluctuations). When stream flows peak during spring runoff, the amount of sediments and thus turbidity increases, decreasing the lakes' transparencies as a result. As snowmelt and runoff decline with the progression of summer, transparencies begin to increase.

Lake Alva has consistently shown relatively deep Secchi depths, and the last 7 years of data have been consistent with this trend, with an average transparency of approximately 20 feet (Figure 3). Before this point, transparencies were still relatively deep, but slightly shallower. Conversely, Seeley Lake consistently has some of the shallowest mean transparencies, and the last 3 years of data have been between the "oligotrophic" and "eutrophic" depth boundaries (Figure 3). Oligotrophic aquatic systems are those that generally host minimal aquatic vegetation and are relatively clear, while eutrophic lakes encompass the other end of the spectrum: bodies of water with high quantities of organisms, nutrients, and algal growth. Before 2018, data points are mixed above and below the "oligotrophic" boundary. If this trend in decreased clarity persists on Seeley Lake, aquatic life could be affected by the underlying processes driving this change.

For the rest of the lakes (Inez, Salmon, Placid, and Big Sky) the mean Secchi transparency in 2018 was one of the shallowest of all time. However, 2019 and 2020 showed deeper transparencies for all of these lakes, bringing each lake back to oligotrophic levels. One hypothesis is that the Rice Ridge Fire, which burned a large swath of land east of Seeley Lake, affected transparencies in 2018, which was 1-year post-fire. This hypothesis is supported by our stream monitoring data, which showed decreased clarities in the fire affected streams 1-year post-fire. Additionally, relative to previous years, 2018 stream flows were very high because there was less vegetation present to slow down runoff during precipitation events, and as a result, nutrient concentrations (nitrogen and phosphorous) were significantly elevated. For more information on this historical stream data, visit crcmt.org/adopt-a-stream.

Transparencies naturally vary through time in response to differences in streamflow or lake flushing, weather and patterns of warming, and other influences. The data could also vary due to inherent limitations in the methodology of collecting data via the Secchi disk. As discussed previously, many factors can influence Secchi data, such as a change in weather conditions, time of day of observation, or the person making observations. Differences within a lake that persist for 4-5 continuous years will be important when considering whether fundamental changes in lake trophic conditions are occurring; however, as of 2020, we have not observed any long-term continual changes in transparency.

5.2 Dissolved Oxygen and Temperature Profiles

Dissolved oxygen declined in the waters below the thermocline at all of the sites throughout the summer. The thermocline is a layer of rapidly changing temperature which limits mixing between near surface and deep water. In this region of water, there is a steep temperature gradient where the water temperature drops rapidly with increasing depth. The thermocline is significant and affects both biotic and abiotic components of a lake.

Dissolved oxygen levels through the water column are directly related to the location of the thermocline. Most dissolved oxygen enters the water through aeration, as well as photosynthesis by phytoplankton or rooted aquatic plants, which almost exclusively occur in the warmer epilimnion where light penetrates. As a result, most of the oxygen is produced in the epilimnion, and because there is little mixing between the layers of a lake in the summer, the cooler hypolimnion can become hypoxic or anoxic, especially later in the summer when stratification is greatest. This oxygen deficit at depth occurs because once mixing stops mid-summer due to stratification, decomposition by microorganisms depletes oxygen levels within that deeper layer. As time passes throughout the summer, this deficit becomes greater.

On Lake Alva, July and August had comparable DO levels at the surface, while September saw a jump of about 2 mg/L in DO at the surface (Figure 16). At depth, directly below the thermocline, the highest DO was recorded in July, followed by August, then September. From July-September the thermocline consistently occurred at around 8-9 meters (Figure 17). Below this point in the water column, the water temperature was consistently at about 5 °C. For most of the lakes, including Lake Alva, surface temperatures declined from July-September (highest in July, lowest in September).

In contrast to Lake Alva, on Big Sky Lake surface DO levels were at their greatest in July, but lower in August and September (Figure 18). The July dissolved oxygen profile taken on Big

Sky Lake was the highest of any of the readings taken in 2020, which peaked at 13.42 mg/L at 5 meters in depth. Although nothing visually anomalous was noted in the water on that monitoring day (7/30/20), it is possible that this reading indicates the growth of a near-surface algae bloom, which would increase DO in the epilimnion through photosynthetic activity. The hypothesis of an algae growth is supported by the Secchi readings, which exhibited a marked decrease in transparency around the time this DO reading was taken (Figure 7). This decrease in transparency at around this time was unique to Big Sky Lake, as most of the other lakes were exhibiting maximums or slight fluctuations in transparencies at this time.

Although sites 1 and 2 on Lake Inez are approximately 18 and 23 meters deep, respectively, DO showed an initial sharp decrease at both sites at around 8-10 meters throughout the summer (Figure 20). The initial DO decrease was sharpest in September and most gradual in July. The thermocline remained at about 8 meters throughout the summer (Figure 21). DO below the thermocline decreased steadily from July through September. In July, DO levels remained relatively high below the thermocline, but by September, DO decreased to approximately 0 mg/L at about 12 meters at site 1 and 15 meters at site 2 (Figure 20). This pattern was common throughout the lakes: as the thermocline became more pronounced later in the summer, the oxygen deficit at depth was also more distinct.

Although DO readings did not begin until July for most of the lakes, one May reading was taken on Placid Lake (Figures 22 and 23). From this profile, it is evident that before air and water temperatures peaked mid-summer, the water was not well stratified, and a thermocline was not well defined. As a result, this DO profile contained some of the highest readings through the water column, with the least amount of change as depth increased. As the water became more stratified in July-September, DO decreased more through the water column in all of the lakes. Once the thermocline formed in Placid Lake, it remained at about 8 meters through the summer, consistent with the other lakes. In general, DO was lower at site 2 (the north arm) than site 1 (mid-lake), especially in August and September. There is likely more mixing mid-lake, which would increase DO through aeration. Additionally, a potentially toxic algae bloom of the genus *anabaena* was confirmed in the north arm of Placid Lake in September of 2020, which could have decreased DO through the respiration of microorganisms consuming this large algae bloom, as discussed in the introduction. The oxygen in Placid Lake decreased quickly through the water column after May which could be cause for concern for larger organisms living in the lake.

In contrast to many of the other lakes, Salmon Lake had its highest oxygen levels above the thermocline in September, followed by August, and then July (Figures 25 and 26). The two northern sites (1 and 2N) consistently had higher oxygen levels than the southern sites (2S and 3). The inlet (at the northern end of the lake) most likely provides the northern sites with more oxygen through water movement. Site 3 is located in the southernmost bay of the lake. The lake narrows just north of this site, which likely decreases water movement in this southernmost bay. Although the 4 deep spots on Salmon Lake are shallower than many of the other lakes (at about 15-18 meters), the oxygen decreased to approximately 0 by about 12-14 meters in a few instances. However, similar to Big Sky Lake, the deep spots on Salmon are quite small in area, and the influence of wind often impacted the readings, as the small boat used on Salmon Lake was easily pushed by the wind and current away from the exact sampling location. In the future, an anchor should be used to ameliorate this limitation in data collection. Nevertheless, the oxygen sag is quite pronounced, and likely concerning for aquatic life, especially in August and September.

Profiles on Seeley Lake were only taken at the mid site and south site (sites 2 and 3, respectively), as the northern site has a maximum depth of approximately 37 meters, exceeding the YSI Pro 20's 30-meter cord (Figures 28 and 29). From July through September, DO was consistently low at the surface on Seeley, ranging from approximately 7-8 mg/L at both of the sites. Seeley and Inez are the only lakes that did not exhibit DO levels above 10 mg/L at any point in the summer. At the mid-lake site (site 2), DO often increased below the thermocline before suddenly dropping to 0 mg/L at about 20-23 meters. At site 3, DO decreased more steadily through the water column. The thermocline was consistently at around 6-7 meters at both sites on Seeley Lake.

There were quite a few limitations in the collection of the DO data presented here. Wind was often detrimental in obtaining accurate readings, as the current pulled the DO meter's cord obliquely, making the depth readings inaccurate at times. Wind and current also pulled the boats, especially the smaller ones on Big Sky Lake, Lake Alva, and Salmon Lake, causing the exact location of the readings to vary (which explains the differences in depths between some of the sampling dates at the same sites). The data presented here are not perfect but present an opportunity to learn more about the current status of our lakes, and how they are changing in comparison to historical dissolved oxygen data.

Despite these limitations, in general, DO deficits were quite pronounced on a few of the lakes, which could cause concern for organisms living deeper in the water column. These data, along with the positive confirmations of potentially toxic algae on two of our lakes this year (Placid and Salmon) make it all the more necessary to continue collecting data and studying the trends in historical data to attempt to prevent concerning depletions in our local water quality.

As discussed previously, historical dissolved oxygen data on Salmon and Seeley Lakes were used to estimate the *areal hypolimnetic oxygen depletion (*AHOD) rates in each lake. AHOD refers to the rate at which oxygen declines in the hypolimnion of a lake during the summer, which is calculated by estimating the total mass of oxygen in the deep, cold waters of the lake multiple times during the summer to see how fast it is consumed. This important measure allows for comparison between lakes and should be the goal of data analysis in the future if dissolved oxygen monitoring continues in the Clearwater Watershed.

More data analysis is necessary to make conclusions about changes occurring over time. Stay tuned on our website (crcmt.org) for more information on historical data comparisons.

6. Appendices

Appendix A: 13 sites, spread throughout the 6 major lakes in the Clearwater Watershed, were monitored for dissolved oxygen, temperature, and Secchi transparency this field season.

Lake	**Site Number**	**Latitude/Longitude**
Alva	1	47° 18' 58.00", 113° 34' 58.80”
Inez	1 (north hole)	47° 17' 10.43", 113° 34' 5.53"
	2 (south hole)	47° 16' 42.82", 113° 33' 54.14"
Seeley	1 (north hole)	47° 12' 16.63”, 113° 31' 12.00"
	2 (mid hole)	47° 11 '10.90”, 113° 30' 14.40"
	3 (south hole)	47° 10' 29.75", 113° 29' 20.40"
Placid	1 (mid hole)	47° 07’ 43.1”, 113° 31’ 34.21”
	2 (north hole)	47° 07’ 5.48”, 113° 31’ 15.92”
Big Sky	1	47° 06’ 56.41”, 113° 23’ 52.8”
Salmon	1 (north hole)	47° 06’ 11.81”, 113° 24’ 46.8”
	2N (mid north hole)	47° 05’ 47.69”, 113° 24’ 18.0”
	2S (mid south hole)	47° 05’ 18.31”, 113° 24’ 00.0”
	3 (south hole)	47° 04’ 18.84”, 113° 23’ 09.6”

6.1 Secchi Transparency and Surface Temperature

Appendix B: individual measurements of Secchi transparency (feet) and temperature (°C) collected by volunteers on lakes of the Clearwater basin in 2020.

Site	Date	Secchi (ft)	Temperature (°C)
Alva: 1	5/27/20	9.58	12.0
Alva: 1	6/15/20	14.08	13.0
Alva: 1	6/30/20	19.71	15.0
Alva: 1	7/14/20	18.21	18.0
Alva: 1	7/30/20	24.88	21.0
Alva: 1	8/20/20	24.96	20.0

Alva: 1	9/9/20	22.67	15.0
Alva: 1	9/22/20	24.25	14.0
Big Sky: 1	5/2/20	10.58	10.0
Big Sky: 1	5/16/20	18.42	11.0
Big Sky: 1	5/30/20	19.13	16.0
Big Sky: 1	6/12/20	22.08	16.5
Big Sky: 1	6/26/20	18.38	20.0
Big Sky: 1	7/11/20	15.75	19.0
Big Sky: 1	7/26/20	16.04	21.0
Big Sky: 1	8/8/20	19.08	21.0
Big Sky: 1	8/22/20	20.4	19.5
Big Sky: 1	9/13/20	17.2	16.0
Big Sky: 1	9/27/20	13.2	14.0
Big Sky: 1	10/9/20	11.7	13.5
Inez: 1 (N Hole)	7/15/20	18.79	19.0
Inez: 1 (N Hole)	7/27/20	26.00	21.0
Inez: 1 (N Hole)	8/27/20	17.96	20.0
Inez: 1 (N Hole)	9/11/20	18.88	12.0
Inez: 2 (S Hole)	7/15/20	21.17	19.0
Inez: 2 (S Hole)	7/27/20	22.13	21.0
Inez: 2 (S Hole)	8/27/20	18.71	20.0
Inez: 2 (S Hole)	9/11/20	18.88	13.0
Placid: 1 (Mid Hole)	5/2/20	9.58	9.9
Placid: 1 (Mid Hole)	5/20/20	11.75	9.0
Placid: 1 (Mid Hole)	7/19/20	24.63	17.0
Placid: 1 (Mid Hole)	8/11/20	22.75	17.0
Placid: 1 (Mid Hole)	8/28/20	22.17	20.0

Placid: 1 (Mid Hole)	9/21/20	16.79	16.0
Placid: 2 (N Hole)	5/2/20	10.54	10.0
Placid: 2 (N Hole)	5/20/20	10.08	8.0
Placid: 2 (N Hole)	7/19/20	21.67	17.0
Placid: 2 (N Hole)	8/11/20	22.79	18.0
Placid: 2 (N Hole)	8/28/20	21.83	20.0
Placid: 2 (N Hole)	9/21/20	16.67	16.0
Salmon: 1 (N Hole)	6/4/20	9.38	12.0
Salmon: 1 (N Hole)	6/19/20	12.92	14.0
Salmon: 1 (N Hole)	7/9/20	21.71	16.0
Salmon: 1 (N Hole)	7/31/20	18.17	21.0
Salmon: 1 (N Hole)	8/21/20	17.46	18.0
Salmon: 1 (N Hole)	9/18/20	14.13	15.0
Salmon: 1 (N Hole)	10/8/20	18.21	13.0
Salmon: 2N (Mid N Hole)	6/4/20	7.63	12.0
Salmon: 2N (Mid N Hole)	6/19/20	12.71	14.0
Salmon: 2N (Mid N Hole)	7/9/20	18.83	17.0
Salmon: 2N (Mid N Hole)	7/31/20	22.38	22.0
Salmon: 2N (Mid N Hole)	8/21/20	19.08	19.0
Salmon: 2N (Mid N Hole)	9/18/20	14.96	15.0
Salmon: 2N (Mid N Hole)	10/8/20	19.25	13.0
Salmon: 2S: (Mid S Hole)	6/4/20	7.79	13.0
Salmon: 2S: (Mid S Hole)	6/19/20	11.83	13.0
Salmon: 2S: (Mid S Hole)	7/9/20	16.13	16.0
Salmon: 2S: (Mid S Hole)	7/31/20	20.92	21.0
Salmon: 2S: (Mid S Hole)	8/21/20	17.33	19.0
Salmon: 2S: (Mid S Hole)	9/18/20	13.63	15.0

Salmon: 2S: (Mid S Hole)	10/8/20	17.50	13.0
Salmon: 3 (S Hole)	6/4/20	8.63	12.0
Salmon: 3 (S Hole)	6/19/20	14.04	14.0
Salmon: 3 (S Hole)	7/9/20	20.21	16.0
Salmon: 3 (S Hole)	7/31/20	19.21	22.0
Salmon: 3 (S Hole)	8/21/20	17.33	19.0
Salmon: 3 (S Hole)	9/18/20	16.13	15.0
Salmon: 3 (S Hole)	10/8/20	18.79	13.0
Seeley: 1 (N Hole)	5/5/20	7.25	10.0
Seeley: 1 (N Hole)	5/25/20	6.83	11.0
Seeley: 1 (N Hole)	6/12/20	14.25	17.0
Seeley: 1 (N Hole)	6/24/20	15.21	18.0
Seeley: 1 (N Hole)	7/13/20	14.33	17.0
Seeley: 1 (N Hole)	7/29/20	18.33	22.0
Seeley: 1 (N Hole)	8/17/20	17.50	21.0
Seeley: 1 (N Hole)	9/1/20	17.67	19.0
Seeley: 2 (Mid Hole)	5/5/20	8.08	11.0
Seeley: 2 (Mid Hole)	5/25/20	8.42	12.0
Seeley: 2 (Mid Hole)	6/12/20	14.29	17.0
Seeley: 2 (Mid Hole)	6/24/20	14.17	21.0
Seeley: 2 (Mid Hole)	7/13/20	15.08	18.0
Seeley: 2 (Mid Hole)	7/29/20	16.21	22.0
Seeley: 2 (Mid Hole)	8/17/20	13.63	21.0
Seeley: 2 (Mid Hole)	9/1/20	15.63	19.0
Seeley: 3 (S Hole)	5/5/20	9.29	11.0
Seeley: 3 (S Hole)	5/25/20	7.58	14.0
Seeley: 3 (S Hole)	6/12/20	13.54	16.0

Seeley: 3 (S Hole)	6/24/20	13.88	21.0
Seeley: 3 (S Hole)	7/13/20	16.25	19.0
Seeley: 3 (S Hole)	7/29/20	14.13	23.0
Seeley: 3 (S Hole)	8/17/20	13.21	20.9
Seeley: 3 (S Hole)	9/1/20	13.54	19.0

6.2 Dissolved Oxygen and Temperature Profiles

Appendix C: dissolved oxygen (mg/L and %) and temperature profiles (°C) on lakes of the Clearwater Basin in 2020.

Site	Date	Depth (m)	DO (mg/L)	DO (%)	Temperature (°C)
Alva: 1	7/30/20	0	8.96	101.3	21.4
Alva: 1	7/30/20	1	8.95	101.1	21.3
Alva: 1	7/30/20	3	9.11	101.8	20.8
Alva: 1	7/30/20	7	10.63	101.9	13.5
Alva: 1	7/30/20	10	8.96	76.2	8.3
Alva: 1	7/30/20	11	6.73	55.6	7.1
Alva: 1	7/30/20	12	6.06	48.8	6.1
Alva: 1	7/30/20	13	5.85	46.7	5.7
Alva: 1	7/30/20	15	5.53	43.6	5.3
Alva: 1	7/30/20	18	5.36	42.1	5.1
Alva: 1	7/30/20	20	5.4	42.2	5
Alva: 1	7/30/20	22	5.5	43	4.9
Alva: 1	7/30/20	27	4.48	34.8	4.7
Alva: 1	7/30/20	29	3.74	29.1	4.7
Alva: 1	8/20/20	0	8.7	97.5	20.9
Alva: 1	8/20/20	1	8.59	95.5	20.5
Alva: 1	8/20/20	3	8.63	95.4	20.3
Alva: 1	8/20/20	5	8.91	96.1	19

Alva: 1	8/20/20	8	9	80.8	10.6
Alva: 1	8/20/20	9	6.76	58.3	8.9
Alva: 1	8/20/20	10	6.25	52.4	7.7
Alva: 1	8/20/20	13	4.03	31.9	5.5
Alva: 1	8/20/20	17	4.34	34.1	5.1
Alva: 1	8/20/20	20	4.53	35.5	5
Alva: 1	8/20/20	21	4.48	35	4.9
Alva: 1	8/20/20	22	4.19	32.6	4.8
Alva: 1	8/20/20	24	2.07	16.1	4.8
Alva: 1	8/20/20	25	0.12	0.9	4.7
Alva: 1	8/20/20	27	0.16	1.3	4.8
Alva: 1	9/22/20	0	10.81	107.1	15
Alva: 1	9/22/20	1	10.74	106.5	15
Alva: 1	9/22/20	3	10.66	105.7	15
Alva: 1	9/22/20	5	10.73	106.1	14.9
Alva: 1	9/22/20	8	10.26	100.1	14.3
Alva: 1	9/22/20	10	6.99	60.7	9.1
Alva: 1	9/22/20	13	3.81	30.6	6
Alva: 1	9/22/20	15	3.45	27.4	5.5
Alva: 1	9/22/20	18	3.52	27.7	5.2
Alva: 1	9/22/20	20	3.44	27	5.1
Alva: 1	9/22/20	22	2.43	19	5
Alva: 1	9/22/20	23	1.87	14.6	5
Alva: 1	9/22/20	24	0.48	3.8	4.9
Alva: 1	9/22/20	25	0.11	0.9	4.9
Big Sky: 1	7/31/20	0	12.01	137.7	22.1
Big Sky: 1	7/31/20	1	12.07	138.4	22.1

Big Sky: 1	7/31/20	2	12.05	137.8	22
Big Sky: 1	7/31/20	3	12.21	139.2	21.9
Big Sky: 1	7/31/20	5	13.42	146.2	19.5
Big Sky: 1	7/31/20	6	12.69	128.1	15.8
Big Sky: 1	7/31/20	7	9.68	92.9	13.5
Big Sky: 1	7/31/20	7.5	7.64	71.5	12.4
Big Sky: 1	7/31/20	8	4.71	43.2	11.5
Big Sky: 1	7/31/20	9	1.98	17.8	10.7
Big Sky: 1	7/31/20	10	0.56	4.8	9.2
Big Sky: 1	7/31/20	11	0.7	5.9	8.1
Big Sky: 1	7/31/20	12	0.18	1.5	7.1
Big Sky: 1	8/20/20	0	7.48	83.4	20.7
Big Sky: 1	8/20/20	1	7.44	83	20.7
Big Sky: 1	8/20/20	2	6.93	77.2	20.7
Big Sky: 1	8/20/20	4	6.86	75.6	20.1
Big Sky: 1	8/20/20	6	6.84	71.7	17.7
Big Sky: 1	8/20/20	7	5.6	54.4	14
Big Sky: 1	8/20/20	8	3.34	30.9	11.9
Big Sky: 1	8/20/20	9	0.45	4	10.3
Big Sky: 1	8/20/20	10	0.43	3.7	9.1
Big Sky: 1	9/18/20	0	8.21	83.5	16.2
Big Sky: 1	9/18/20	1	8.06	82.1	16.2
Big Sky: 1	9/18/20	3	7.7	78.4	16.2
Big Sky: 1	9/18/20	5	8.09	82.4	16.2
Big Sky: 1	9/18/20	7	8.16	83	16.2
Big Sky: 1	9/18/20	8	3.51	34.2	14.1
Big Sky: 1	9/18/20	9	0.09	0.8	11

Big Sky: 1	9/18/20	10	0.2	1.7	10
Inez: 1 (N Hole)	7/27/20	0	8.43	95.1	21.3
Inez: 1 (N Hole)	7/27/20	1	8.43	94.8	21.1
Inez: 1 (N Hole)	7/27/20	2	8.68	96.4	20.5
Inez: 1 (N Hole)	7/27/20	6	10	99.2	15
Inez: 1 (N Hole)	7/27/20	8	8.92	79	10
Inez: 1 (N Hole)	7/27/20	9	7.39	63.4	8.7
Inez: 1 (N Hole)	7/27/20	10	4.74	38.8	6.7
Inez: 1 (N Hole)	7/27/20	13	4.33	34.6	5.8
Inez: 1 (N Hole)	7/27/20	15	3.33	26.5	5.6
Inez: 1 (N Hole)	7/27/20	18	1.26	10	5.5
Inez: 1 (N Hole)	7/27/20	20	0.43	3.4	5.5
Inez: 1 (N Hole)	7/27/20	21	0.34	2.7	5.6
Inez: 1 (N Hole)	7/27/20	22	0.29	2.3	5.6
Inez: 2 (S Hole)	7/27/20	0	8.67	97.9	21.4
Inez: 2 (S Hole)	7/27/20	1	8.61	97	21.2
Inez: 2 (S Hole)	7/27/20	2	8.39	94	20.9
Inez: 2 (S Hole)	7/27/20	3	8.49	94.7	20.8
Inez: 2 (S Hole)	7/27/20	7	9.04	81.5	10.8
Inez: 2 (S Hole)	7/27/20	8	5.8	49.1	8.1
Inez: 2 (S Hole)	7/27/20	9	5.2	42.6	6.8
Inez: 2 (S Hole)	7/27/20	10	4.69	37.8	6.1
Inez: 2 (S Hole)	7/27/20	13	3.8	30.3	5.8
Inez: 2 (S Hole)	7/27/20	15	3.34	26.6	5.7
Inez: 2 (S Hole)	7/27/20	17	3.39	26.9	5.6
Inez: 2 (S Hole)	7/27/20	19	2.42	19.2	5.5
Inez: 2 (S Hole)	7/27/20	21	0.3	2.4	5.3

Inez: 2 (S Hole)	7/27/20	22	0.17	1.4	5.3
Inez: 2 (S Hole)	7/27/20	24	0.14	1.1	5.3
Inez: 1 (N Hole)	8/31/20	0	7.67	82.2	18.7
Inez: 1 (N Hole)	8/31/20	1	7.43	79.7	18.7
Inez: 1 (N Hole)	8/31/20	3	7.51	80.5	18.7
Inez: 1 (N Hole)	8/31/20	5	7.55	81	18.7
Inez: 1 (N Hole)	8/31/20	7	7.48	71.3	13.2
Inez: 1 (N Hole)	8/31/20	8	6.17	55.7	10.8
Inez: 1 (N Hole)	8/31/20	9	4.72	40.7	8.9
Inez: 1 (N Hole)	8/31/20	10	2.94	24.5	7.4
Inez: 1 (N Hole)	8/31/20	11	1.82	15	6.8
Inez: 1 (N Hole)	8/31/20	13	1.6	12.8	6
Inez: 1 (N Hole)	8/31/20	15	1.13	9.1	5.8
Inez: 1 (N Hole)	8/31/20	17	0.72	5.7	5.7
Inez: 1 (N Hole)	8/31/20	18	0.07	0.6	5.7
Inez: 1 (N Hole)	8/31/20	19	0.1	0.8	5.6
Inez: 1 (N Hole)	8/31/20	20	0.28	2.2	5.7
Inez: 2 (S Hole)	8/31/20	0	7.51	80.5	18.7
Inez: 2 (S Hole)	8/31/20	1	7.87	84.6	18.8
Inez: 2 (S Hole)	8/31/20	3	7.79	83.7	18.8
Inez: 2 (S Hole)	8/31/20	5	7.74	83.1	18.8
Inez: 2 (S Hole)	8/31/20	7	7.98	76.8	13.6
Inez: 2 (S Hole)	8/31/20	8	5.39	47.6	9.8
Inez: 2 (S Hole)	8/31/20	9	3.95	33	7.6
Inez: 2 (S Hole)	8/31/20	10	2.87	23.5	6.8
Inez: 2 (S Hole)	8/31/20	11	1.75	14.1	6.3
Inez: 2 (S Hole)	8/31/20	13	1.2	9.6	5.9

Inez: 2 (S Hole)	8/31/20	16	0.83	6.7	5.7
Inez: 2 (S Hole)	8/31/20	18	0.1	0.8	5.6
Inez: 1 (N Hole)	9/29/20	0	10.84	94.1	9.2
Inez: 1 (N Hole)	9/29/20	1	7.8	74.8	13.5
Inez: 1 (N Hole)	9/29/20	2	7.74	74.2	13.5
Inez: 1 (N Hole)	9/29/20	5	7.66	73.4	13.5
Inez: 1 (N Hole)	9/29/20	8	7.3	69.7	13.3
Inez: 1 (N Hole)	9/29/20	9	6.22	58.4	12.5
Inez: 1 (N Hole)	9/29/20	10	1.75	14.8	8.2
Inez: 1 (N Hole)	9/29/20	11	0.64	5.3	6.8
Inez: 1 (N Hole)	9/29/20	12	0.2	1.6	6.5
Inez: 1 (N Hole)	9/29/20	13	0.12	1	6.5
Inez: 2 (S Hole)	9/29/20	0	7.81	75.2	13.6
Inez: 2 (S Hole)	9/29/20	1	7.77	74.9	13.7
Inez: 2 (S Hole)	9/29/20	2	7.79	75	13.7
Inez: 2 (S Hole)	9/29/20	5	7.66	73.7	13.6
Inez: 2 (S Hole)	9/29/20	8	7.36	70.4	13.3
Inez: 2 (S Hole)	9/29/20	9	3.36	30.1	10.5
Inez: 2 (S Hole)	9/29/20	10	3.26	28.6	9.6
Inez: 2 (S Hole)	9/29/20	11	2.09	17.7	8.2
Inez: 2 (S Hole)	9/29/20	13	0.41	3.3	6.4
Inez: 2 (S Hole)	9/29/20	15	0.07	0.6	6.1
Placid: 1 (Mid Hole)	5/20/20	0	10.53	96.8	11.6
Placid: 1 (Mid Hole)	5/20/20	5	10.62	91.4	8.8
Placid: 1 (Mid Hole)	5/20/20	10	9.32	77.5	7.4
Placid: 1 (Mid Hole)	5/20/20	15	8.24	66.7	6.3
Placid: 1 (Mid Hole)	5/20/20	20	7.26	57.3	5.3

Placid: 1 (Mid Hole)	5/20/20	25	6.3	49.3	5
Placid: 1 (Mid Hole)	5/20/20	27	3.46	27.1	4.9
Placid: 1 (Mid Hole)	5/20/20	29	0.23	1.8	4.9
Placid: 2 (N Hole)	5/20/20	0	11.25	103.3	11.5
Placid: 2 (N Hole)	5/20/20	2	10.71	95.4	10.3
Placid: 2 (N Hole)	5/20/20	5	10.44	90.4	9
Placid: 2 (N Hole)	5/20/20	10	9.41	78.2	7.3
Placid: 2 (N Hole)	5/20/20	15	8.15	65.7	6.2
Placid: 2 (N Hole)	5/20/20	18	6.73	53.5	5.5
Placid: 2 (N Hole)	5/20/20	18.5	0.7	5.6	5.5
Placid: 2 (N Hole)	5/20/20	19.5	0.28	2.3	5.5
Placid: 1 (Mid Hole)	7/19/20	0	8	88.6	20.4
Placid: 1 (Mid Hole)	7/19/20	1	8.11	88.3	19.5
Placid: 1 (Mid Hole)	7/19/20	5	8.82	88.5	15.5
Placid: 1 (Mid Hole)	7/19/20	10	7.18	61.7	8.7
Placid: 1 (Mid Hole)	7/19/20	13	6.52	54.5	7.5
Placid: 1 (Mid Hole)	7/19/20	17	6.16	50.6	6.9
Placid: 1 (Mid Hole)	7/19/20	20	5.36	43	5.9
Placid: 1 (Mid Hole)	7/19/20	22	4.61	36.7	5.7
Placid: 1 (Mid Hole)	7/19/20	23	4.17	33.1	5.6
Placid: 1 (Mid Hole)	7/19/20	24	4.43	35.2	5.6
Placid: 1 (Mid Hole)	7/19/20	24	0.18	1.5	5.4
Placid: 1 (Mid Hole)	7/19/20	25	0.22	1.7	5.3
Placid: 1 (Mid Hole)	7/19/20	26	0.33	2.6	5.3
Placid: 1 (Mid Hole)	7/19/20	27	0.63	5	5.4
Placid: 2 (N Hole)	7/19/20	0	8.15	89.6	20
Placid: 2 (N Hole)	7/19/20	1	8.21	88.7	19.2

Placid: 2 (N Hole)	7/19/20	5	8.52	84.9	15.2
Placid: 2 (N Hole)	7/19/20	10	6.82	58.4	8.6
Placid: 2 (N Hole)	7/19/20	13	6.26	52.6	7.8
Placid: 2 (N Hole)	7/19/20	15	6.14	51.2	7.4
Placid: 2 (N Hole)	7/19/20	17	4.78	38.6	6.2
Placid: 2 (N Hole)	7/19/20	17.5	1.31	10.6	6.1
Placid: 2 (N Hole)	7/19/20	18	0.3	2.4	6.2
Placid: 1 (Mid Hole)	8/28/20	0	10.04	110.8	20.2
Placid: 1 (Mid Hole)	8/28/20	1	10.03	110	19.9
Placid: 1 (Mid Hole)	8/28/20	3	10.15	110.7	19.6
Placid: 1 (Mid Hole)	8/28/20	7	10.06	101.5	15.8
Placid: 1 (Mid Hole)	8/28/20	8	7.97	74.4	12.2
Placid: 1 (Mid Hole)	8/28/20	9	7.56	68.1	10.7
Placid: 1 (Mid Hole)	8/28/20	10	6.63	58	9.5
Placid: 1 (Mid Hole)	8/28/20	15	6.42	52.7	6.9
Placid: 1 (Mid Hole)	8/28/20	19	4.49	36.2	6.1
Placid: 1 (Mid Hole)	8/28/20	23	3.52	28.1	5.7
Placid: 1 (Mid Hole)	8/28/20	24	2.37	18.8	5.5
Placid: 1 (Mid Hole)	8/28/20	25	0.72	5.7	5.4
Placid: 1 (Mid Hole)	8/28/20	28	0.15	1.2	5.4
Placid: 2 (N Hole)	8/28/20	0	10.19	112.8	20.3
Placid: 2 (N Hole)	8/28/20	1	10.18	111.3	19.7
Placid: 2 (N Hole)	8/28/20	3	10.21	111.2	19.5
Placid: 2 (N Hole)	8/28/20	6	9.48	93.1	14.5
Placid: 2 (N Hole)	8/28/20	10	6.62	58.1	9.6
Placid: 2 (N Hole)	8/28/20	13	5.54	47.1	8.2
Placid: 2 (N Hole)	8/28/20	16	3.41	28.2	7.2

Placid: 2 (N Hole)	8/28/20	17	0.28	2.3	7.3
Placid: 2 (N Hole)	8/28/20	18	0.12	1	7.2
Placid: 2 (N Hole)	8/28/20	20	0.21	1.7	7.1
Placid: 1 (Mid Hole)	9/30/20	0	8.64	86.7	15.6
Placid: 1 (Mid Hole)	9/30/20	3	8.87	85.8	13.8
Placid: 1 (Mid Hole)	9/30/20	5	8.16	78.7	13.7
Placid: 1 (Mid Hole)	9/30/20	8	8.02	77.1	13.6
Placid: 1 (Mid Hole)	9/30/20	12	3.58	30.7	8.7
Placid: 1 (Mid Hole)	9/30/20	15	2.91	23.9	6.8
Placid: 1 (Mid Hole)	9/30/20	18	2.5	20.1	6.1
Placid: 1 (Mid Hole)	9/30/20	21	1.76	14	5.7
Placid: 1 (Mid Hole)	9/30/20	24	0.12	1	5.4
Placid: 2 (N Hole)	9/30/20	0	8.95	88.6	14.9
Placid: 2 (N Hole)	9/30/20	2	8.86	86	14
Placid: 2 (N Hole)	9/30/20	5	8.77	84.5	13.7
Placid: 2 (N Hole)	9/30/20	10	3.41	29.9	9.6
Placid: 2 (N Hole)	9/30/20	12	2.84	23.7	7.6
Placid: 2 (N Hole)	9/30/20	15	2.92	24	7
Placid: 2 (N Hole)	9/30/20	17	0.18	1.5	6.6
Salmon: 1 (N Hole)	7/17/20	0	7.6	82.3	19.2
Salmon: 1 (N Hole)	7/17/20	3	8.35	88.7	18.3
Salmon: 1 (N Hole)	7/17/20	5	7.75	79	16.3
Salmon: 1 (N Hole)	7/17/20	8	5.42	50.5	12.1
Salmon: 1 (N Hole)	7/17/20	9	5.21	48.1	11.8
Salmon: 1 (N Hole)	7/17/20	11	4.81	43.7	11.1
Salmon: 1 (N Hole)	7/17/20	15	3.19	28.2	9.9
Salmon: 1 (N Hole)	7/17/20	17	2.84	25.1	9.9

Salmon: 1 (N Hole)	7/17/20	18	0.18	1.6	9.5
Salmon: 2N (Mid N Hole)	7/17/20	0	7.72	83.9	19.4
Salmon: 2N (Mid N Hole)	7/17/20	2	8.15	88.4	19.3
Salmon: 2N (Mid N Hole)	7/17/20	5	7.51	75.3	15.5
Salmon: 2N (Mid N Hole)	7/17/20	9	5.27	48.6	11.7
Salmon: 2N (Mid N Hole)	7/17/20	12	4.52	40.6	10.6
Salmon: 2N (Mid N Hole)	7/17/20	15	3.77	33.3	9.8
Salmon: 2N (Mid N Hole)	7/17/20	18	0.92	8	9.1
Salmon: 2N (Mid N Hole)	7/17/20	20	0.12	1	9.1
Salmon: 2S (Mid S Hole)	7/17/20	0	8.07	87.6	19.3
Salmon: 2S (Mid S Hole)	7/17/20	1	8.04	88.3	19
Salmon: 2S (Mid S Hole)	7/17/20	2	8.31	88.9	18.6
Salmon: 2S (Mid S Hole)	7/17/20	5	6.88	66.9	14.1
Salmon: 2S (Mid S Hole)	7/17/20	10	4.6	41.7	11
Salmon: 2S (Mid S Hole)	7/17/20	11	4	36	10.7
Salmon: 2S (Mid S Hole)	7/17/20	13	2.65	23.6	10.1
Salmon: 2S (Mid S Hole)	7/17/20	15	0.23	2	9.1
Salmon: 3 (S Hole)	7/17/20	0	8.35	90.5	19.3
Salmon: 3 (S Hole)	7/17/20	1	8.31	89.8	19.1
Salmon: 3 (S Hole)	7/17/20	3	8.01	79.9	15.2
Salmon: 3 (S Hole)	7/17/20	6	5.42	50.2	11.9
Salmon: 3 (S Hole)	7/17/20	10	4.75	43.4	11.3
Salmon: 3 (S Hole)	7/17/20	11	3.63	33	11
Salmon: 3 (S Hole)	7/17/20	13	0.44	4	10.6
Salmon: 1 (N Hole)	8/28/20	0	11.38	124.3	19.6
Salmon: 1 (N Hole)	8/28/20	3	11.22	120	18.6
Salmon: 1 (N Hole)	8/28/20	6	10.68	112.1	17.7

Salmon: 1 (N Hole)	8/28/20	8	5.53	54.9	15
Salmon: 1 (N Hole)	8/28/20	9	3.35	32.1	13.4
Salmon: 1 (N Hole)	8/28/20	10	2.93	27.7	12.8
Salmon: 1 (N Hole)	8/28/20	13	1.26	11.4	11.2
Salmon: 1 (N Hole)	8/28/20	15	0.26	2.3	10.5
Salmon: 2N (Mid N Hole)	8/28/20	0	10.87	121	20.6
Salmon: 2N (Mid N Hole)	8/28/20	3	11.25	121.1	18.9
Salmon: 2N (Mid N Hole)	8/28/20	5	9.83	104	18.1
Salmon: 2N (Mid N Hole)	8/28/20	7	4.83	47.9	14.9
Salmon: 2N (Mid N Hole)	8/28/20	8	4.45	43.4	14.2
Salmon: 2N (Mid N Hole)	8/28/20	10	2.55	23.9	12.4
Salmon: 2N (Mid N Hole)	8/28/20	12	1.81	16.7	11.6
Salmon: 2N (Mid N Hole)	8/28/20	14	1.05	9.6	11
Salmon: 2N (Mid N Hole)	8/28/20	16	0.3	2.7	10.4
Salmon: 2S (Mid S Hole)	8/28/20	0	9.96	110.7	20.5
Salmon: 2S (Mid S Hole)	8/28/20	2	11.35	123.1	19.3
Salmon: 2S (Mid S Hole)	8/28/20	5	9.34	98.2	17.8
Salmon: 2S (Mid S Hole)	8/28/20	8	4.07	39.6	14.1
Salmon: 2S (Mid S Hole)	8/28/20	9	2.37	22.3	12.7
Salmon: 2S (Mid S Hole)	8/28/20	10	1.84	17.1	12.1
Salmon: 2S (Mid S Hole)	8/28/20	12	0.36	3.3	11.3
Salmon: 3 (S Hole)	8/28/20	0	10.5	117	20.7
Salmon: 3 (S Hole)	8/28/20	2	11.13	121.2	19.5
Salmon: 3 (S Hole)	8/28/20	5	10.57	113.3	18.7
Salmon: 3 (S Hole)	8/28/20	6	7.04	71.8	16.3
Salmon: 3 (S Hole)	8/28/20	7	5.3	52.1	14.5
Salmon: 3 (S Hole)	8/28/20	10	0.31	2.9	11.4

Salmon: 1 (N Hole)	9/23/20	0	12.31	121.8	14.9
Salmon: 1 (N Hole)	9/23/20	2	11.96	118.2	14.9
Salmon: 1 (N Hole)	9/23/20	5	12.34	121.7	14.8
Salmon: 1 (N Hole)	9/23/20	7	12.32	121.4	14.7
Salmon: 1 (N Hole)	9/23/20	10	11.26	110.7	14.6
Salmon: 1 (N Hole)	9/23/20	12	9.58	93	14
Salmon: 1 (N Hole)	9/23/20	13	6.63	63.4	13.4
Salmon: 1 (N Hole)	9/23/20	14	0.88	8.2	12.5
Salmon: 1 (N Hole)	9/23/20	15	0.17	1.5	12
Salmon: 2N (Mid N Hole)	9/23/20	0	11.79	117.1	15.1
Salmon: 2N (Mid N Hole)	9/23/20	2	11.63	115.4	15
Salmon: 2N (Mid N Hole)	9/23/20	5	11.34	112.2	14.9
Salmon: 2N (Mid N Hole)	9/23/20	7	8.37	82.6	14.8
Salmon: 2N (Mid N Hole)	9/23/20	10	4	38.5	13.6
Salmon: 2N (Mid N Hole)	9/23/20	12	0.45	4.2	12.6
Salmon: 2N (Mid N Hole)	9/23/20	14	0.12	1.1	11.6
Salmon: 2S (Mid S Hole)	9/23/20	0	11.6	115.2	15.1
Salmon: 2S (Mid S Hole)	9/23/20	2	11.52	114.3	15
Salmon: 2S (Mid S Hole)	9/23/20	5	11.13	110.2	14.9
Salmon: 2S (Mid S Hole)	9/23/20	7	10.77	106.6	14.9
Salmon: 2S (Mid S Hole)	9/23/20	8	6.28	62	14.8
Salmon: 2S (Mid S Hole)	9/23/20	9	3.43	33.3	14
Salmon: 2S (Mid S Hole)	9/23/20	10	2.12	20.4	13.5
Salmon: 2S (Mid S Hole)	9/23/20	12	0.19	1.7	11.7
Salmon: 3 (S Hole)	9/23/20	0	11.4	113.1	15
Salmon: 3 (S Hole)	9/23/20	2	11.17	110.3	14.8
Salmon: 3 (S Hole)	9/23/20	5	11.09	109.5	14.8

Salmon: 3 (S Hole)	9/23/20	7	10.88	107.4	14.8
Salmon: 3 (S Hole)	9/23/20	8	9.11	89	14.3
Salmon: 3 (S Hole)	9/23/20	10	0.25	2.3	11.4
Seeley: 2 (Mid Hole)	7/29/20	0	7.11	84	23.7
Seeley: 2 (Mid Hole)	7/29/20	1	7.29	84.3	22.5
Seeley: 2 (Mid Hole)	7/29/20	3	7.14	81.6	22
Seeley: 2 (Mid Hole)	7/29/20	6	8.01	76.7	13.4
Seeley: 2 (Mid Hole)	7/29/20	10	7.28	63	9
Seeley: 2 (Mid Hole)	7/29/20	12	6.84	58.8	8.8
Seeley: 2 (Mid Hole)	7/29/20	15	6.68	57.2	8.6
Seeley: 2 (Mid Hole)	7/29/20	20	6.18	52.6	8.3
Seeley: 2 (Mid Hole)	7/29/20	20.5	5.92	50.2	8.2
Seeley: 2 (Mid Hole)	7/29/20	21	5.72	48.6	8.2
Seeley: 2 (Mid Hole)	7/29/20	21.5	5.13	43.5	8.1
Seeley: 2 (Mid Hole)	7/29/20	22	4.93	41.8	8.1
Seeley: 2 (Mid Hole)	7/29/20	23	0.33	2.8	8.3
Seeley: 3 (S Hole)	7/29/20	0	7.27	86.3	23.9
Seeley: 3 (S Hole)	7/29/20	1	7.35	85.7	23
Seeley: 3 (S Hole)	7/29/20	3	7.48	85.1	21.7
Seeley: 3 (S Hole)	7/29/20	5	7.93	81.7	16.8
Seeley: 3 (S Hole)	7/29/20	10	6.75	58.2	8.8
Seeley: 3 (S Hole)	7/29/20	13	6	51.3	8.5
Seeley: 3 (S Hole)	7/29/20	16	4.61	39	8.1
Seeley: 3 (S Hole)	7/29/20	18	4.16	35.1	8
Seeley: 3 (S Hole)	7/29/20	20	3.81	32.1	7.9
Seeley: 3 (S Hole)	7/29/20	20.5	3.12	26.3	7.9
Seeley: 3 (S Hole)	7/29/20	20.75	0.54	4.6	7.9

Seeley: 3 (S Hole)	7/29/20	21	0.46	3.9	7.9
Seeley: 3 (S Hole)	7/29/20	22	0.33	2.8	7.8
Seeley: 3 (S Hole)	7/29/20	23	0.27	2.3	7.9
Seeley: 2 (Mid Hole)	8/17/20	0	7.8	88.5	21.6
Seeley: 2 (Mid Hole)	8/17/20	1	7.87	87.8	20.7
Seeley: 2 (Mid Hole)	8/17/20	3	7.9	87.6	20.4
Seeley: 2 (Mid Hole)	8/17/20	6	7.19	69.7	14
Seeley: 2 (Mid Hole)	8/17/20	10	6.44	55.8	9.2
Seeley: 2 (Mid Hole)	8/17/20	13	5.64	48.6	8.8
Seeley: 2 (Mid Hole)	8/17/20	15	5.95	51.1	8.7
Seeley: 2 (Mid Hole)	8/17/20	18	5.49	47	8.5
Seeley: 2 (Mid Hole)	8/17/20	19	5.43	46.4	8.5
Seeley: 2 (Mid Hole)	8/17/20	19.5	5.4	46	8.5
Seeley: 2 (Mid Hole)	8/17/20	20	0.19	1.6	8.4
Seeley: 3 (S Hole)	8/17/20	0	7.83	88.2	21.2
Seeley: 3 (S Hole)	8/17/20	1	7.74	86.7	20.9
Seeley: 3 (S Hole)	8/17/20	2	7.93	88.2	20.5
Seeley: 3 (S Hole)	8/17/20	5	7.83	83.1	18.2
Seeley: 3 (S Hole)	8/17/20	6	6.65	67.5	16.1
Seeley: 3 (S Hole)	8/17/20	7	5.89	54.8	12.2
Seeley: 3 (S Hole)	8/17/20	8	5.49	48.4	9.8
Seeley: 3 (S Hole)	8/17/20	9	5.34	46.5	9.3
Seeley: 3 (S Hole)	8/17/20	10	5.24	45.3	9
Seeley: 3 (S Hole)	8/17/20	12	4.94	42.5	8.8
Seeley: 3 (S Hole)	8/17/20	14	4.04	34.6	8.6
Seeley: 3 (S Hole)	8/17/20	17	2.99	25.4	8.2
Seeley: 3 (S Hole)	8/17/20	20	1.45	12.2	8

Seeley: 3 (S Hole)	8/17/20	22	0.16	1.3	8
Seeley: 2 (Mid Hole)	9/17/20	0	8.13	82.8	16.2
Seeley: 2 (Mid Hole)	9/17/20	1	8.06	82.2	16.3
Seeley: 2 (Mid Hole)	9/17/20	3	8.15	83	16.2
Seeley: 2 (Mid Hole)	9/17/20	5	7.74	78.5	16
Seeley: 2 (Mid Hole)	9/17/20	8	4.28	39.7	12
Seeley: 2 (Mid Hole)	9/17/20	10	3.93	34.8	10
Seeley: 2 (Mid Hole)	9/17/20	13	4.41	38.6	9.4
Seeley: 2 (Mid Hole)	9/17/20	16	4.37	38	9.2
Seeley: 2 (Mid Hole)	9/17/20	18	4	34.6	9
Seeley: 2 (Mid Hole)	9/17/20	20	2.11	18.2	8.8
Seeley: 2 (Mid Hole)	9/17/20	22	0.09	0.8	8.8
Seeley: 3 (S Hole)	9/17/20	0	7.98	81.6	16.4
Seeley: 3 (S Hole)	9/17/20	2	8.23	84.2	16.5
Seeley: 3 (S Hole)	9/17/20	5	7.6	77.2	16.1
Seeley: 3 (S Hole)	9/17/20	7	4.53	43.2	13.3
Seeley: 3 (S Hole)	9/17/20	10	3.93	34.9	10.1
Seeley: 3 (S Hole)	9/17/20	12	3.44	30.2	9.6
Seeley: 3 (S Hole)	9/17/20	15	2.15	18.6	9
Seeley: 3 (S Hole)	9/17/20	17	0.79	6.8	8.7
Seeley: 3 (S Hole)	9/17/20	20	0.09	0.7	8.4