

# 2004 SILVER LAKE ANNUAL REPORT

*prepared in part for the E.L. Rose Conservancy*

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## **EXECUTIVE SUMMARY:**

Our initial approach towards studying the fish community of Silver Lake included both qualitative biological assessments and a collection and review of historic Silver Lake reports or documents. Two biological assessments of Silver Lake were completed during the summer of 2004, a littoral habitat assessment and a snorkel assessment of the lake's littoral zone. Although approximately 2/3 of the lake's shoreline has been cleared and developed, some degree of woody material continues to accumulate in most of the lake's nearshore areas. In addition, the large portion of the western lake shoreline that has not been developed or cleared most closely represents how the Silver Lake shoreline would have originally appeared prior to human settlement. This shoreline is likely of great importance to the lake's natural function. The nearshore fish community of Silver Lake is thriving and indicative of many lakes and ponds in northeastern Pennsylvania. Given the current reports and resources it is not possible to determine what fish species made up the pre-settlement fish community but, it is clear that historical stocking efforts and non-native fish introductions have occurred throughout the recorded history of Silver Lake. Silver Lake's warmwater fish community (largemouth bass in particular) is comprised of an unusually high proportion of large individuals, making these fish populations both unique and susceptible to overharvest (i.e. removal of large fish). The most important aspect of Silver Lake water quality noted from a review of historic reports is the change in the dissolved oxygen level within the lake's hypolimnion at some point between the 1992 (TETHYS) and 2001 (Dr. John Titus) surveys. This is likely the result of ongoing nutrient loading to Silver Lake, thereby resulting in the production of more algae by comparison with historic levels. It would be beneficial to develop specific goals for both the water quality and fish community management of Silver Lake to ensure that the quality and unique nature of this lake is preserved.

# Biological Assessments

Two biological assessments of Silver Lake were completed during the summer of 2004: (1) a littoral habitat assessment, and (2) a snorkel assessment of the lake's littoral zone. A trapnet assessment was planned for the late fall period, however, this survey had to be postponed until the spring of 2005 due to delays in acquiring collection permits from the Pennsylvania Fish and Boat Commission.

## Silver Lake Littoral Habitat Assessment

Purpose: Qualitatively determine the relative amount, distribution, and quality of nearshore (littoral zone) habitats for both native and non-native fish populations of Silver Lake.

Previous research throughout the midwestern and western United States has shown the negative effect of removing coarse woody material or "debris" from natural lakes and streams. Wood is often removed from shorelines by lakefront property owners in an attempt to "clean" the lake and create more beach-like shorelines. Nearshore wood provides essential natural habitat for various life stages of fish and other aquatic organisms and provides natural levels of nutrients within the littoral zone. Our research program at Cornell has been particularly interested in the influence of woody material upon fish communities in Adirondack lakes and streams. Our qualitative survey of Silver Lake was intended to assess the relative abundance of nearshore wood within Silver Lake and determine if any apparent shoreline deforestation and/or littoral zone clearing may have adversely impacted fish populations.

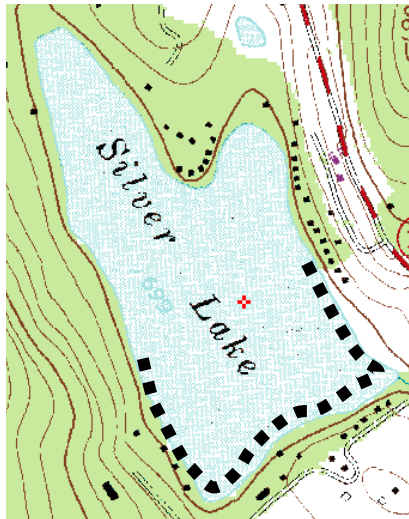
Although large portions of the lake's shoreline have been developed with docks (approximately 2/3 of the shoreline), some degree of woody material continues to be deposited into those lake areas. A large portion of the western lake shoreline has not been developed or cleared and most closely represents how Silver Lake would have originally looked prior to human settlement. This forest/lake edge is critical to the lake's natural function. It continues to provide natural habitat within the lake's littoral zone in the form of submerged trees.

## Silver Lake Fish Community Assessment

Purpose: Determine the composition of the nearshore, warmwater fish community and estimate relative abundance of present species.

Approximately one third of the Silver Lake littoral zone was surveyed by snorkeling during July 2004 to determine what fish species were present in the nearshore zone of Silver Lake during the warmwater period. Snorkeling provides an instantaneous characterization of a lake's fish community, requires no official sampling permission or permitting from the Pennsylvania Fish and Boat Commission, and can provide qualitative estimates of various species abundances. Fish surveys by snorkel sampling are limited due to the fact that only fish present in shallow, nearshore waters can be identified. The presence of species that prefer offshore habitats (pelagic prey fish, such as alewife and rainbow smelt) and species that prefer deeper, cooler habitats (lake trout, rainbow trout, brook trout, and brown trout) is often difficult to detect using snorkeling surveys. In addition to providing information regarding fish populations, snorkel surveys provide a more detailed view of the available fish habitat and the composition of the lake bottom substrate.

Figure 1.) Topographic map of Silver Lake showing the portion of the littoral zone surveyed by snorkeling during July (dashed line).



#### Fish Species Identified From Snorkel Surveys:

Pumpkinseed, *Lepomis gibbosus* were the most abundant species noted in the littoral zone. The population consisted of a wide range of year classes with large numbers of young-of-year (YOY) present and some extremely large individual adults. This species – often referred to as “sunnies” – provides an excellent summer fishery, especially for beginning anglers.

Largemouth bass, *Micropterus salmoides* was the next most abundant species in the littoral zone. Much like the pumpkinseed population, the largemouth bass population consisted of a wide range of year classes, with limited, but adequate numbers of YOY bass. Of special note were the numbers of exceptionally large largemouth bass discovered during the snorkel surveys. Based on the average size of observed largemouth bass, the person who conducted this survey (Brian Weidel) considers this population as the most distinctive that he has ever surveyed. This largemouth bass population is a unique but fragile natural resource. Even slight increases in angler harvest of these largemouth bass could potentially harm the size structure of this population.

Rock bass, *Ambloplites rupestris* were abundant within the lake, but showed a patchy distribution within the littoral zone. This species was often observed in association with rocky structures (natural or manmade). Again, as with largemouth bass, the rock bass population contained a large proportion of exceptionally large individuals and large numbers of YOY individuals. In some lakes where this species has been introduced, rock bass have had dramatic negative effects on native minnow and sport fish populations through both competition for food and direct predation.

Yellow Perch, *Perca flavescens*, Grass pickerel, *Esox niger*, and Brown bullhead, *Ameiurus nebulosus* were also noted in low abundance throughout the littoral zone. Pickerel and bullhead are often difficult to observe in snorkeling surveys, so their apparent low abundance was not surprising. However, large numbers of YOY and yearling perch are often quite abundant within the littoral zone and easily observed in similar lakes, therefore their low abundance was surprising.

Fish species of note that were not identified but have been recently reported to be present within the lake include smallmouth bass, *Micropterus dolomieu*, and alewife, *Alosa pseudoharengus*. It would be unusual to have missed observing smallmouth bass if they were present, given the large proportion of shoreline sampled. This indicates that any remaining smallmouth bass population likely occurs in low abundance. Alewife would not typically be observed during a snorkel survey. Their recently reported presence is intriguing and suggests that they were introduced into the lake intentionally, perhaps by an angler dumping “unused” baitfish into the lake.

The nearshore fish community of Silver Lake is healthy and indicative of many lakes and ponds in northeastern Pennsylvania. However, the current nearshore fish community is potentially quite different from the native fish community present prior to human settlement. It is likely that pumpkinseeds are the only remaining abundant native fish population within the lake, but the lack of detailed historical records make it almost impossible to characterize the native Silver Lake fish community. Although we have talked to a wide range of experts familiar with native fish distributions in New York and Pennsylvania lakes, we can only speculate regarding which fish species were originally native to Silver Lake.

## Lessons From Reviewing Historical Reports

We considered it important to piece together the history of Silver Lake’s fish community and water quality characteristics to understand how the lake may have changed over time, thereby providing a necessary perspective for future lake management decisions. The appended list of reports and surveys have been collected from various E.L. Rose Conservancy members and the Pennsylvania Fish and Boat Commission. Many of these reports refer to additional documents that have not yet been obtained, therefore we request that anyone with information about these reports or other additional literature contact either Dr. Kraft or Brian Weidel.

### Water Quality/Chemistry

The most important aspect of Silver Lake water quality determined from the review of historic reports is the change in the dissolved oxygen level of the lake’s hypolimnion that occurred between the 1992 (TETHYS) and 2001 (Dr. John Titus) surveys. This is most likely the result of recent increases in nutrient loads to Silver Lake that have produced more abundant algae than were historically present in the lake. When this algae dies it sinks into the hypolimnion, where decomposition of the algae lowers the availability of dissolved oxygen. Because this region of oxygen-poor bottom water is effectively separated from the oxygen rich surface region, the dissolved oxygen content continually declines throughout the summer as algae sink and decompose. An oxygen level greater than 5 parts per million is considered to be the lower limit for survival of most fish species. Silver Lake oxygen levels during late summer 2001 were as

low as 3 and 2 parts per million (at a depth of 18 meters). Although this phenomenon has been alluded to within recent reports, it is not yet clear whether these low oxygen levels have affected those fish species that require cooler water habitats.

### Fish Community

Early fish surveys in Silver Lake were limited to using only one or two collection techniques at a single time of the year, therefore it is difficult to be confident that these surveys accurately represent the historic lake fish community. For example, one of our goals in reviewing the available literature was to determine if lake trout and or brook trout – two species of particular interest from a conservation standpoint – were native to Silver Lake. The earliest records suggest that the fish community may have included lake trout at the turn of the century, however, during the late 1800's fish propagation, movement, and introductions were common throughout the northeastern U.S., making it difficult to determine if lake trout were native or introduced. No information has been found regarding brook trout's presence in Silver Lake.

It is quite clear that bass (largemouth and smallmouth) were introduced to the warmwater fish community and that these fish are non-native within Silver Lake. An important part of our current Adirondack research program is focused on identifying the effects of such bass introductions on native Adirondack fishes, however, the vague nature of the earliest Silver Lake reports ("minnows" are often listed as having been captured, without any information regarding the particular species present) make it difficult for us to determine the effect of bass introductions into this particular lake. The most consistent feature of the Silver Lake fish community is that stockings and non-native fish introductions have occurred throughout recorded history (see Table 1).

## Potential Lake and Fish Community Management Issues

The following list provides a summary of key lake management issues. Although water quality and fish management issues are often considered without respect to one another, we consider it important to recognize some inherent linkages between these ecosystem components. This is a short list of non-specific issues intended to focus on the key points. There are likely other issues that need to be added to the list after consulting with E.L. Rose Conservancy and Silver Lake Association members, as well as any other interested community residents.

### Water Quality/Chemistry

Issue: Increases in nutrient loading to the lake will cause water quality to decline, with key concerns regarding:

- Drinking water
- Lake water clarity
- Midsummer oxygen levels

Recommendation: goals should be identified for maintaining and regularly assessing lake water quality.

## Fish Community

Issue: The Silver Lake fish community represents several unique features and is a resource worthy of attention. For example:

- The current fish population consists of large individuals that are fragile to overharvest.
- Available nearshore wood habitat provides an important resource for the current fish community.
- Uncommon coldwater species, such as lake trout and brook trout, might be native and/or capable of survival within Silver Lake.

Recommendation: Goals should be defined for managing the Silver Lake fish community.

## APPENDIX: Historical Report Review

### **1931: Commonwealth of Pennsylvania Board of Fish Commissioners, Pond and Lake Survey Report**

(report obtained from records at the PAFBC Pleasant Gap Complex, Bellefonte, PA)

This survey report was filled out for 9, 1931, however it is unclear if any specific fish sampling was conducted in order to fill out the report. The report contains special mention of the lake being used for summer boys and girls camps.

#### Water Quality and Chemistry Notes:

Free from pollution  
Fed by springs

#### Fish Community and Fishing Notes:

Community includes catfish, black bass, sunfish  
Fishing prohibited

### **1935: Commonwealth of Pennsylvania Board of Fish Commissioners, Pond and Lake Stocking Report**

(report obtained from records at the PAFBC Pleasant Gap Complex, Bellefonte, PA)

This document contains sparse information about yellow perch (*Perca flavescens*) being stocked into Silver Lake. There is no mention whether the lake contained yellow perch prior to the stocking and it is likely that this document identifies the initial introduction of yellow perch into the Silver Lake fish community.

#### Water Quality and Chemistry Notes:

None

#### Fish Community and Fishing Notes:

May 25, 1935 : 250,000 Yellow perch fry stocked into Silver Lake, Susquehanna Co., PA

### **1931: Commonwealth of Pennsylvania Board of Fish Commissioners, Pond and Lake Survey Report**

(report obtained from records at the PAFBC Pleasant Gap Complex, Bellefonte, PA)

This survey, conducted by Kieth Harter (sp?) on April 23, 1938 appears to have been at the request of Mr. J.T. Russell who was interested in stocking Silver Lake. Mr. Harter's recommendations were to not stock the lake because it was entirely under private ownership. This survey and report are important because it provides the earliest currently available written account of the Silver Lake fish community and also makes note of the physical features of the wooded shoreline.

#### Water Quality and Chemistry Notes:

Free from pollution  
Fed by springs

### Fish Community and Fishing Notes:

Fish community includes:

- Lake trout (*Salvelinus namaycush*)
- Smallmouth(ed) bass (*Micropterus dolomieu*)
- Sunfish
- Yellow Perch (*Perca flavescens*)
- Pike or Pickerel
- Bullheads or Catfish
- Minnnows
- Eels, assumed American eel (*Anguilla rostrata*)

### Lake Physical Habitat Features:

- Shoreline 100% wooded
- Shoreline 5% marsh land (wetland)

### **1946: A Biological Survey of Silver Lake, by G.L. Trembley and F.J. Trembley**

This survey is currently the most complete historical document on the biological and physical status of Silver Lake. The report, like many others undertaken for small waters throughout Pennsylvania, was completed by Gordon Trembley who was best known for his service as Chief Biologist and Assistant Executive Director of the Pennsylvania Fish and Boat Commission (1946-1969). The report is quite thorough, though slightly biased. The exceptional water quality (due to low nutrient levels) within Silver Lake was noted in this report, yet lake fertilization and prey fish stocking were recommended because of apparent deficiencies in food abundance for game fish. Additionally, a list of fish plantings (stockings) helps confirm species introduced to the Silver Lake fish community.

### Water Quality and Chemistry Notes:

- Underlying geology is Devonian sandstone of the Catskill formation
- Low soluble mineral content
- Lack of permanent tributaries maintains low siltation rates
- High water clarity, Secchi disc depth: 15 feet, Secchi color: “white”
- Thermally stratified throughout summer
- High levels of dissolved oxygen at lake bottom (8.0 ppm @ 80 feet)

### Fish Community and Fishing Notes:

Fish community includes:

- Largemouth Bass (*Micropterus salmoides*)
- Pumpkinseed (*Lepomis gibbosus*)
- Yellow Perch (*Perca flavescens*)
- Yellow bullhead (*Ameiurus nebulosus*)

Noted to be missing: minnows, lake trout, pike-perch (walleye), cut-throat trout

Fish stockings noted:

- 1942 – 10,000 Smallmouth bass
- 1943 – 16,000 Largemouth bass
- 1943 – 4,000 Bluegills
- 1944 – 100 Largemouth bass



1945 - ??? Pike-perch or Walleye (*Sander vitreus*)

Notes from angling effort;

Smallmouth bass – good five years ago, poor now

Largemouth bass – only a few caught

Pickereel – good in the past only 10 caught this year

Yellow Perch – catches down, fish smaller

Eels – common in the past, few now

Bullheads – Best fishing at this time.

#### Lake Physical Habitat Features:

Littoral zone contains large trees

Lake substrate predominantly sand, mud and clay deeper, sparse rock

Submergent vegetation sparse, filamentous algae present

Curly leaf pond weed (*Potamogeton natans*)

Common spatter dock (*Nymphaea advena*)

White water lily (*Nymphaea alba*)

Emergent vegetation abundant

Three-way sedge (*Dulichium arundinaceum*)

Pickereel weed (*Pontederia cordata*)

American bur reed (*Sparganium americanum*)

#### **1981: Water quality in Silver Lake**

This survey and report by Dr. John Gannon of SUNY Oswego, are based on a cursory examination of the lake's water quality and opinions obtained from lake shoreline homeowners. The report provides both a geologic perspective on how Silver Lake was created and uses a geologic lake progression scale to provide a perspective regarding the current state of Silver Lake. Conclusions from the report focused on how cultural influences (nutrient loading, soil erosion and siltation) may be accelerating change within Silver Lake from a deep, coldwater, low nutrient, oligotrophic system to a shallow, warm, high nutrient, eutrophic lake system. The report commends the lake's shoreline land owners for their commitment to lake water quality, but warns of the potential for increased nutrient loading to decrease the water quality of Silver Lake. Increased nutrients are discussed relative to current and potential septic practices.

#### Water Quality and Chemistry Notes:

“High” water quality

#### **1992: Biological Survey of Silver Lake**

This survey and report were conducted and prepared by TETHYS Consultants, Inc of Harrisburg, PA, based upon a biological assessment of Silver Lake (conducted August 20, 1992). The report provides important lake water chemistry information, reporting the most recent water sampling evaluation during which the lake's hypolimnion contained adequate oxygen to support fish. The report applies various indexes of biological integrity, designed to assess the quality of the biotic life within Silver Lake. According to current standards, this approach is not particularly helpful because it is most useful when comparing a suite of similar lakes to one another. Additionally, the report seems to generally support the idea of stocking additional non-

native species (predators) to the lake without regard for the effects on current native and non-native fish populations.

Water Quality and Chemistry Notes:

pH, conductance, and dissolved oxygen levels “healthy” throughout lake depths  
Fecal coliform levels should be checked periodically during summer

Fish Community and Fishing Notes:

“Healthy” fishery

For given species, the Silver Lake populations are larger than “average” populations  
Suitable for a put-grow-take trout fishery but is not capable of maintaining natural populations

**2001: Notes on Silver Lake temperature and oxygen profiles**

This short, but data filled survey and report were conducted by Dr. John Titus and Nate Nunley, from the Department of Biological Sciences, SUNY Binghamton. This report provides key information because it definitively shows that the dissolved oxygen content in the deepest region of water (the hypolimnion) becomes too low to support fish life during late summer. The report warns of the potential negative effects of continued nutrient enrichment and lake eutrophication.

Table 1.) Trout stocking in Silver Lake, incomplete list. List provided by Gerry O'Neil.

DATE	YEAR	Fish	Quantity	MaxLength	Total Cost	Cost / Fish
6/11/1959	1959	Rainbow Trout	4	19	\$66.25	\$16.56
6/11/1959	1959	Rainbow Trout	100	12	\$125.00	\$1.25
6/11/1959	1959	Rainbow Trout	25	16	\$58.75	\$2.35
11/1/1971	1971	Rainbow Trout	100	10	\$68.20	\$0.68
11/1/1971	1971	Rainbow Trout	300	10	\$165.00	\$0.55
11/15/1974	1974	Rainbow Trout	150	9	\$97.50	\$0.65
11/15/1974	1974	Rainbow Trout	80	10	\$64.00	\$0.80
11/15/1974	1974	Golden Trout	25	9	\$38.50	\$1.54
12/12/1976	1976	Rainbow Trout	450	9	\$326.00	\$0.72
11/29/1978	1978	Brook Trout	200	9	\$200.00	\$1.00
11/29/1978	1978	Rainbow Trout	100	9	\$117.50	\$1.18
10/21/1979	1979	Rainbow Trout	300	12	\$464.82	\$1.55
10/26/1981	1981	Rainbow Trout	200	11	\$387.05	\$1.94
10/10/1982	1982	Brown Trout	100	7	\$100.00	\$1.00
10/10/1982	1982	Rainbow Trout	150	11	\$277.50	\$1.85
10/10/1982	1982	Rainbow Trout	150	7	\$127.50	\$0.85
10/10/1982	1982	Brook Trout	100	7	\$85.00	\$0.85
10/10/1982	1982	Brown Trout	100	7	\$100.00	\$1.00
11/25/1984	1984	Brown Trout	50	12	\$0.00	\$0.00
11/25/1984	1984	Rainbow Trout	100	12	\$0.00	\$0.00
12/7/1986	1986	Rainbow Trout	300	11	\$525.00	\$1.75
12/7/1986	1986	Brown Trout	25	8	\$44.75	\$1.79
1/1/1991	1991	Rainbow Trout	200	12	\$420.00	\$2.10
1/1/1995	1995	Rainbow Trout	85	15	\$250.50	\$2.95
1/1/1995	1995	Rainbow Trout	200	12	\$550.00	\$2.75
10/6/1996	1996	Brown Trout	125	14	\$340.00	\$2.72
10/6/1996	1996	Rainbow Trout	200	14	\$500.00	\$2.50
11/2/2002	2002	Golden Trout	120	10	\$193.50	\$1.61
11/2/2002	2002	Kamloop Rainbow Trout	119	10	\$193.50	\$1.63
9/6/2003	2003	Rainbow Trout	100	10	\$193.95	\$1.94
9/6/2003	2003	Golden Trout	100	8	\$193.95	\$1.94

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