Diet of lake trout (*Salvelinus namaycush*) following an alewife (*Alosa pseudoharengus*) introduction in Otsego Lake, NY

Joe Collins[1]

ABSTRACT

Since the introduction of alewives (*Alosa pseudoharengus*) in 1986 (Foster 1989), ecological changes related to the trophic interactions in the zooplankton communities in Otsego lake have occurred (Harman et al. 2002). To determine the effect of these changes on the diet of lake trout, angler surveys were conducted for the collection of stomachs for analysis. This study was compared those of 2002 and 2003 (High 2004) and to a study conducted by the Department of Environmental Conservation before alewives were introduced into Otsego lake (Stanford 1984). Before alewife introduction, slimy sculpins (*Cottus cognatus*) were the primary forage whereas alewives are currently the primary forage. Midges were the only invertebrate consumed by lake trout; they were collected from all size classes of lake trout examined.

INTRODUCTION

Alewives (*Alosa pseudoharengus*) were first documented in Otsego Lake in 1986 (Foster 1989). Alewives are efficient planktivores which selectively consume larger bodied organisms. Their dominance has shifted Otsego Lake's zooplankton community from larger crustaceans to smaller rotifers (Taylor and France 1994). Since smaller bodied zooplankton are inefficient grazers, summer time algal biomass in the lake subsequently increased. High levels of algae in the lake have increased decomposition at the bottom of the lake, leading to reduced dissolved oxygen in lower (hypolimnetic) zone.

Typically, the cold (<10°C), deep water lakes are where lake trout (*Salvelinus namaycush*) reside during summer stratification, though they may spend time feeding in shallower waters (Smith 1985). Along with cooler water, lake trout require adequate dissolved oxygen, the optimal level being >6mg/l (Nicholls 1995). During summer stratification, lake trout face potential stress if those conditions are lacking. Reduction of alewives, through increased predation, potentially could improve lake trout habitat.

Lake trout are generally considered opportunistic feeders (Smith 1985). Prior to the establishment of alewives in Otsego Lake they ate slimy sculpins (*Cottdae cognatus*) and midges (*Chironmidae*), and to a lesser degree consumed yellow perch (*Perca flavecense*) and cisco (*Coregonus artedii*) in Otsego Lake (Sanford 1984). Similarly,

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[1] F.H.V. Mecklenburg Conservation Fellow, Summer 2004. Present Affiliation: Gilbertsville-Mt. Upton.

sculpins were the primary forage fish in Lake Ontario (Elrod 1983). The diet of lake trout would be expected to change with shifts in the forage base. The goal of this study was to monitor and document any changes in lake trout diet since the introduction of alewives. This work is a continuation of that conducted during the summer of 2003 (High 2004).

MATERIALS & METHODS

Lake trout stomachs were provided by anglers during the months of August and September of 2003 and May through July of 2004. A total of 33 lake trout stomachs were collected and analyzed. Fish lengths ranged from 534 mm to 749 mm, which exceed the legal length limit of 534mm for Otsego Lake. Stomachs were preserved in a -20^{o}C freezer until they could be examined. Samples were labeled according to fin clip (which provides information regarding wild verses stocked fish and the year stocked, if not wild), length and date. Contents were identified, counted and placed in different Pyrex containers and dried at 105º C in a drying convection oven model SB550. Stomach contents were then weighed using a digital scale. Data were calculated as Percent Concentration by Weight (PCW), Percent Composition by Number (PCN) and Frequency of Occurrence (FOO) as described by Nielsen and Johnson (1983). PCW, the weight of each food item expressed a percentage of the total weight of ingested food per fish analyzed, was determined by dry weight. Percent Composition by Number (PCN) was used to determine how many of each item was represented per fish. Frequency of Occurrence (FOO) estimates the proportion of the lake trout that contained one or more of a given food type (Neilson and Johnson 1983).

RESULTS AND DISCUSSION

Since lake trout stomachs were provided by anglers, only samples from lake trout greater than 534 mm (21 in), the minimum legal creel limit, were represented. This differed from the study by High (2004), wherein a substantial proportion of samples were taken during the regular biannual gill netting surveys conducted by the NYSDEC, which provided stomachs from all size classes. Neither angling nor gill netting as a means of collecting stomachs can be assumed to accurately reflect feeding behavior, as actively feeding fish may not be representative, and fish captured in gill nets often regurgitate (Neilson and Johnson 1983).

During this study, Lake trout were found to consume only alewives and midge pupae and larvae; other unidentifiable “fish parts” were collected as well. This was consistent with work conducted by High (2004).

Table 1 shows Frequency of Occurrence for alewives, midges and “empty stomachs” over time. Table 2 provides Percent Composition by Number and Percent Composition by Weight for lake trout stomach items arranged by lake trout size. PCN suggests that lake trout 500-600 mm in size consume more midges than alewives, whereas 600 mm and larger lake trout predate more heavily upon alewives. Percent

Composition by Number and Frequency of Occurrence suggest that substantial numbers of midges are consumed in May and August-September (Tables 1 and 3), likely correlating with the emergence, and therefore the availability, of those insects. However, Percent Composition by Weight suggests that alewives are the main source of energy for lake trout in Otsego Lake.

Month	Alewives	Midges	Empty
2003			
Aug-Sept (18)	39	50	33
2004			
May (10)	50	20	30
June-July (5)	40	0	60

Table 3: Frequency of Occurrence of alewives, midges and empty stomachs of lake trout over time.

Length mm	Midges		Alwives		Unknown Fish Parts	
----------	PCN	PCW	PCN	PCW	PCN	PCW
500-549 (8)	93.22	2.09	5.08	91.08	1.69	6.83
550-599 (11)	16.67	0.69	83.33	99.31	0.00	0.00
600-649 (6)	44.44	0.07	44.44	99.46	11.11	0.47
650-699 (3)	86.67	0.48	6.67	98.60	6.67	0.92
700-749 (5)	42.86	0.35	57.14	99.65	0.00	0.00

Table 2. Percent Composition by Number (PCN) and Percent Composition by Weight (PCW) for items found in lake trout stomachs. Data are organized by length.

Month(N)	Midges		Alewives		Unknown Fish Parts	
----------	PCN	PCW	PCN	PCW	PCN	PCW
May '04(10)	41.53	0.17	46.72	98.89	11.75	0.93
June '04 (2)	0.00	0.00	100.00	100.00	0.00	0.00
July '04 (3)	0.00	0.00	100.00	100.00	0.00	0.00
August '03 (8)	88.89	3.34	11.11	96.66	0.00	0.00
September ‘03 (10)	91.23	2.80	7.02	91.90	1.75	5.30

Table 3. Percent Composition by Number (PCN) and Percent Composition by Weight (PCW) for items found in lake trout stomachs. Data are organized by month.

REFERENCES

Elrod, J.H. 1983. Seasonal food of juvenile lake trout in US waters of Lake Ontario. J. Great Lakes Res. 9(3):396-402.

Foster, J.R. 1989. Introduction of the alewife (*Alosa pseudoharengus*) into Otsego Lake. *In* 22nd Ann. Rept. (1989). SUNY Oneonta Bio. Fld. Sta, SUNY Oneonta.

France, K. and L.A. Taylor. 1994. A study of the Otsego Lake limnetic zooplankton community, 1993. In 26th Ann. Rept. (1993). SUNY Oneonta Bio. Fld. Sta., SUNY Oneonta.

Harman, W.N., M.F. Albright and D.M. Warner. 2002. Trophic changes in Otsego Lake, NY following the introduction of the alewife (*Alosa psuedoharengus*). Lake and Reserv. Manage. 18(3)215-226.

High, J. 2003. Diet of lake trout (*Salvelinus namaycush*) following the alewife (*Alosa pseudoharengus*) introduction into Otsego Lake, NY. *In* 36th Ann. Rept. (2003). SUNY Oneonta Bio. Fld. Sta, SUNY Oneonta.

Murphy, R.B. and D.W. Willis. 1996. Fisheries Techniques, 2nd Ed. Quantitative description of the diet. American Fisheries Society. Bethesda, MD.

Nicholls, K.H. 1995. Limnological basis for a Lake Sincoe phosphorus loading objective. Lake Simcoe environmental management strategy. Implementation technical report B17. Ontario, Canada.

Nielson, L.A. and D.L. Johnson. Fisheries techniques. South Printing Company, Inc. Blacksburg, VA.

Sanford, D.K. 1984. Otsego Lake lake trout study, 1969-1981. New York State Department of Environmental Conservation. Region IV Fisheries Office. Stamford, NY.

Smith, C.L. 1985. The inland fishes of New York State. New York State of Environmental Conservation. Albany, NY.