North Lake Monitoring 2022

North Lake Management District

Kevin Du

2/14/2023

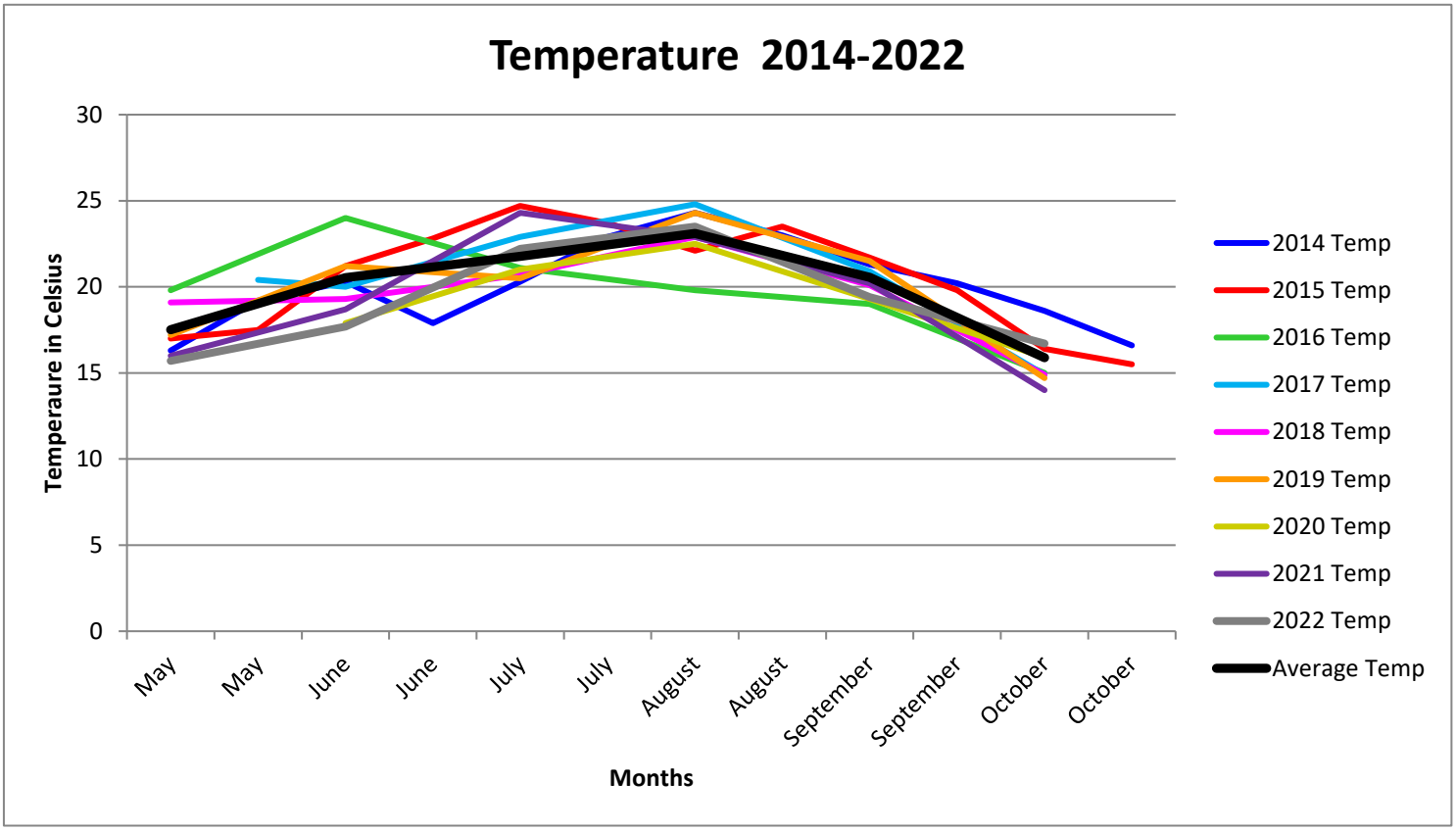

Figure 1: Surface temperatures are fairly stable. No significant differences between average temperature and individual years. Temperature criteria is 18°C due to presence of rainbow trout in the lake, however temperature measurements used in the graph is only surface temperature and is not representative of the rainbow trout's habitat in the water column. For 2022, temperatures were within expected range.

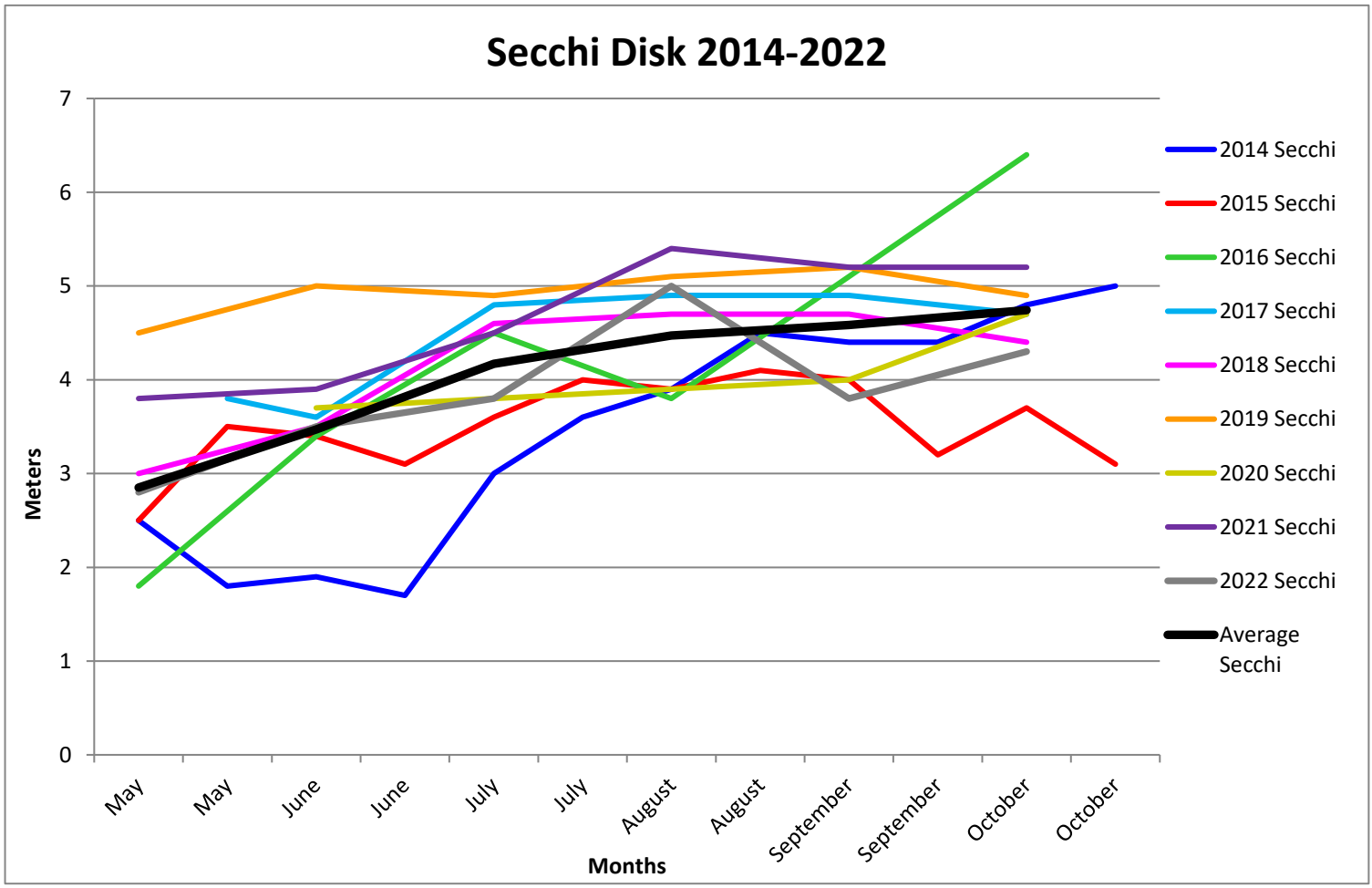

Figure 2: Clarity of North Lake varied during beginning of summer and stabilizes towards fall. Clarity generally increases towards end of summer/beginning of fall. Clarity of the lake for 2021 was high and was above the average for the whole year. In 2022, clarity of the lake was slightly lower overall compared to 2021.

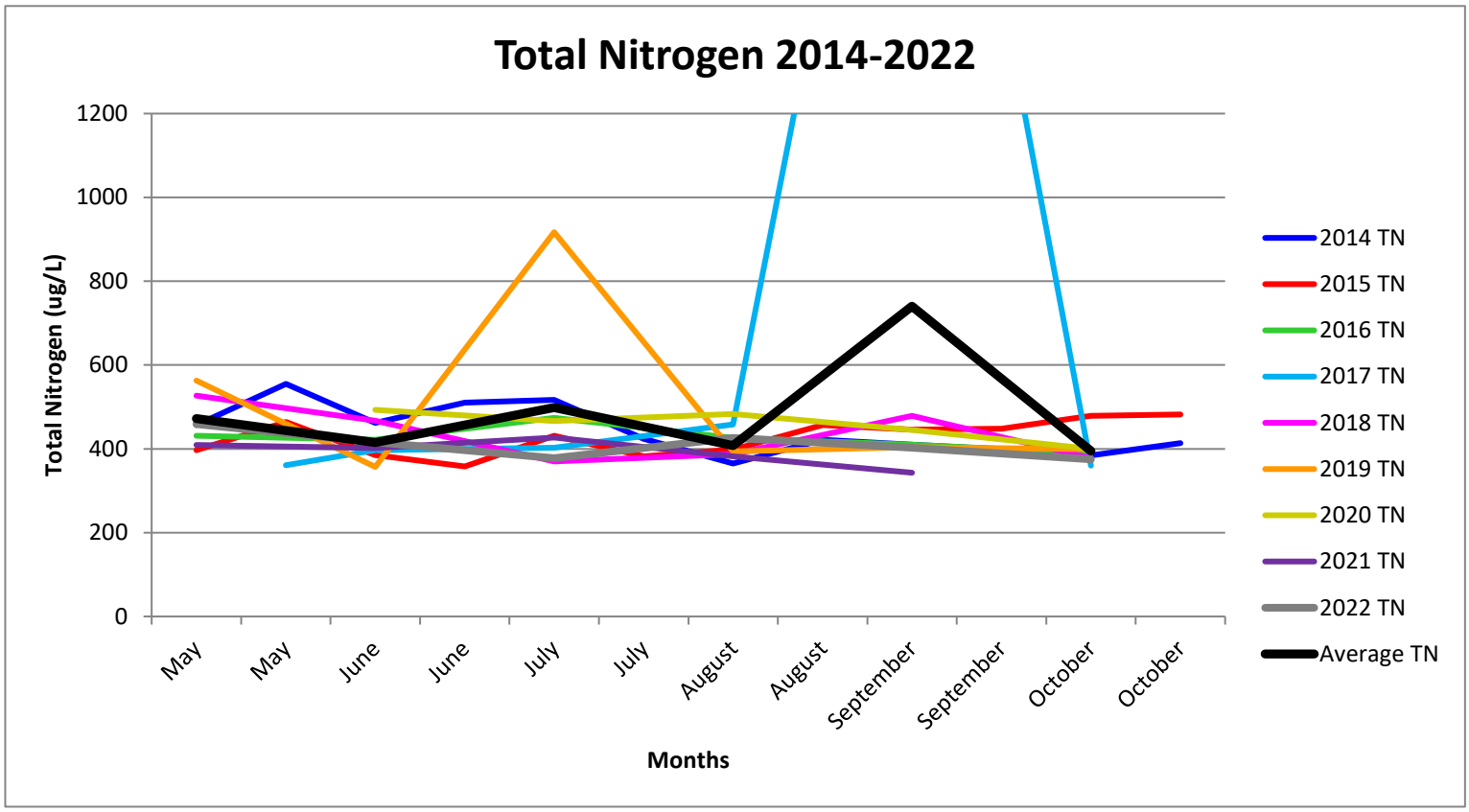

Figure 3: No criteria for total nitrogen. Generally, the lower the value the better. Total nitrogen levels are relatively stable except for a couple spikes during 2017 and 2019 which correlate with spike of total phosphorous seen below. 2022 total nitrogen stayed around 400 ug/L as expected.

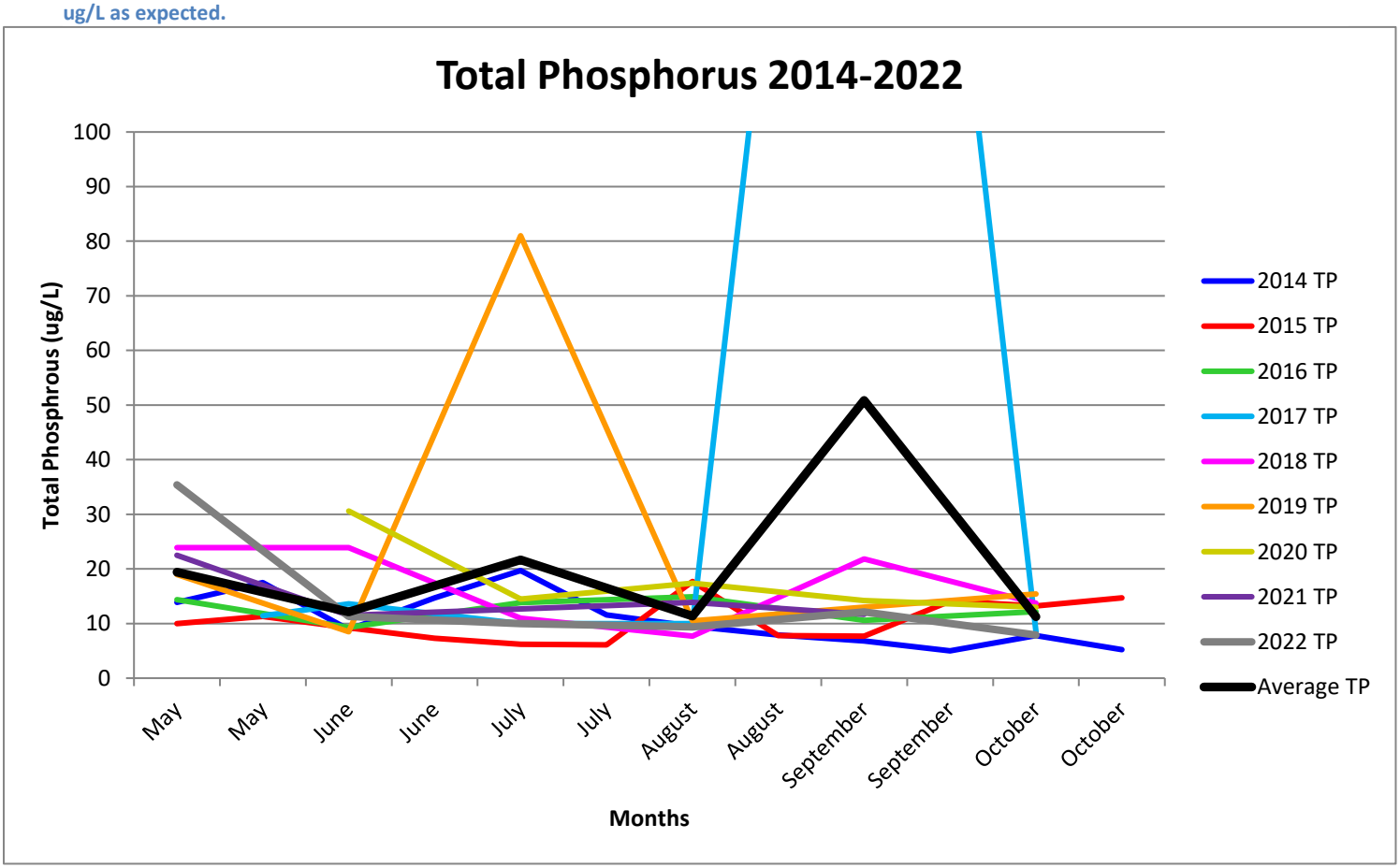

Figure 4: North Lake is within the Puget Lowlands ecoregion therefore its recommends to take action to study the lake if concentrations are greater than 20 ug/L. Majority of the data points are below the 20 ug/L action value, except for a few instances during 2017, 2018, 2019, and 2020. If outliers are removed the average trend line would be below the 20 ug/L. In 2022 concentrations are as expected with highest concentration in the first month or two and then starts to trend down.

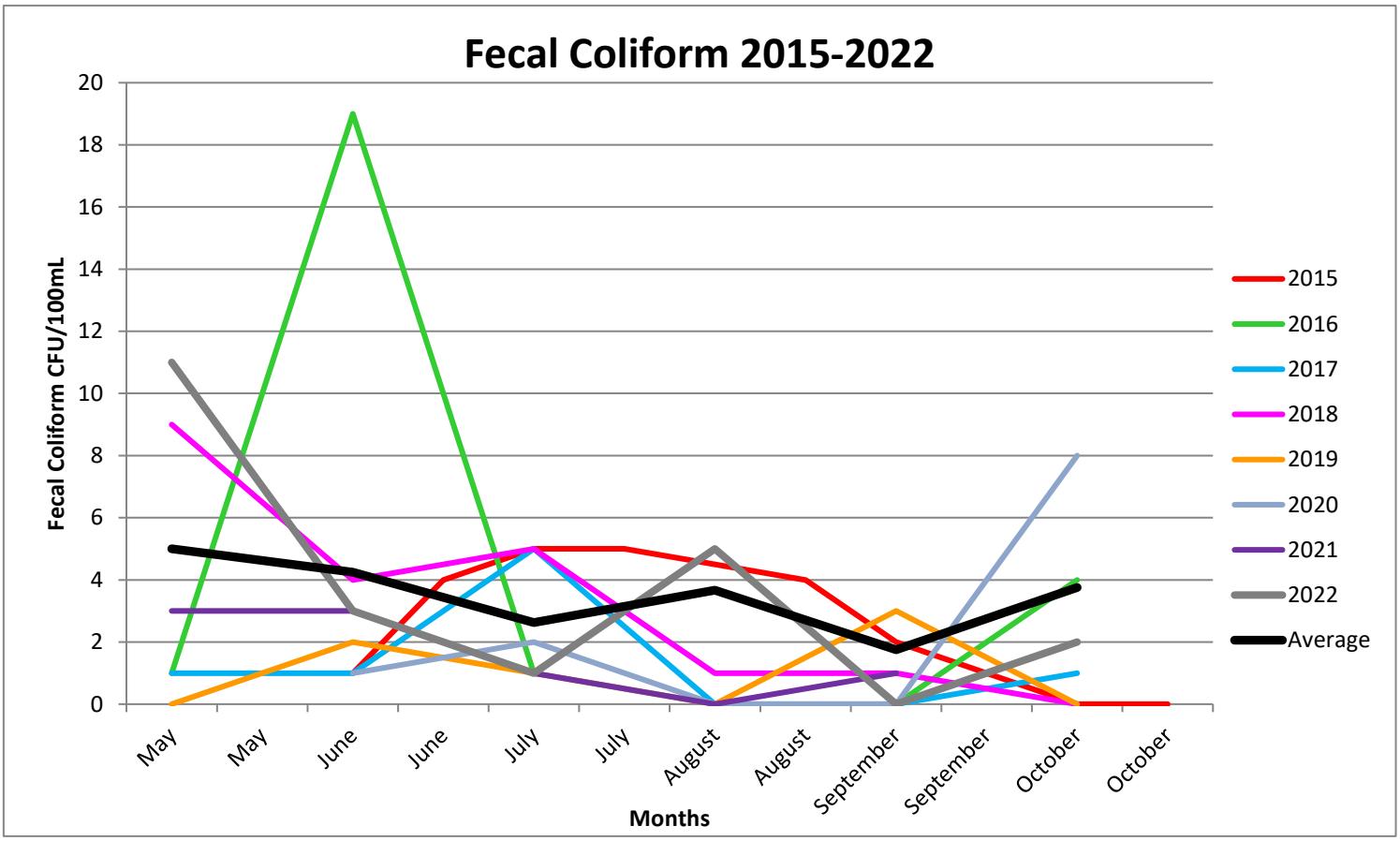

Figure 5: Criteria is 100 CFU/100mL and results are not close to reaching the 100 CFU/100mL threshold. 2022 measurements were higher in May than usual, but still well below the criteria.

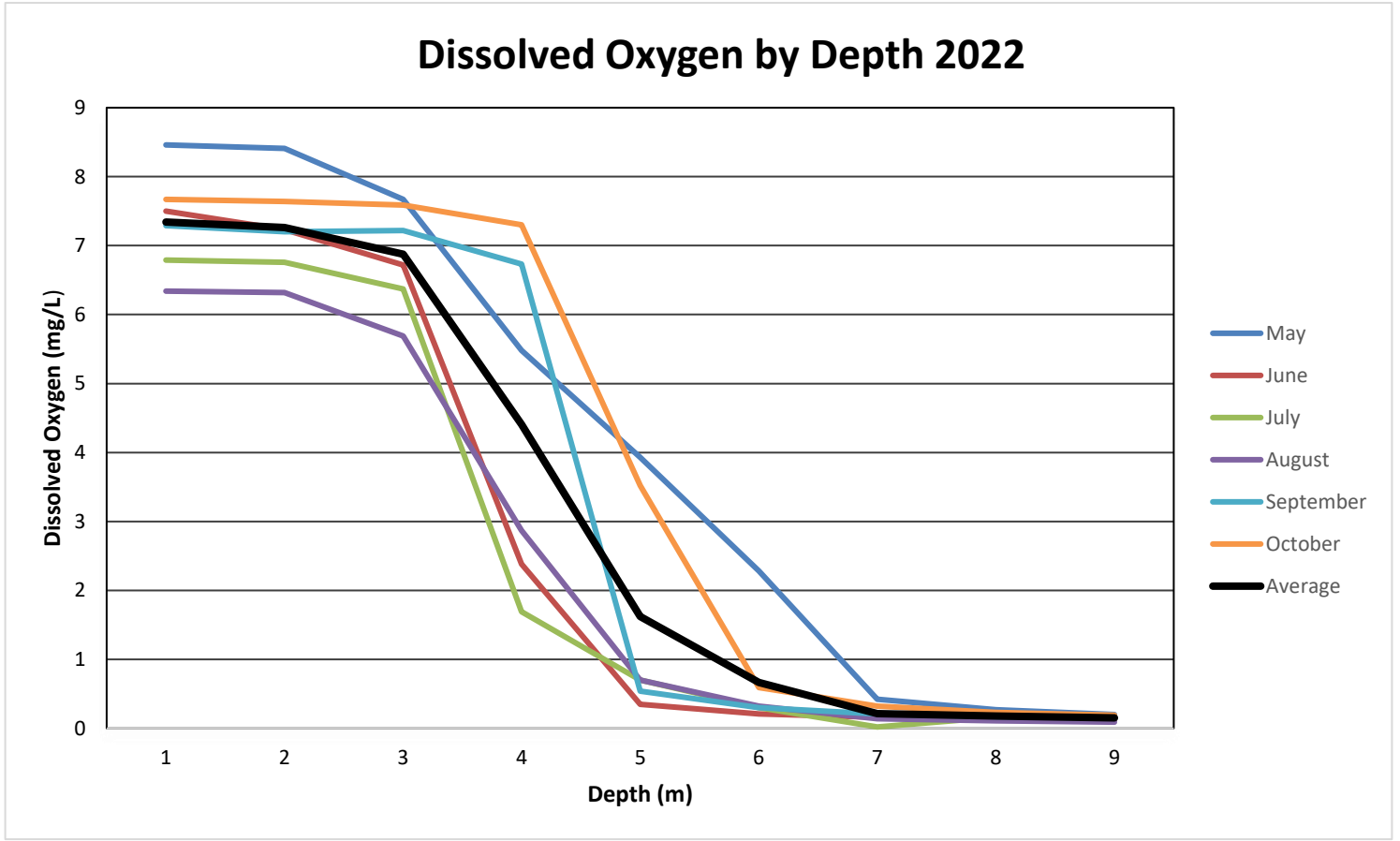

Figure 6: The concentration of dissolved oxygen drops significantly around the 4-meter mark. The criteria of dissolved oxygen for Redband trout a subspecies of rainbow trout lakes is 8 mg/L. Generally, the higher the dissolved oxygen the better. All DO measurements for North Lake 2019, 2020, 2021 were below the 8 mg/L concentration. For 2022 it is fairly similar to last years DO measurement.

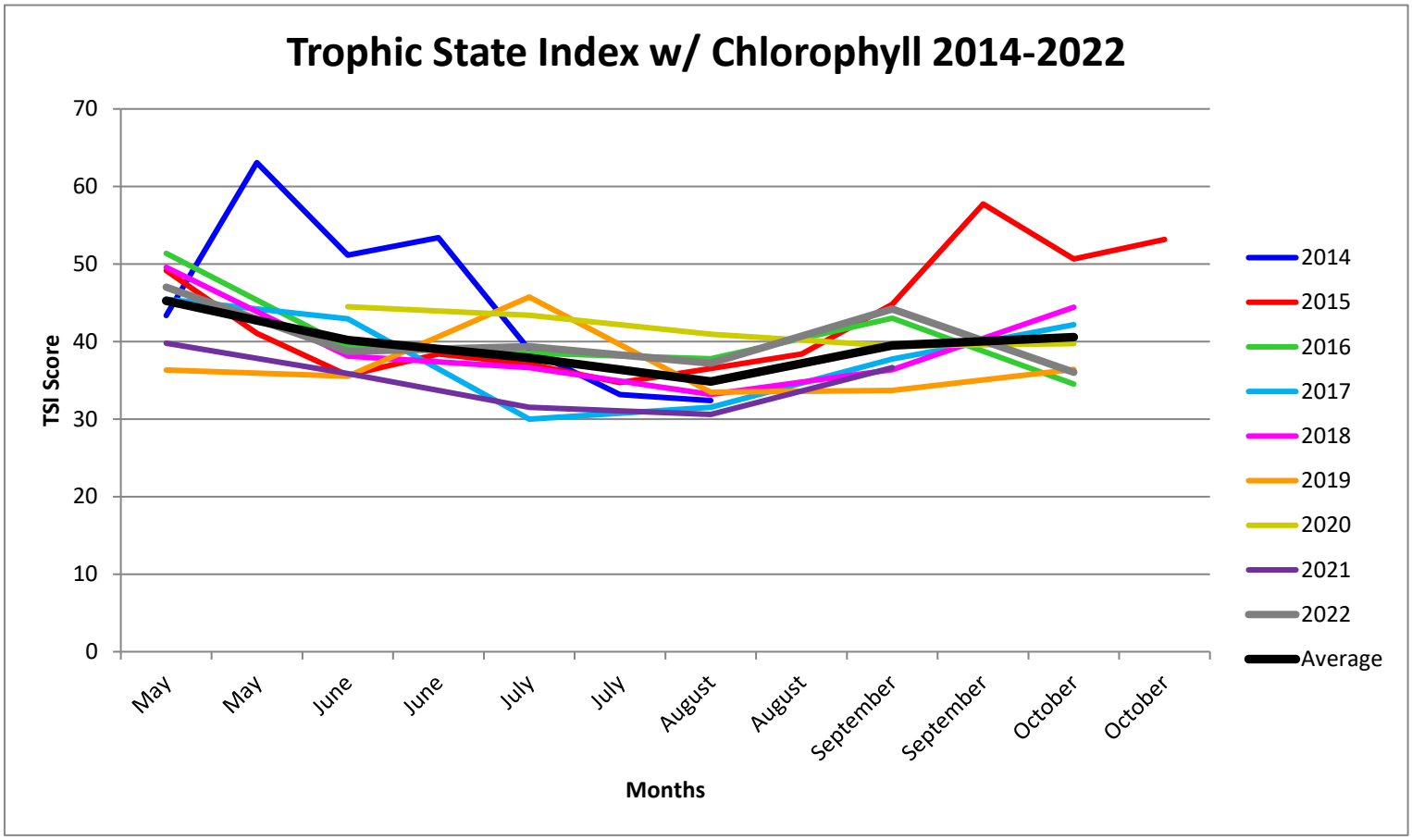

Figure 7: TSI based on Chlorophyll-a abundance. Chlorophyll-a is the most accurate representation of TSI score for the summer as noted by Carlson the developer of TSI value system. Average TSI score ranges between 35-58 which is considered to be mesotrophic/eutrophic. The 2022 TSI score ranges between 36-47 which is considered to be between oligotrophic and mesotrophic. Slightly higher range compared to 2021 TSI of 30-39.

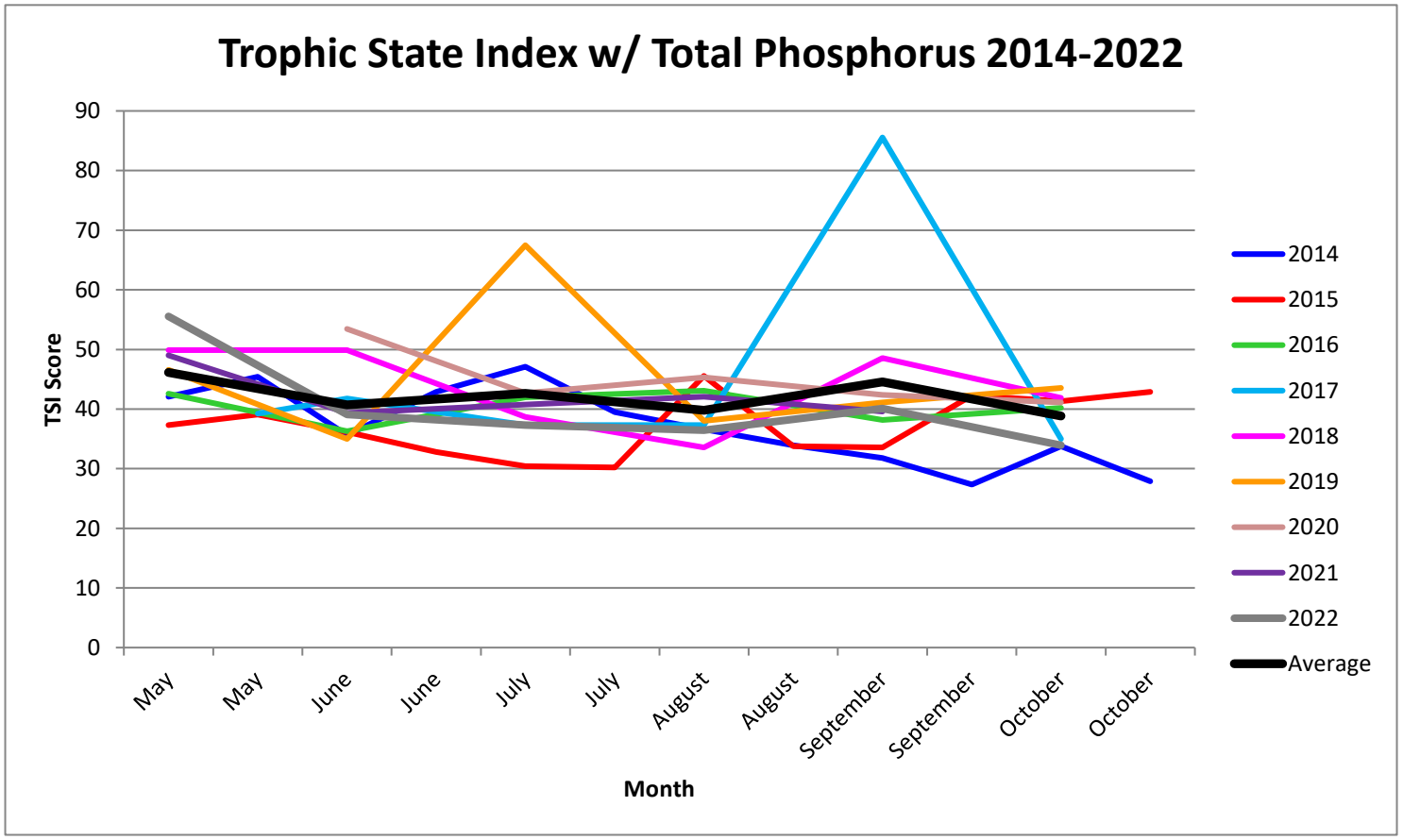

Figure 8: TSI based on total phosphorus. Average score ranges from 34-48 which means the lake is mesotrophic. 2022 TSI value ranged from 34-55 which indicates the lake is mesotrophic/eutrophic based on its total phosphorus concentration and is similar to last year.

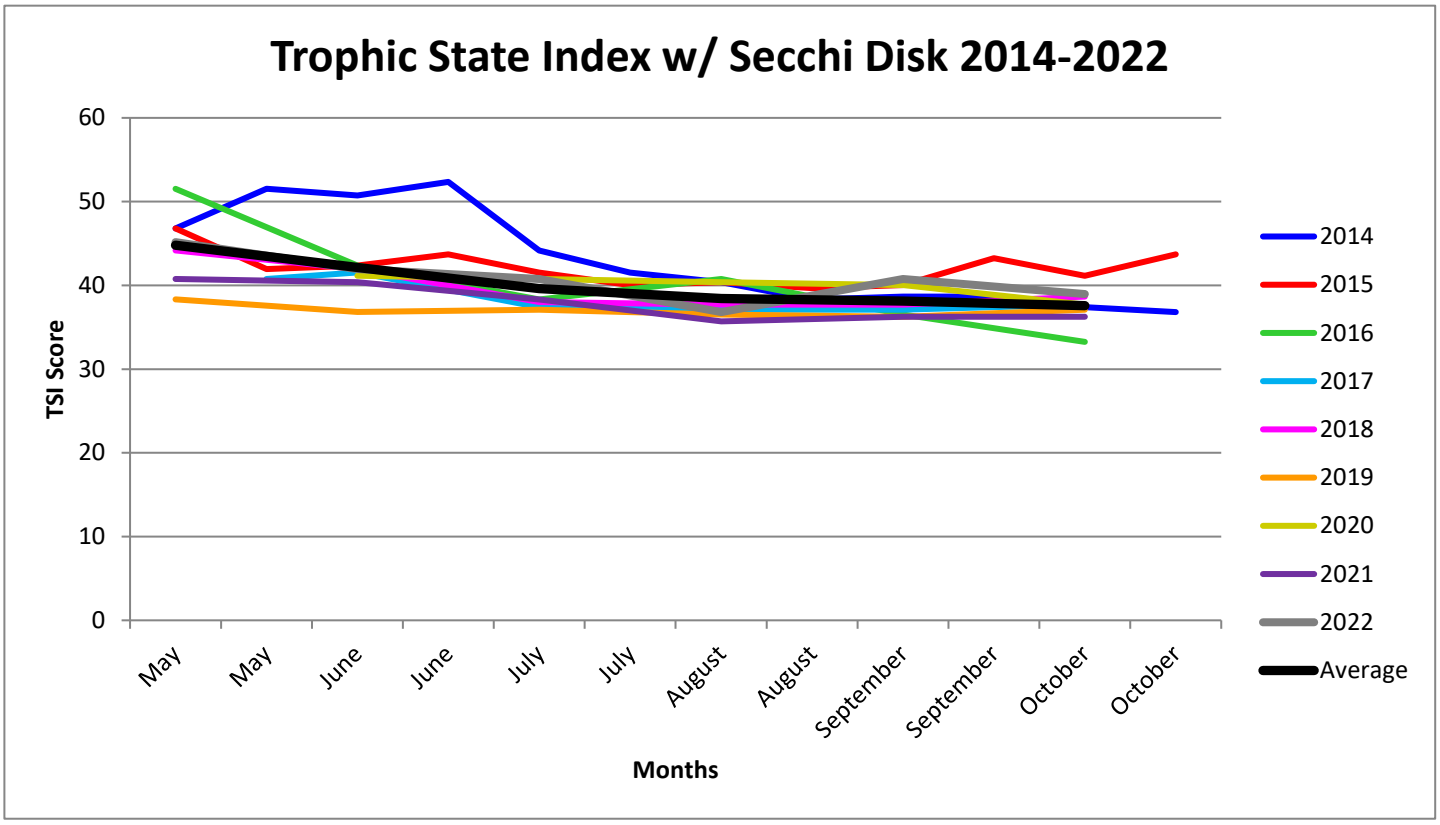

Figure 9: TSI based on secchi disk. Average TSI score ranges from 38-48 which means the lake is mesotrophic. 2022 TSI score ranged from 37-45 which means the lake is in between oligotrophic and mesotrophic and is roughly the same as last year.

TSI Table (Carlson, 1977)			
TSI Value	**Attributes**	**Water Supply**	**Add fishing**
<30	Oligotrophy: Clear water, oxygen throughout the year in the hypolimnion.	Water may be suitable for an unfiltered water supply.	Salmonid fisheries dominate.
30-40	Hypolimnia of shallower lakes may become anoxic.		Salmonid fisheries in deep lakes only.
40-50	Mesotrophy: Water moderately clear; increasing probability of hypolimnetic anoxia during summer.	Iron, manganese, taste, and odor problems worsen. Raw water turbidity requires filtration.	Hypolimnetic anoxia results in loss of salmonids. Walleye may predominate
50-60	Eutrophy: Anoxic hypolimnia, macrophyte problems possible.		Warm-water fisheries only. Bass may dominate.
60-70	Blue-green algae dominate, algal scums and macrophyte problems.	Episodes of severe taste and odor problem.	Nuisance macrophytes, algal scum and transparency may discourage swimming and boating.
70-80	Hypereutrophy: (light limited productivity). Dense algae and macrophytes.		
>80	Algal scums, few macrophytes.		Rough fish dominate; summer fish kills possible.