

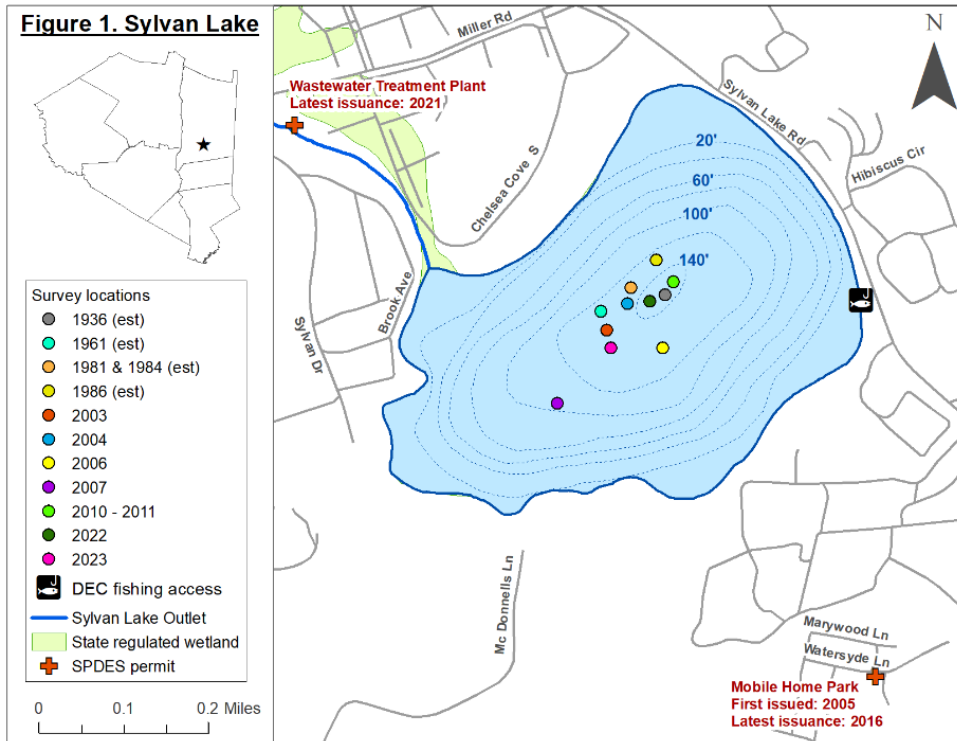
Historical Evaluation of the Sylvan Lake Trout Zone (Survey #322023)

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July 2023

Sylvan Lake (Beekman, NY) is a unique 109-acre waterbody found within NYSDEC's Region 3 (See Figure 1). The lake's 518-acre watershed is relatively small, fed by intermittent tributaries, freshwater seeps, and run-off. Water exits the lake through a wetland complex on the northwest shore. Sylvan Lake is just over 140 feet in the center, making it one of the deepest lakes in the state (NYSDEC 2008). Due to strong thermal stratification in summer months, the lake supports a two-story fishery with warmwater species in the vegetated shallows and stocked salmonids in the pelagic zone. Public access is available from the NYSDEC car-top launch located on the eastern end of the lake (Figure 1). This parcel was acquired from the Dutchess

Figure 1. Sylvan Lake



County Federation of Sportsmen (Federation) in 2012, who developed the launch in 2005. Prior to 2005, the Federation maintained a different boat launch at the lake's northeast corner from 1966 to 1985. Paid access has also been historically available through boat liveries, private clubs, and a seasonal RV park with a boat launch. Due to the wide availability of access and amount of deepwater habitat, the state has a history of salmonid stocking policies beginning in 1926. The most recent policy of 1700 yearling brown trout began in 2005 and continues to present day. To evaluate stocking policies, state biologists surveyed the lake sporadically since 1936 to estimate survival and to evaluate the available deepwater habitat necessary to support the stocked fish. This report compares the thermal and dissolved oxygen (DO) vertical profiles from historical surveys.

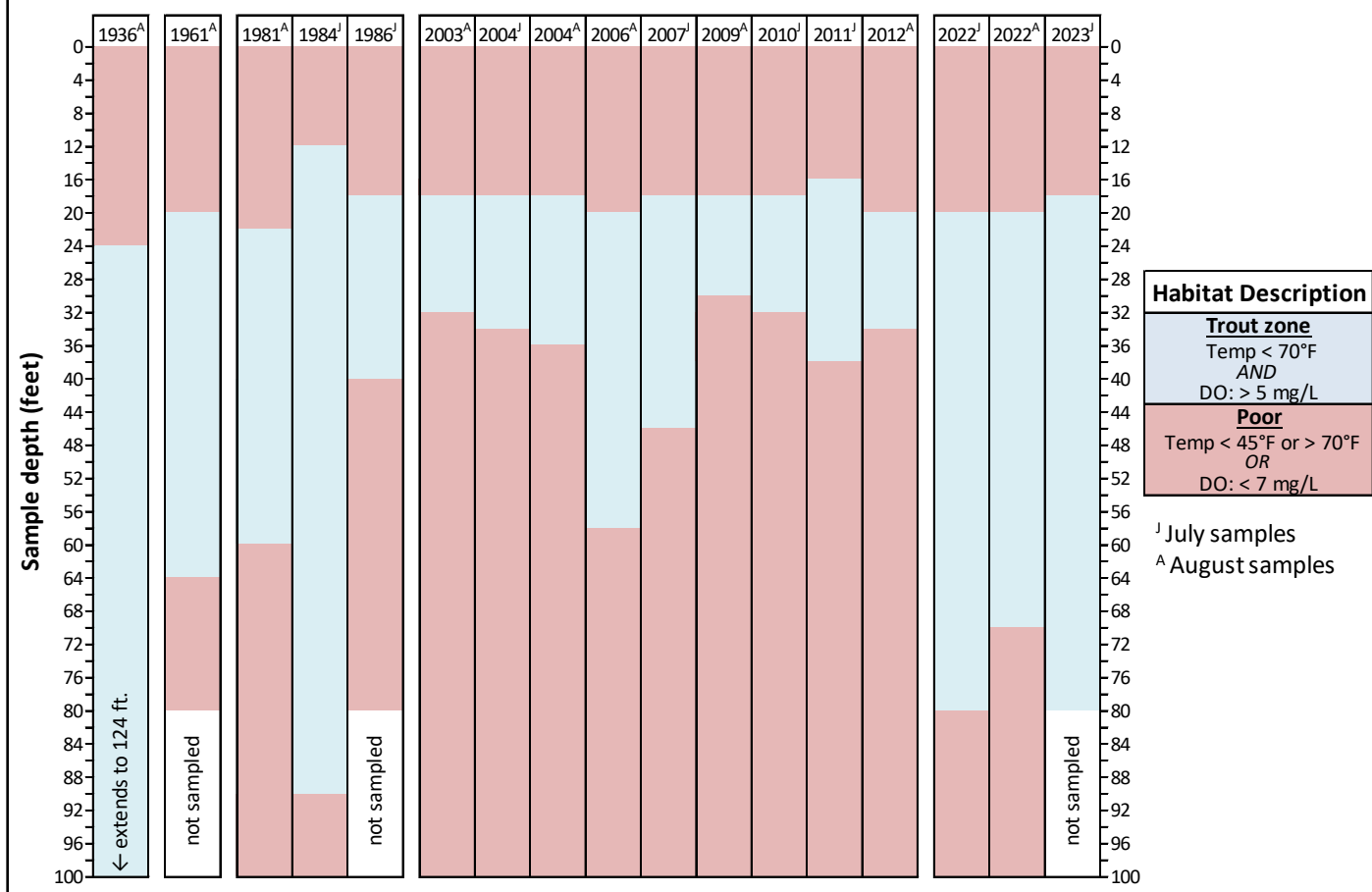
Fifteen vertical profiles of Sylvan Lake are reported between 1936 and 2023. Roughly half were made in July and the other half in August. Depth profiles for both months were made in 2004 and 2022. As shown in Figure 1, samples were taken near the center of the lake and at depths of at least 80 feet. Prior to 2004, water samples were obtained using a bottle sampler at roughly 10-foot depth intervals, while a combination of a bottle sampler and a YSI Multimeter with a 100-foot cable (Yellow Springs, OH) was used between 2004 and 2012. The YSI Multimeter was exclusively used in 2022-2023.

Traditionally, NYSDEC stocked lakes maintain a wide 'trout zone' or band of water with summertime temperatures $\leq 70^{\circ}\text{F}$ and DO readings $\geq 5 \text{ mg/L}$. To be conservative in the trout zone calculations for Sylvan Lake, any gaps in DO readings were set to the values of the next deepest record in the report. For example, the unmeasured DO values from 51 feet to 59 feet in the 1961 report were changed in our database to the value reported for 60 feet. The same methodology was used for temperature gaps, except for profiles where 70°F fell between two consecutive readings. In these instances, the depth at 70°F was estimated based on the rate of temperature decline between consecutive readings. Once adjusted, each profile was evaluated for a combination of temperature and DO that best support salmonids.



Figure 2 compares estimates of the available trout habitat for all survey years and months. Of all years reported, the 1936 profile had by far the deepest trout zone, spanning at least 100 feet. The next deepest was recorded in 1984. A much-reduced trout zone was observed in 1986 and similar values were reported from 2003-2012. The mean depth of trout zone from 2003-2012 was just 21 feet, with 2006 the only year surpassing 30 feet. Surprisingly, in both 2022 and 2023, the trout zone returned to pre-1986 levels, with all readings exceeding 45 feet.

Figure 2. Trout habitat conditions based on depth profiles of temperature and dissolved oxygen



In response to the continuing trend of poor summertime trout habitat in the early 2000's, Region 3 Fisheries petitioned to have the lake listed as an 'Imperiled Water' by the NYSDEC Division of Water (DOW). As a result, the NYSDEC Division of Water's Lake Classification and Inventory (LCI) program sampled the lake from June through August 2008 (NYSDEC 2008). LCI found similar trout zone issues and reported the summertime DO problems were consistent with elevated algal levels (estimated through chlorophyll a readings). The persistence of chlorophyll a throughout the summer suggested an ongoing nutrient loading issue. The lack of permanent tributary inlets to the lake led LCI to infer the main sources of excess nutrients were likely lawn runoff, on-site septic systems, and waste from the large flock of resident Canadian geese observed on the lake. The latter being a potential major source of phosphorous (Moore et al. 1998); however, this flock has recently been controlled through adult removals and egg addling (NYSDEC Bureau of Wildlife, personal communication).

One septic system of particular concern was investigated by DEC staff in 2005. This four-tank system, with two sub-surface outflows, supported a mobile home park located roughly a half-mile southeast of Sylvan Lake. Though this facility had the capacity for discharging 11,700 gallons per day of graywater via sub-surface releases, it was not operating with a State Pollutant Discharge Elimination System (SPDES) permit. There was concern that this sub-surface discharge could eventually reach the lake due to historic mine shafts and prevailing surficial geology. A SPDES permit for the facility was sought via Consent Order in 2005, which included annual accumulation inspections to prevent solids from leaving the system (SPDES 0271101). Issues with compliance continued through at least 2006 (NYSDEC Fisheries and NYSDEC DOW email correspondence); however, this SPDES permit was re-issued in 2017 and no additional septic issues have been reported for this facility or for any other properties around the lake.

Ongoing aquatic macrophyte control in the lake may also contribute to the nutrient problem. Records of plant removal permits date back to at least 1994, and four local organizations currently have vegetation control permits for the removal of invasive plants (Eurasian milfoil) and to improve boating and swimming areas in the nearshore (NYSDEC Department of Permits, personal communication). Permitted methods have included hydro-raking, aquatic herbicides, and macrophyte-eating triploid grass carp, all of which can alter nutrient cycling. Plant decay resulting from herbicide/hydro-raking re-introduces nutrients to the system during the most productive times of the year. As do grass carp, which excrete at least 50% of the nutrients from plants they consume (NYSFOLA 2009). In addition, the removal of plants from the shallows, compromises an important buffer between upland nutrient inputs and the pelagic zone. Future permittees should carefully consider these side effects when evaluating plant control methodologies.

Finally, the invasion of zebra mussels has also likely impacted the lake's nutrient distribution. First confirmed in Sylvan Lake in 2021 (IMap 2024), this species can drastically change novel environments by shifting nutrient availability from the pelagic zone to the benthic zone through their extensive filtration and subsequent excretion (Arnott and Vanni 1996). This may manifest in less algal blooms and resulting high oxygen demands in the pelagic zone when the blooms die off (Dzialowski and Jessie 2009). Though this shift may seem a benefit, any reduction in phytoplankton biomass could also limit zooplankton availability for open-water baitfish and juvenile sportfish. In addition, zebra mussels have been linked to a shift from mostly harmless green algae-dominated phytoplankton communities to ones dominated by toxic blue-green algae (Vanderploeg et al. 2001; Raikow et al. 2004). No recent studies have evaluated the size and distribution of the zebra mussel or plankton communities.

Depth profiles in 2022-2023 show a recovery of the trout zone to 1961-1984 levels. This recovery in DO at deeper depths may be a response to several factors that decreased nutrient loading into the pelagic zone, including the SPDES permit for the mobile home park, the efforts to control the resident goose population, the death of grass carp stocked in 2008, and the introduction of invasive zebra mussels into the system. Depth profiles of the lake should be monitored over the next few years, and subsequently every five years, to evaluate this changing ecosystem and inform the stocking policy. Evaluations of zebra mussel biomass, the plankton community, and the pelagic forage fish population are also important next steps.

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