

Diet analysis of predator fish in Otsego Lake prior and subsequent to walleye (*Sander vitreus*) stocking; day vs. night, 2004

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INTRODUCTION

Otsego Lake (42° 41'N-70°W) is the headwaters of the glacially-created Susquehanna River valley within the northern Appalachian Plateau. Historically considered oligo-mesotrophic, (Harman et al., 1997) the unauthorized introduction of alewives (*Alosa pseudoharengus*) in 1986 (Foster 1989) affected the lake, creating changes similar to those of eutrophy (Harman et al. 2002). Efficient planktivores, alewives shifted species dominance in Otsego Lake from predominately large bodied crustaceans to smaller *Bosmina* sp. and rotifers (Warner 1999). Concurrent with the increasing alewife abundance, water transparency declined due to the lack of zooplankton grazing on algae. Increased algae levels causes depressed hypolimnetic oxygen concentrations during summer stratification. This is a result from decomposing algae in the hypolimnetic zone.

Reduction in the populations of the Otsego bass (*Coregonus clupeaformis*) and Cisco (*C. artedii*) could be due to competition with alewives for larger zooplankton (Linhart 1999), or fry predation by alewives.

Since 2000, walleye (*Sander vitreus*) have been re-introduced at a targeted rate of 80,000/year. Ongoing BFS research has investigated alewife abundance (i.e., Brooking and Cornwell 2005), as well as trophic changes (i.e., Albright, 2005) that might be related to declining alewife populations resulting from walleye predation.

Alewives spawn in the shallows of the littoral zone from late May or early June until August (Smith 1985). Annual walleye stocking was undertaken subsequent to the spawning of alewives. Introduced walleyes are expected to target alewife fry allowing walleye growth to maintain a pace that would allow them to utilize that year class. Stocked walleye must survive heavy predation, an important variable determining the success of stocked fish (Clapp et al. 1995; Santucci and Wahl 1993). Hoyle and Keast (1987) indicate bass can consume slender bodied prey up to 50% of the bass total length. Prey 35% of their total length is optimal prey size.

Over the summer of 2004, three different batches of fish were stocked in Otsego Lake. The walleyes stocked on 30 June averaged 40mm in length. Those stocked on 9 July averaged 51mm in length and those stocked on 13 July averaged 53mm. The Hoyle and Keast model projects that these stocked walleye could be vulnerable to predators as small as 100mm (minimum) and very vulnerable to 150mm predators (optimal).

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Brooking et al. (2001) explored the possibility that stocked walleye survival would be lower in lakes having higher densities of large predators, (implying that small predators won't effectively consume walleye). Brooking (2001) also hypothesized that walleye predation may be occurring within a larger suite of predators beyond those considered in the bass-esocid model.

Bass and esocids (e.g., pickerel (*Esox niger*) and northern pike (*Esox lucius*)) are visual, opportunistic predators that will take advantage of disoriented or struggling prey (Smith 1985). Other potential predators of fingerling walleye, such as rock bass (*Ambloplites rupestris*), reportedly feed primarily during the day (Smith, 1985). Yellow perch (*Perca flavescens*) are also believed to be primarily day-time feeders (McDonnell and Cornwell 2003)

The goal of this study was twofold: 1) To determine survival rates of stocked walleye and to identify specific predators of walleye by examining stomach contents and to ascertain whether walleye are being selected for, or against, by comparing their percent composition in prey diet relative to other forage, and 2) To evaluate any differences in the above following night, as opposed to daytime, stocking. It was hypothesized that most of the predators of stocked walleye are visual, opportunistic diurnal feeders. Therefore, it was expected that walleye stocked at night should be less vulnerable to early post-stocking predation. Haul seining was used to collect predator fish. Methods used were similar to those developed in 2002 (McDonnell and Cornwell 2003).

MATERIALS AND METHODS

This study was conducted during June and July 2004. Six sample sites were used in collecting the predation data: Five Mile Point, Three Mile Point, Brookwood Point, Point Judith, Point Florence and Gravelly Point (Figure 1). These sites were chosen for accessibility, suitability for haul seining and for having similar bathymetries.

Daytime stocking was done on the west shore at Five mile Point, Three mile Point and Brookwood point. East shore locations of Point Judith, Point Florence and Gravelly Point were used for the night time stocking. Since walleye fingerlings tend to be littoral fish, east vs. west separation was intended to reduce the likelihood that they would be collected at sites other than that which they were stocked (Cornwell 2004). That is, they were not expected to cross the deep basin of Otsego lake.

Walleye were evenly stocked along the littoral zone over a 15-20' contour at all locations using the Biological Field Station barge and work boats. A pre-stock evaluation was conducted. Post-stock sampling occurred 3-6 hours following day stocking. Night stocking began at about 01:00, with sampling commencing about 3 hours later at daybreak.

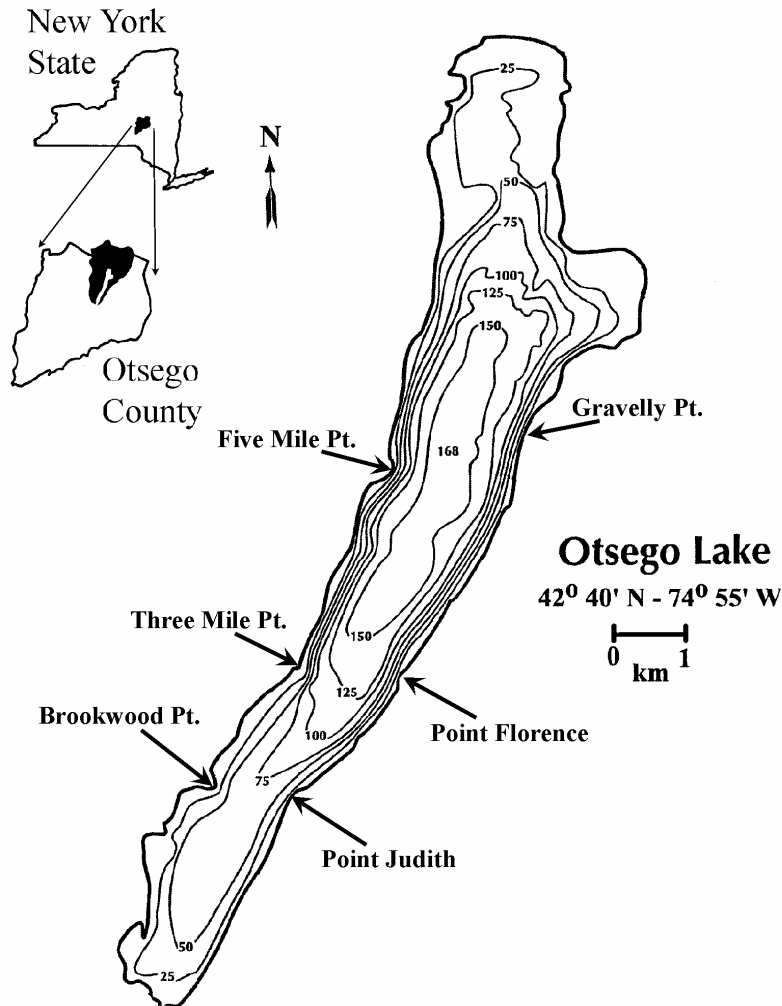


Figure 1. Bathymetric map of Otsego Lake showing locations of sites of walleye stocking and subsequent seining.

The collection of fish followed methodologies outlined in Nelson et al. (1983) using a 200' haul seine. Collected fish were weighed and measured then stomach contents were removed using pulsed gastric lavage as described by Lagler et al. (1963) and Foster (1977) on fish 100mm and larger. Stomach contents were collected in Whirl-Pacs[®], labeled, preserved in ethanol, frozen and examined later in the lab.

Stomach contents for predators are described in two ways. Frequency of occurrence is the proportion of fish that contained one or more of a given food type (Bowen 1996). The percent composition is the number of items of a given food type expressed as a percentage of the total items counted of all food types (Bowen 1996). Selection indices for predators are based on a comparison between the relative abundance of a prey type in the diet of the predator and the relative abundance of that prey type in the environment (Bowen 1996). The proportion of prey in the environment was determined by prey items captured in the haul seine at the time of predator collection. A selection index can then be made to determine if a prey type is selected for, selected against or eaten in the same frequency as it occurs in the environment (Bowen 1996). The

Strauss index (1979) is used to describe prey selection by predators in this study and is represented by the formula:

$$L = r_i - p_i$$

L is the expression of the Strauss index from 1 to -1, r_i is the relative abundance of prey type in the predator diet and p_i is the relative abundance of that prey fish in the environment (Bowen 1996). Ration (r_i) was determined directly from the predator stomachs subsequent to stocking in percent composition by number. Prey proportion (p_i) was determined through haul seining. A Strauss index of 1 indicates perfect selection for a prey item and an index of -1 indicates perfect selection against (Bowen 1996).

RESULTS AND DISCUSSION

Tables 1 through 4 give the frequency of occurrence (FOO) and percent contribution (PN) of various prey items in the game fish encountered for east shore sites pre-stocking, west shore sites pre-stocking, east shore sites post-stocking, and west shore sites post-stocking, respectively. Stocking on the east shore was conducted at night; west shore stocking was conducted during the day. Crustaceans (mainly crayfish) and insects comprised the bulk of stomach contents in both the east and west sites, and both prior to and following stocking. Following stocking, walleye were the most commonly consumed prey fish, though they were also found to be the most prevalent prey fish in the environment.

Table 5 indicates that yellow perch, largemouth bass, smallmouth bass and chain pickerel were selective for walleye fingerlings that were stocked during the daytime. Selectivity by all those game fish for walleye was substantially reduced when stocking took place at night. Rock bass alone were selective against day-stocked walleye; however, of those collected, all had empty stomachs or crayfish parts. Rock bass was the only species having a higher selection following night stocking, though that selection, at 0.026, was weak. This is despite the reputation of rock bass being a visually oriented, day time feeder (Smith 1995).

CONCLUSIONS

Given the resources expended in stocking game fish, tools or strategies undertaken which improve the survival of those fish stocked should have considerable appeal. This research suggests that walleye fingerling stocked during the day are selected for by most game fish; these walleye are likely disoriented and, as such, prove to be easy targets. Selection on walleye by game fish declined markedly when stocking occurred at night, implying most predation by Otsego's game fish is visually oriented. It seems likely that if stocked fingerlings are able to avoid predation in the first several hours of being added, long term survival will be enhanced as these fish become acclimated to their new environment.

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