

**TELLICO RESERVOIR
WATER CLARITY
MONITORING PROGRAM:**

Report for 2018 through 2020

By

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and

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**Water Quality Improvement Committee
Watershed Association of the Tellico Reservoir**

Acknowledgements

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Tellico Reservoir Water Clarity Monitoring Program

Report of Activities

2018 -2020

Tellico Reservoir is perceived to have good water quality, but many of the streams flowing into the reservoir are listed as impaired for bacteria and high levels of nutrients. Though the pollutants are normally confined to the streams, a heavy rain event can cause that water (and its contents) to flow into the reservoir (Lucas and Waldrop, 2018).

Many states (Minnesota, Alabama, Mississippi, Utah) have citizen volunteers that regularly monitor lakes and streams. Minnesota has had a lake monitoring program in effect for over 40 years, where thousands of volunteers have collected water clarity data on over 4,000 lakes using a secchi disk. The State of Minnesota states that “water clarity is an important indicator of lake health. It signifies the amount of algae in the water, which can affect plant, insect, fish and wildlife communities. Long-term monitoring can help detect signs of degradation to a lake” (Minnesota PCA website).

The North American Lake Management Society (NALMS) sponsors the Secchi Dip-In program where volunteers make water visibility observations during the month of July. NALMS has a website with specific instructions on collecting data, and a data portal for recording observations.

Secchi Disk used to measure water clarity in lakes



The WQIC began a water clarity monitoring program on Tellico Reservoir in 2018. A secchi disk was used to measure the clarity of the water per EPA guidelines (EPA 2017). A secchi disk is an 8 inch disc colored black and white in a checkerboard fashion. It is lowered into the water till no longer visible. The depth where the disc disappears is a measure of clarity and is referred to as secchi disk visibility or secchi depth.

In 2018, secchi disk visibility and temperature were collected mainly from the courtesy piers at the Clear Creek Boat Ramp and the Tellico Village Yacht Club. Secchi disk visibility and temperature was collected at 4 sites from piers, mainly the Clear Creek Boat Ramp and the Tellico Village Yacht Club courtesy pier. Other pier sites where limited data was collected was Sequoyah Marina Courtesy Pier and the boat ramp on the tail water to Tellico Reservoir.

In 2019 and 2020 in addition to the Yacht Club and Clear Creek sites, other sites were frequently visited: Morganton Boat Ramp courtesy pier, Fort Loudon State Park kayak launch pier, Toqua Boat Ramp courtesy pier. Other pier sites where limited data were collected was Sequoyah Marina courtesy pier, Harrison Branch Boat Ramp courtesy pier, and the boat ramp on the tail water to Tellico Reservoir (reference to Watts Bar Reservoir),

In September 2018 a sampling run was made by boat to collect visibility data on the embayments of Fork Creek, Baker Creek, and Bat Creek. This data was collected to compare with visibility measured during past sampling events of the WQIC. In September 2020 visibility data was also collected at these locations as part of a project to evaluate the trophic state of Tellico Reservoir.

Results

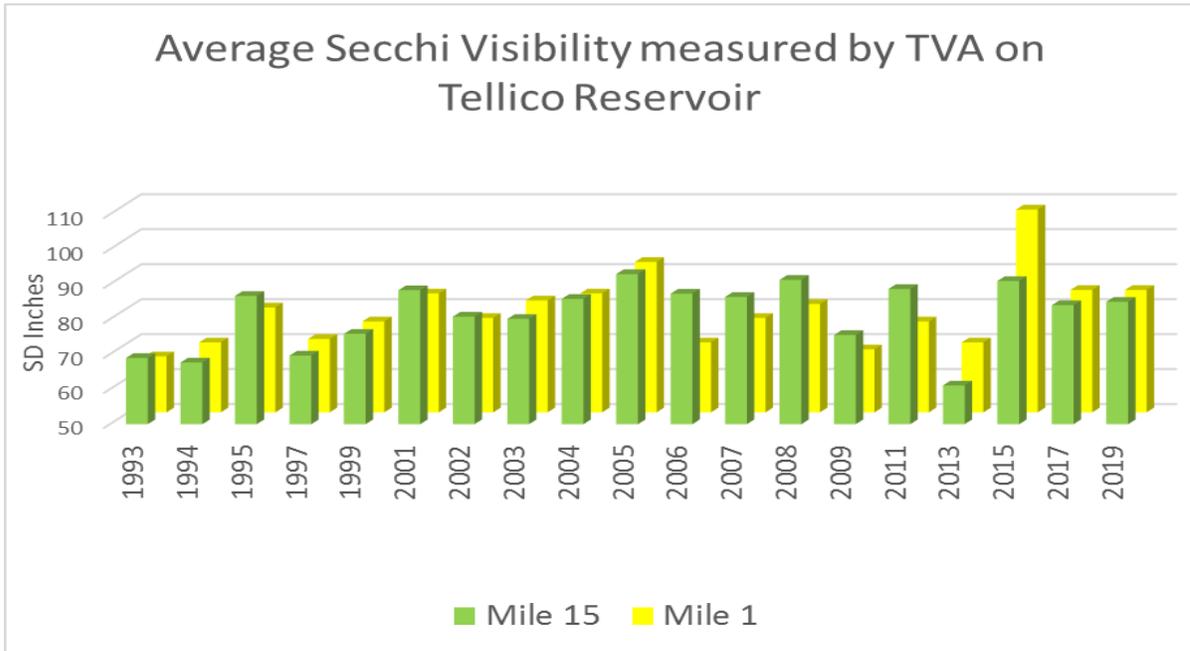
Highlights of Monitoring Program

- The average annual secchi disk visibility measured by TVA at Mile 1 and Mile 15, 1993-2019 was 79 inches and 81 inches, respectively.
- Secchi disk visibility has ranged from a low of 9 inches, due to muddy water to a high of 103 inches
- The average secchi disk visibilities for 2018 measured at the Yacht Club courtesy pier and at the Clear Creek boat ramp was 58 inches and 47 inches, respectively.
- The average secchi disk visibilities for 2019 measured at the Yacht Club courtesy pier and at the Clear Creek boat ramp was 56 inches and 54 inches, respectively
- The average secchi disk visibilities for 2020 measured at the Yacht Club courtesy pier and at the Clear Creek boat ramp was 64 inches (N=22, Range 35-91) and 67 inches (N=37, Range 32-78), respectively. The average secchi disk visibilities for Toqua Boat Ramp, Ft Loudon State Park, and Morganton Boat Ramp (Baker Creek) were -
 - Toqua Boat Ramp 73 inches (N= 45, range 53-96 for May to Nov.),
 - Ft Loudon Kayak Pier 75 inches (N=53, range 32-99)
 - Morganton Boat Ramp 37 inches (N=20, range 22-59)
- The September secchi disk visibility in three Tellico Reservoir embayments during 2018 averaged 21 inches less than that in 2016. But in 2020 the visibility was only an average of 11 inches less than that in 2016.

The Tennessee Valley Authority (TVA) has measured water quality parameters on Tellico Reservoir at Mile 1 and Mile 15 since 1991 and 1993, respectively. TVA collects data now every other year (odd years), collecting data monthly, April to September. The water quality parameters assessed, includes secchi disk visibility

The WQIC requested, and received, the TVA’s secchi disk data on Tellico Reservoir (TVA unpublished data). The TVA annual average secchi disk measurements at Mile 1 and Mile 15 are presented in Figure 1. The annual average secchi disk visibility at Mile 15 ranged from a low of 61 inches to a high of 93 inches with a mean of the annual averages of 81 inches. While at Mile 1 the range was 58 to 108 inches with a mean of 79 inches.

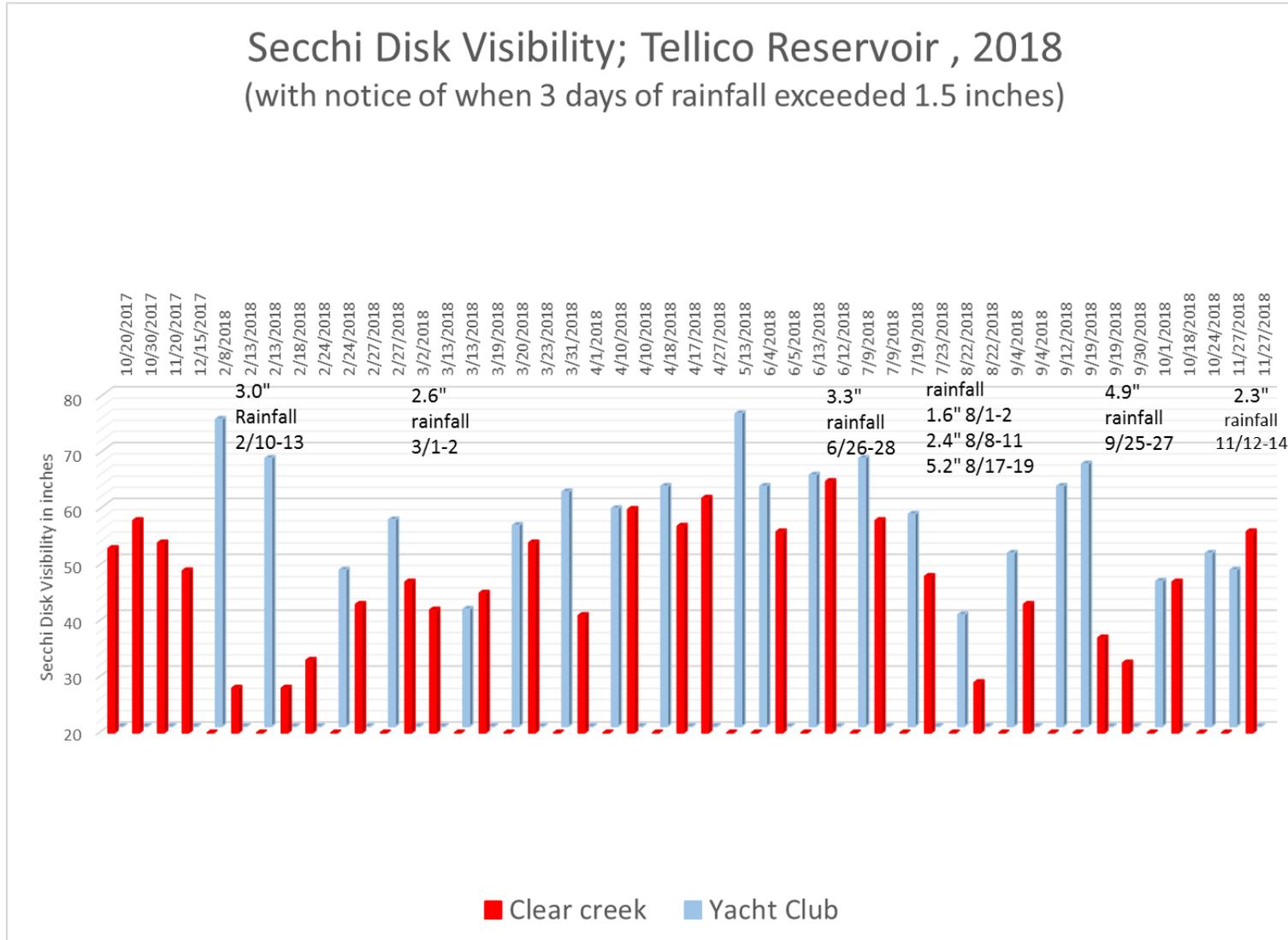
Figure 1.



The water clarity monitoring program on Tellico Reservoir began in 2018.. The average secchi disk visibilities for the Yacht Club and Clear Creek was 58 inches and 47 inches, respectively. The range in visibilities was 40 – 76 inches for the Yacht Club and 28-65 inches for Clear Creek.

The secchi disk measurements taken in 2018 at the Tellico Yacht Club and Clear Creek Boat ramp are presented in Figure 2. Usually, when there was rain event with precipitation greater than 1.5 inches the secchi disk visibilities at the Yacht Club fell to 50 inches or less. The decrease in visibility could be delayed a few days and except one sample day, the turbidity appeared to be principally from phytoplankton. It is presumed that the heavy rain washed in sediment and other organic matter that added turbidity to the water; or washed in nutrients, that fertilized the phytoplankton. This relationship was not as pronounced at the Clear Creek site. Turbidity decreased following heavy rains, but turbidity was found also to be low when there hadn’t been recent rainfall. It is possible that boat launching at the Clear Creek site may have an influence on visibility measurement.

Figure 2.



Comparison of Water visibility at the Tellico Village Yacht Club 2018 versus 2019. Note the absence of any secchi disk readings in above 70 inches in 2019.

Figure 3

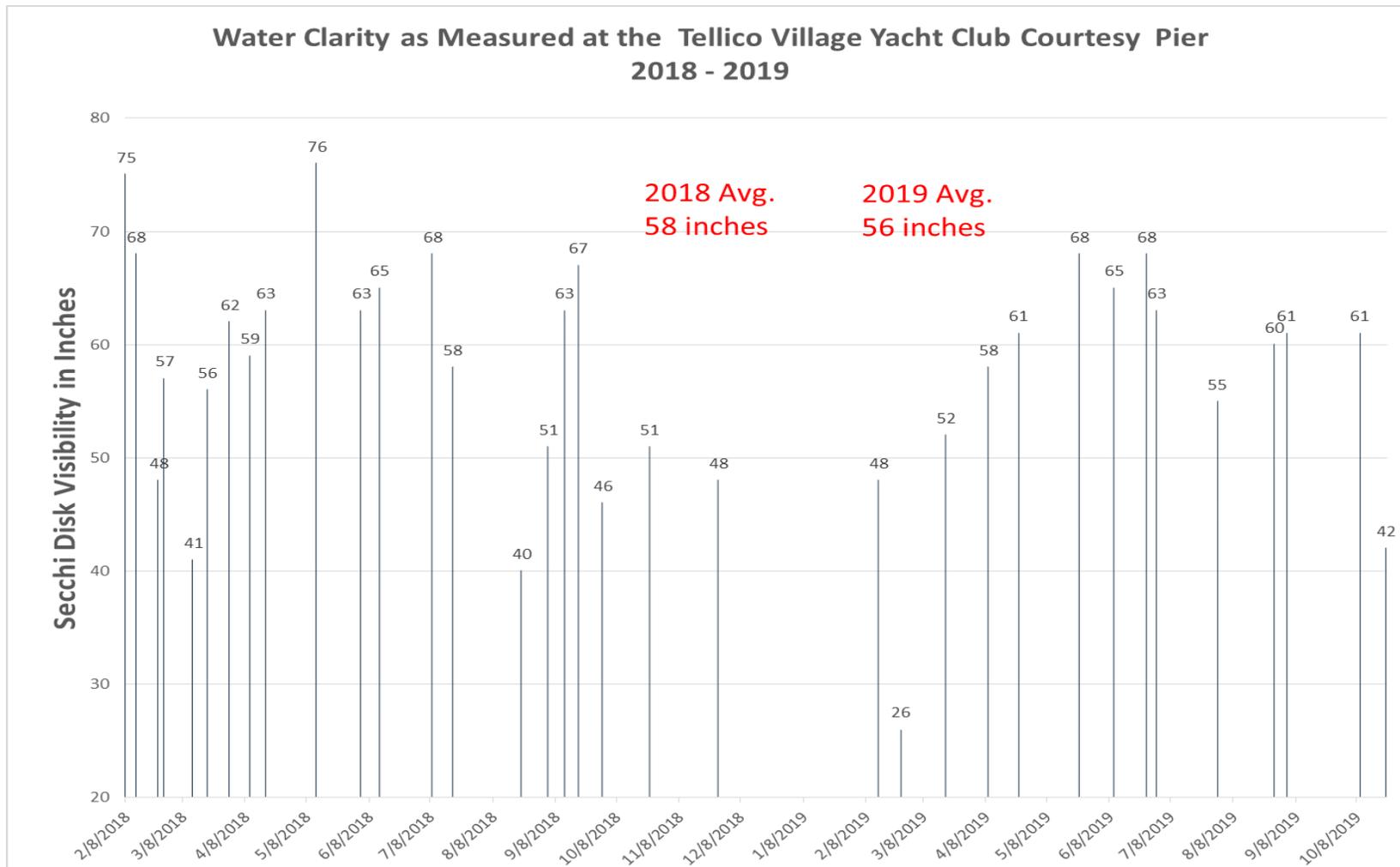


Figure 4 Water visibility at the Yacht Club in 2020

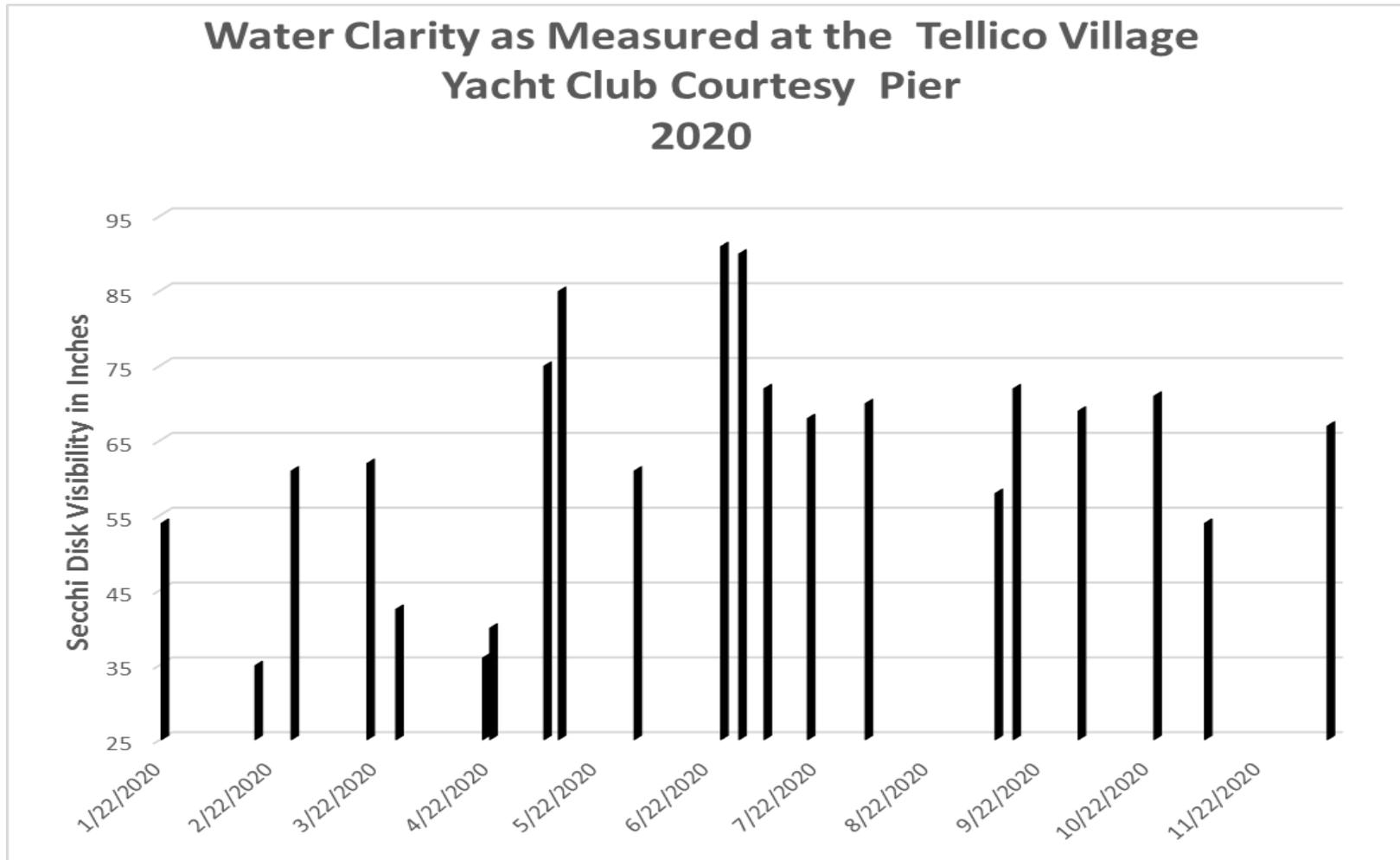
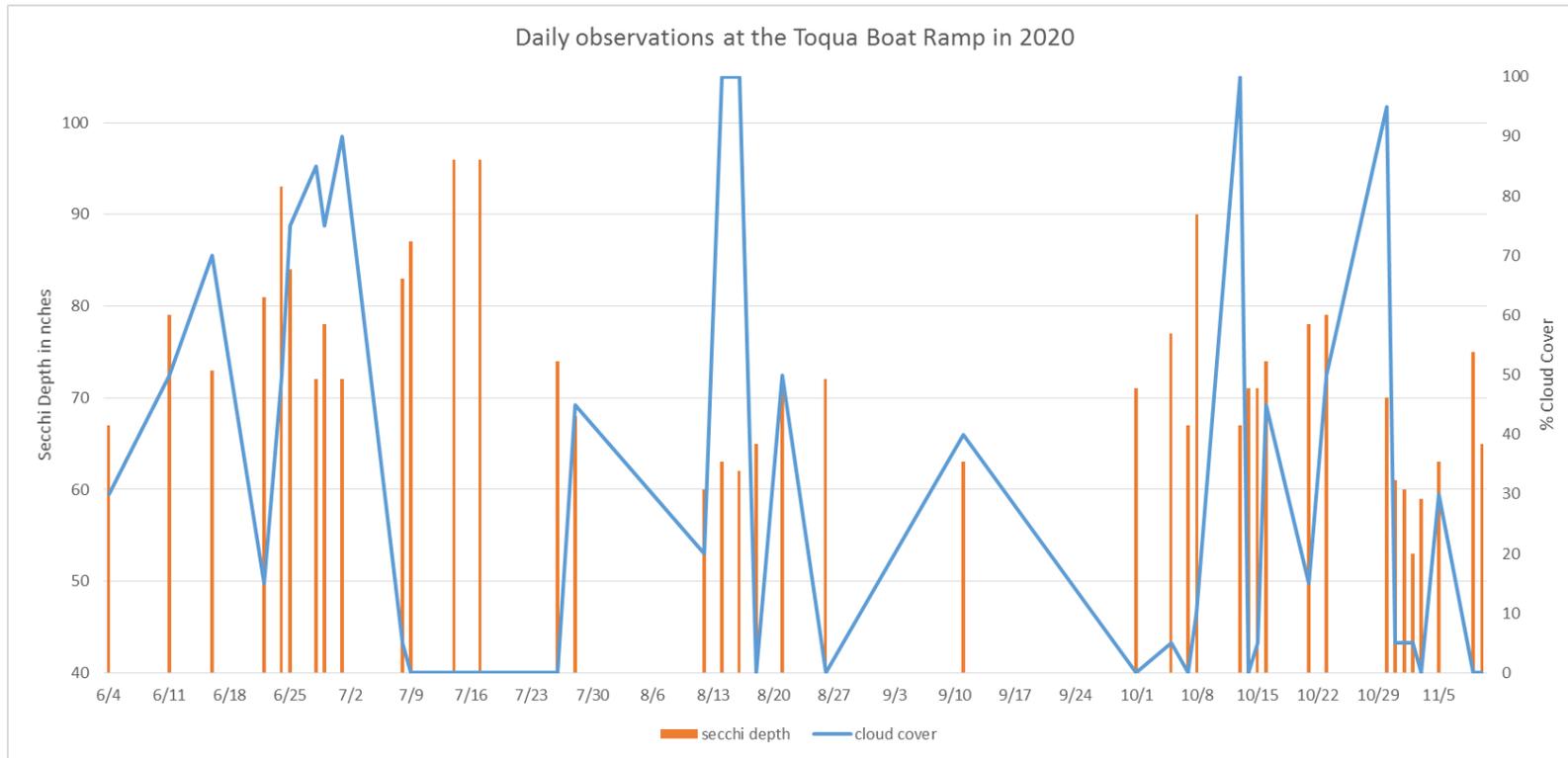


Figure 5. Water visibility at the Toqua Boat Ramp in 2020



There were periods where visibility measurements were taken on consecutive, or near consecutive, days at the Toqua Boat Ramp and at Ft. Loudoun State Park.

Major rainfall events during the period June to November, 2020 were consistent with periods of high cloud cover and lower secchi depth visibility: The rainfall events and measured rainfall are shown below, as recorded at a private residence in Tellico Village.

6/9-10 - .25 inches; 6/29-7/1 – 1.91 inches; 7/20-21 - .87 inches; 7/30-31 - .98 inches; 8/10 - .56 inches; 8/15 – 1.67 inches; 8/20-23 – 1.04 inches; 9/24-25 – 2.9 inches; 9/28-29 – 1.22 inches; 10/10-11 – 2.07 inches; 10/24 – 1.56 inches; 10/28-29 – 2.26 inches

Figure 6 Water visibility at the Ft Loudon State Park in 2020

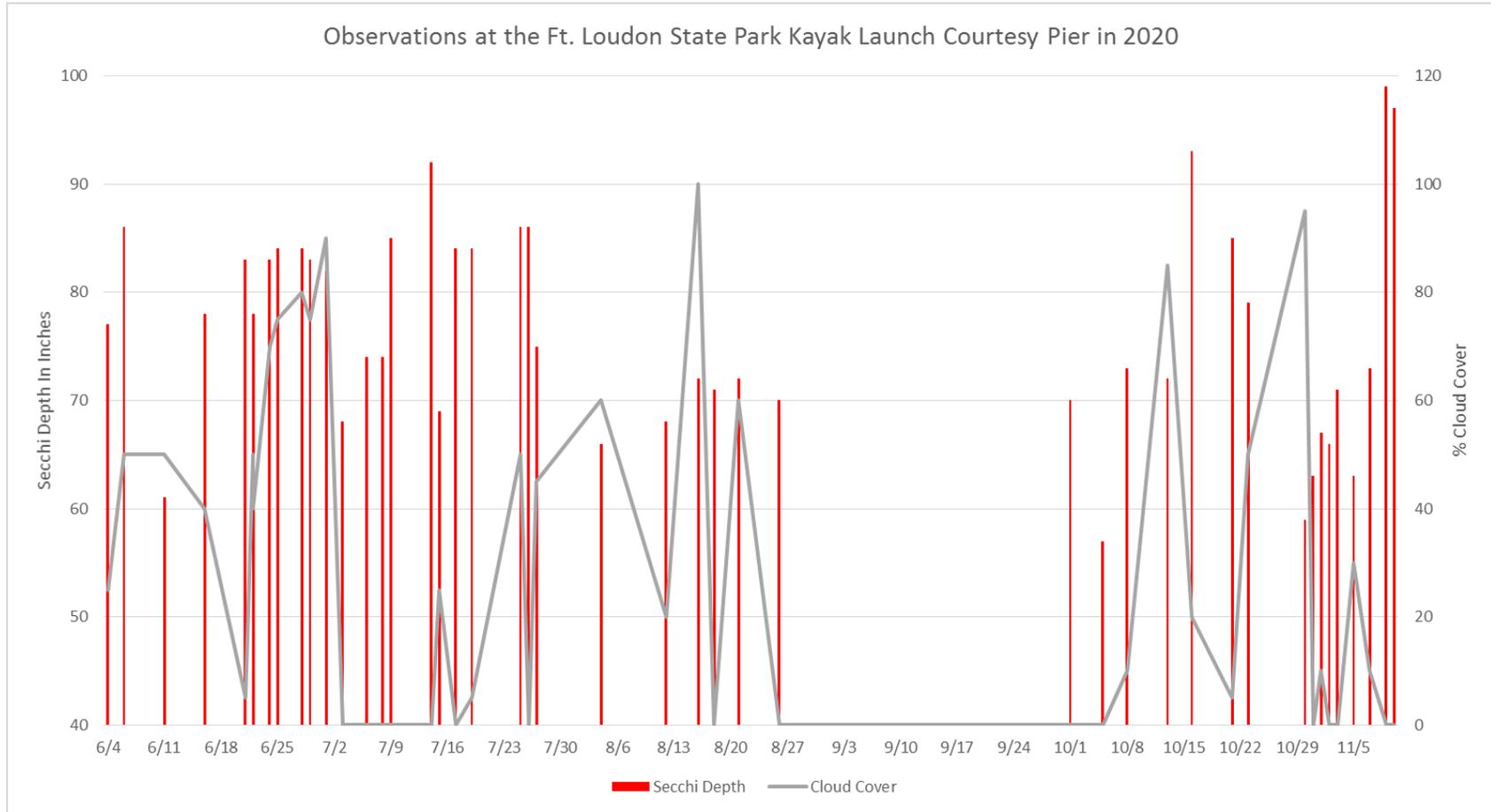
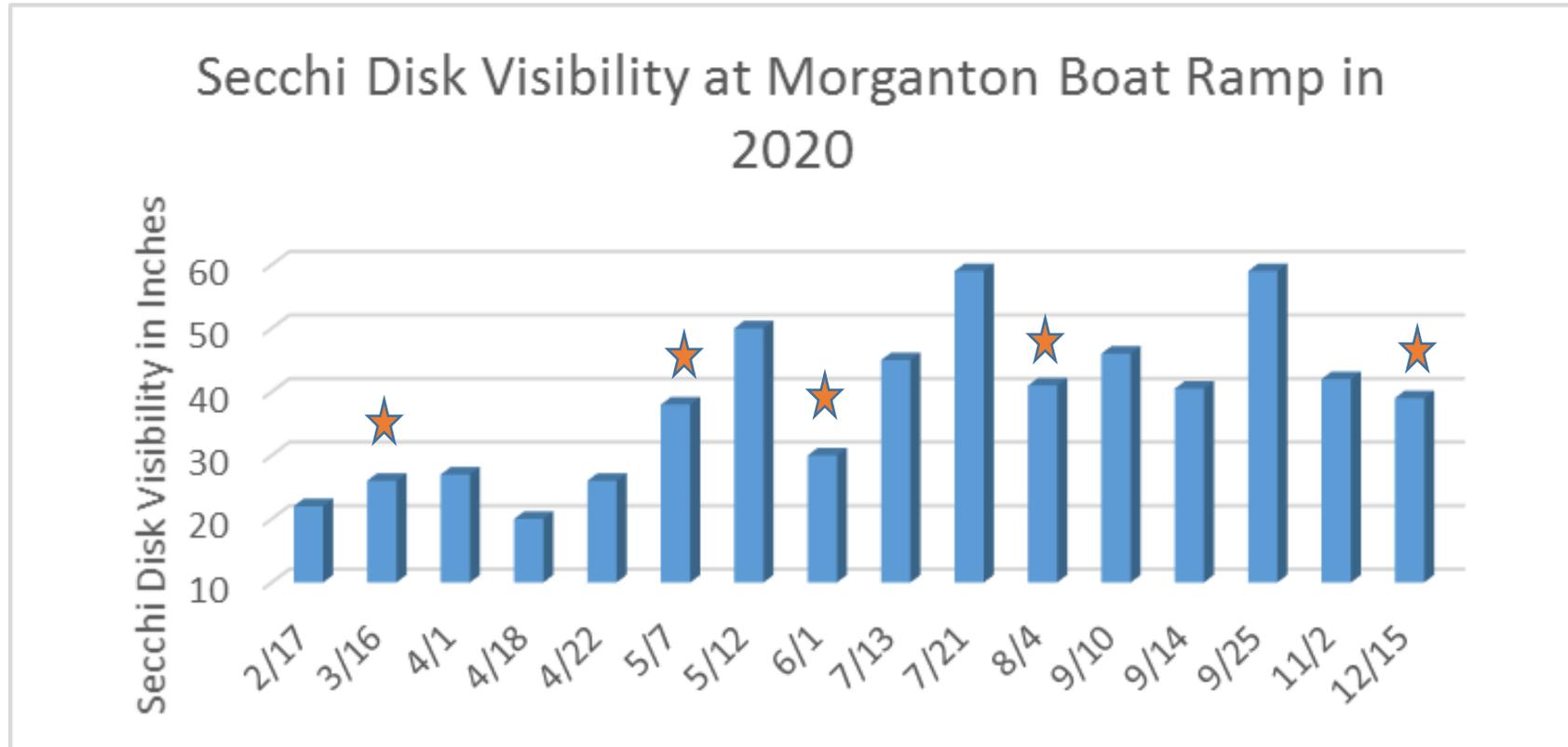


Figure 7. Water visibility at the Morganton Boat Ramp in 2020

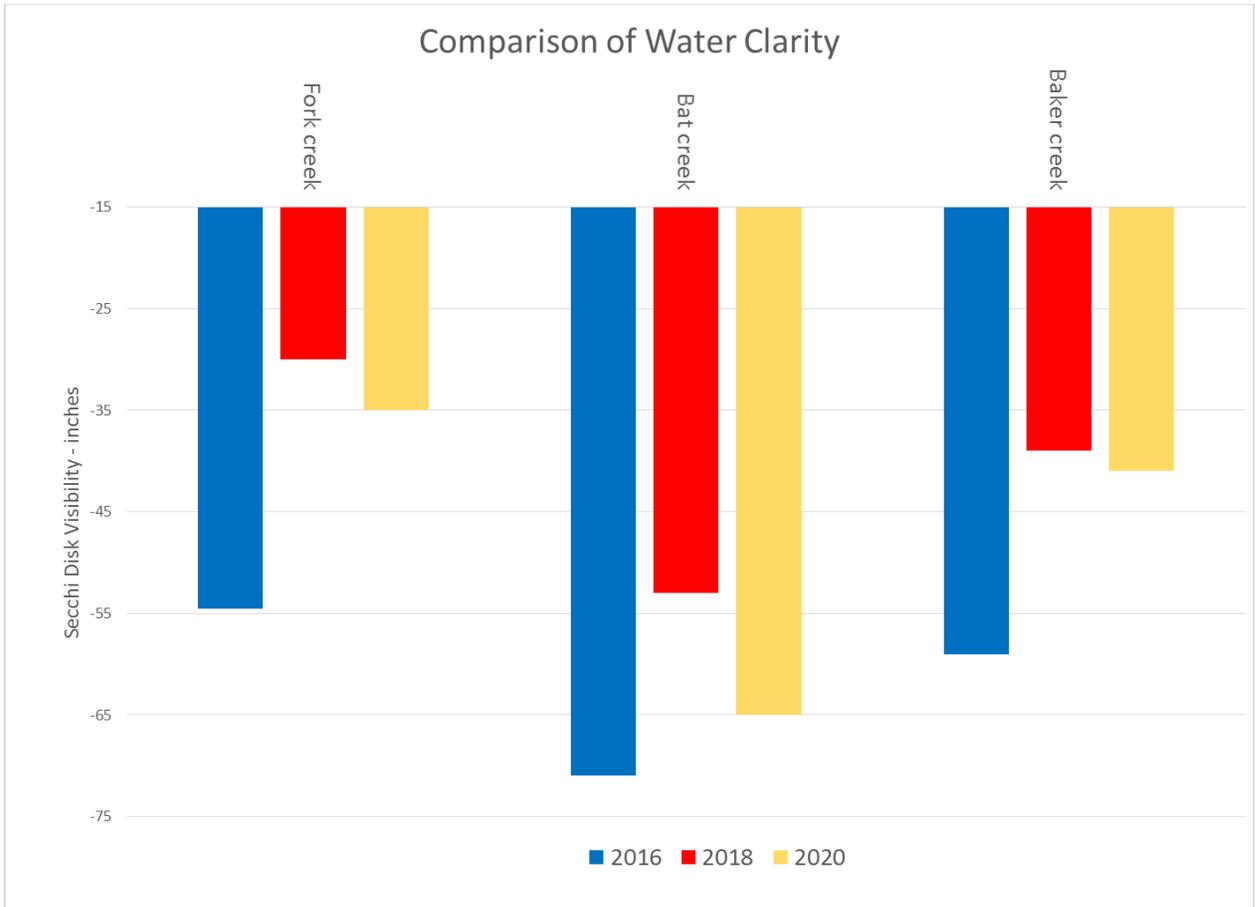


The water color for the dates marked with a star was green, but the water was murky. In these murky waters one could not tell definitively that the source of the turbidity was solely due to the presence of phytoplankton. For the other dates the perceived source of the turbidity appeared to be solely due to phytoplankton.

Comparison of water clarity with that of 2016

A special boat trip was made in September 2018 to collect clarity data for comparison with that collected during sampling events of the WQIC in 2016. Secchi disk data was collected during the WQIC 2016 project to evaluate bacteria levels in three embayments of Tellico Reservoir (Lucas and Waldrop, 2018). In 2020 secchi disk data was also collected at the embayments as part of a study to ascertain the trophic status of the reservoir.. The secchi disk measurements taken during sampling in September of 2016, 2018, and 2020 are presented in Figure 5. The September water clarity in the mid embayment sites of the three embayments during 2018 was less than that in 2016. The decrease in visibility ranged from 18 inches to 24 inches, average 21 inches, for the Bat Creek, Baker Creek and Fork Creek embayments. But visibility in 2020 had increased and was only less than 15 inches on average than that in 2016. It is interesting to note that rainfall in September was 2.4 inches in 2016, 10.9 inches in 2018 and 5.8 inches in 2020.

Figure 5. Comparison water clarity during past sampling events of the WQIC during the month of September. These are single observation events.



Visibility measurements were taken to compare water clarity between Mile 15 and the Yacht Club area, and on how visibility differed between the deep water pier at the yacht club versus visibility at the middle of the lake at that location. Generally the Tellico Village Yacht Club courtesy pier has visibility only a few inches less than that found at mid channel.

Date	Site	Secchi Disk Visibility(in.)
9/12/2018 1200hrs	Yacht Club Pier	63
9/12/2018 1300hrs	Yacht Club mid reservoir	66
9/12/2018 1600hrs	Yacht Club mid reservoir	62
9/12/2018 1530hrs	Mile 15	78
5/7/2020 1150 hrs	Yacht Club Pier	75
5/7/2020 1115 hrs	Yacht Club mid reservoir	75
5/7/2020 1055 hrs	Mile 15	64
9/14/2020 0830 hrs	Yacht Club Pier	68
9/14/2020 0845 hrs	Yacht Club mid reservoir	72
9/14/2020 1040 hrs	Mile 15	67

The data for this project is stored in an xcel spreadsheet: Data_Secchi Disk_Tellico Watershed.xlsx

It is hoped that the program could involve into an even more elaborate monitoring regime where water clarity is measured at more sites on the reservoir and in the reservoir's major tributary streams/rivers. There has been no stream data collected, and more embayment sites are needed. The data for the upper reservoir is sparse.

References

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