

# Hydroacoustic surveys of Otsego Lake, 2005

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## INTRODUCTION

In 2005, we sampled Otsego Lake (Otsego Co.) with acoustics to estimate abundance of offshore fishes. This was a cooperative project between Cornell University Biological Field Station, SUNY Cobleskill Department of Fisheries and Wildlife, and SUNY Oneonta Biological Field Station. Otsego Lake has a warm-water fishery dominated by bass, esocids, and sunfishes, while a cold-water fishery includes a wild population of lake trout (*Salvelinus namaycush*) and is maintained by stocking lake trout, brown trout (*Salmo trutta*) and Atlantic salmon (*S. salar*). In recent years, a walleye population has been established through stocking as well. Nearly all of these fisheries are probably strongly affected by a dense alewife population that became established in the late 1980s (Foster 1980). Schooling characteristics and patchy distribution of offshore baitfish populations such as alewife often make conventional netting gear ineffective at providing reliable density estimates. However, hydroacoustics combined with netting often provides more reliable estimates (Wanzenbock et al. 2003). Our report summarizes the results of hydroacoustic surveys of Otsego Lake in the spring and fall of 2005, and comparison to surveys as far back as 1996.

## METHODS

Cornell University researchers surveyed the offshore pelagic fish communities using hydroacoustics. Small-mesh netting for alewife was done in conjunction with these surveys by SUNY Oneonta and SUNY Cobleskill staff. Density of fish targets in the acoustics was estimated along transects in the lake, and the catch in gillnets was used to identify targets and to sample length, weight, and depth distribution of alewife.

Hydroacoustic surveys were conducted on the nights of 4 June and 5 October 2005 along 9 transects throughout the lake. Transects ran from shore to shore along a zig-zag pattern, distributed from the northern to southern ends of the lake. Data were collected with a 70 kHz, split-beam Simrad EY500 echo sounder and stored directly on the hard drive of a laptop computer. The transducer was towed at a depth of approximately 0.5 m. The unit was calibrated in spring and summer of 2005 and the performance checked against a standard copper sphere. Echo integration threshold for data collection was set to -80 dB.

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Acoustics data were analyzed with Sonardata Echoview v.3.45 software. On the echograms for each of the 9 transects, the surface (0-2 m) and the bottom (0.3 m from the actual bottom) were removed to leave just the open water area for analysis of fish density. Fish density ( $\#/m^2$ ) was calculated using the area backscattering coefficient and average in-situ target strength calculated for targets larger than  $-70$  dB. Only targets with a target strength of  $-61$  dB and larger were considered to be fish targets, based on target strength distributions of alewife in cages (Cornell University, unpublished data), so the density was multiplied by the ratio of targets over  $-61$  dB. Target strength distributions were checked so that echoes which were too small to be fish could be removed. In these cases (fall 2002, 2004 both spring and fall), the cutoff used for target strength distributions was  $-51$  dB, and the densities increased by 1.316 to account for targets between  $-51$  and  $-61$  dB (Cornell University, unpublished data). The density of fish per square meter was then multiplied by 10,000 to get the density of fish/ha. Average and standard deviation were calculated based on the actual number of transects done (9 in 2005).

## RESULTS AND DISCUSSION

Acoustic fish abundance in June was estimated to be 236 fish/ha, with a 95% confidence interval of  $\pm 137$  fish/ha based on 9 transects, down from 907 fish/ha found in June 2004. Targets corresponding in size with alewife showed some concentration in the upper 5 m of the water column, though targets were also distributed down to bottom. In the spring netting survey, average length and weight of alewife was 148 mm and 24.4 g. All alewife were  $>130$  mm suggesting there were no yearlings caught, which are generally 90-120 mm. Biomass of alewife in June 2005, estimated from the acoustic abundance and average weight in gillnets, was estimated to be 5.8 kg/ha. Larger fish targets ( $-35$  dB and larger) occurred in the 20-40 m depths at a density of approximately 7.6 fish/ha (95% CI  $\pm 4.8$  fish/ha). These were most likely salmonids; however this estimate may include some other predators such as cisco, whitefish, walleye, or bass, which are typically bottom-oriented predators but will sometimes suspend in open water when open water forage is available. This is probably a minimal estimate of predator density since some overlap of target strengths occurred, and since other predators are likely too close to bottom to be detected.

Pelagic fish abundance in October was estimated to be 9,562 fish/ha, with a 95% confidence interval of  $\pm 2,322$  fish/ha based on 9 transects (Table 1). Targets corresponding in size with alewife were concentrated between 5-15 m deep in the water column (Figure 1). The fall gillnet survey caught 122 alewife, of which 102 (84%) were probably young of the year ( $<95$  mm). This suggests the density of YOY alewife was about 8,032 fish/ha, and abundance of adults was 1,530 fish/ha, indicating high reproduction in the summer of 2005. YOY alewife averaged 73 mm and 3.2 g in the nets, and older alewife averaged 141 mm and 22 g. The biomass of YOY and adult alewife in fall of 2005 was estimated to be 2.6 kg/ha and 3.4 kg/ha, respectively. Though YOY were much more abundant, their biomass was still less than the adult biomass due to their small average size. Larger fish targets ( $-35$  dB and larger) occurred in the 15-40 m depths (Figure 1) at a density of approximately 8.6/ha (95% CI  $\pm 5.7$  fish/ha, Table 2).

Table 1 provides a comparison with past acoustic surveys in fall. Fall surveys were done in 1996, 1997, and 2000-2005. All surveys were analyzed with the Echoview software using the same methods outlined above, except for Fall 2000 which was done with a different acoustics setup (Biosonics). While there have been some discrepancies between the different acoustics units used, the 95% confidence intervals generally overlap in surveys done with both units at the same time (Mason and Schaner, 2001). Abundance of alewife in the fall (Figure 2) has varied in a cyclical pattern, from a low of 1,400 fish/ha in 2000 to almost 11,000 fish/ha in 2002. These alewife densities are mostly within the range of densities observed in the Finger Lakes (1500-4000/ha, Cornell University, unpublished data) though higher in some years in Otsego Lake. Densities of alewife in Cayuta Lake (a small, highly productive shallow lake in Schuyler County) have shown a similar range in densities (2,000-12,000 fish/ha from 1995-2005, Cornell University, unpublished data) as Otsego Lake. Cause for these large, cyclical fluctuations in alewife abundance have often been attributed to cannibalism by adult alewife on their own larvae, predation by walleye and salmonid predators, winter kills and die-offs due to dramatic changes in thermal regimes from sudden wind events (Crowder 1980, Eck and Wells 1987, Jones et al. 1993).

Table 1. Otsego Lake fall alewife density from acoustics surveys.

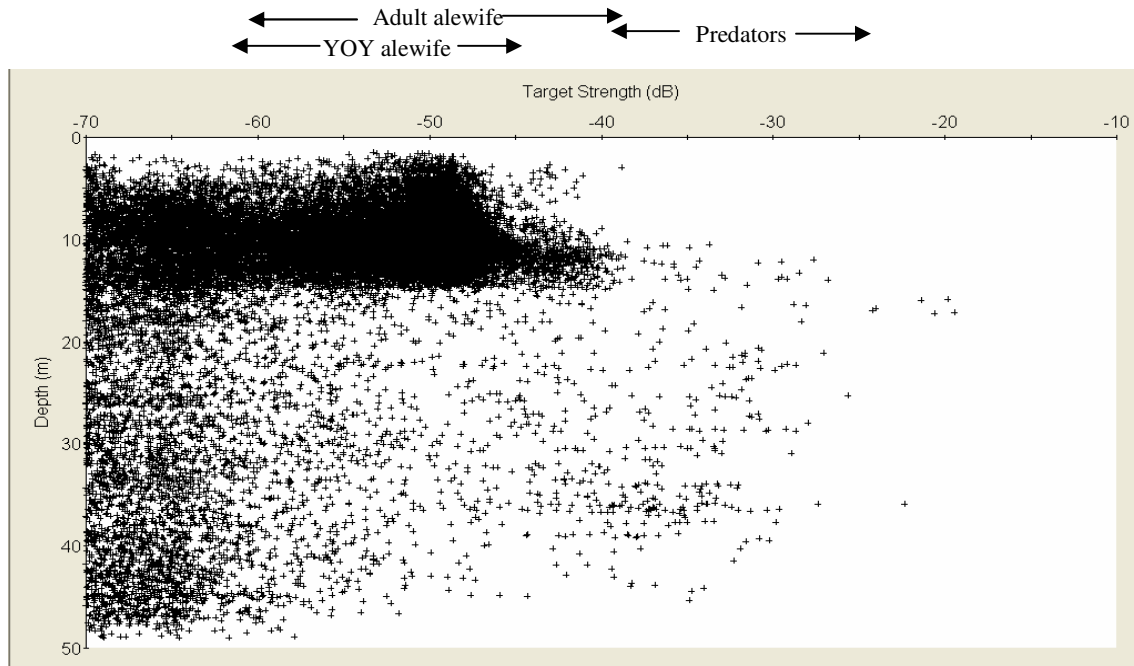
Date	Alew (#/ha)	# transects	stdev	95% SE
9/16/1996	5170	7	1434	1063
10/12/1997	2053	9	798	521
10/1/2000 (Biosonics)	1382	8	925	774
10/13/2001	8562	9	3811	2490
10/1/2002	10901	16	4886	2394
10/10/2003	3851	16	2901	1421
10/9/2004	2418	9	1571	1026
10/5/2005	9562	9	3555	2322

Table 2. Estimated abundance of predator-size echoes from acoustics.

Date	Predators (#/ha)	N	stdev	95% SE
9/16/1996	7.5	7	4.2	3.1
10/12/1997	3.3	9	3.4	2.2
10/13/2001	35.2	9	13.9	9.1
10/1/2002	15.2	16	10.7	5.2
10/10/2003	1.2	16	1.5	0.7
10/9/2004	3.5	9	4.7	3.1
10/5/2005	8.6	9	8.8	5.7

Further monitoring of the alewife population and more intensive analysis of spring and fall hydroacoustic data for alewife should provide researchers with additional insight into the effects that walleye and salmonid predators may have on the Otsego Lake alewife population.

**Figure 1. Depth distribution of various sized acoustics targets, 10/5/2005.**



**Figure 2. Fall alewife density in Otsego Lake, 1996-2005, with 95% CI.**



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