The Oneida Lake Creel Survey, 2002-2007

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Executive Summary

Angling on Oneida Lake is a popular activity and represents a large economic stimulus to the surrounding area. Despite over 50 years of fish population and limnological monitoring by Cornell University Biological Field Station, assessments of the impact of angling on sportfish populations in the lake are limited. Angling effort and success was assessed in the late 1950s (Grosslein 1961) and in 1997-1998 (VanDeValk et al. 1999). Through funding from the New York State Department of Environmental Conservation, a creel survey, based on the methods used by Grosslein (1961), was conducted during the 2002-2007 walleye angling seasons.

The season was separated into 2 time periods, open water, early May until late October, and ice, late January until mid-March. Angling effort was estimated by counting boats from a 10m tower and adjusting those counts based on a relationship between tower counts and concurrent flyovers. Counts were then multiplied by the number of hours of daylight, for that day, to estimate angling effort in boat hours. Estimates of total effort are presented in angler-hours which are calculated by multiplying the number of boats counted by the mean number of anglers per boat during the sample period.

Angler success was estimated from roving (on lake) interviews of anglers while they fished. Angler success rate data was recorded by the clerk and included: how long the party had been fishing, how many anglers were in the party, how many fish were caught, by species, and how many fish were harvested, by species. Individual catch or harvest rates were calculated by dividing the number of fish caught or harvested by the individual party's effort (duration of trip times the number of anglers). Mean success rates were then averaged over the time period reported (day, month or season). Estimates of total catch and harvest are the product of angling effort (boat-hours) times angler success.

During 2 of the roving survey years, usable concurrent access point surveys were conducted by interns during summer months (mid June through early July 2002 and 2006). Methods comparisons of roving and access point (boat launch) interviews were conducted to identify if those methods were interchangeable.

Angler effort generally increased throughout the survey from 12.95 angler-

hours/ha (2002) to 22.3 angler-hours/ha (2007). Most of the angling effort occurred during the open water season (mean: 84%) and ranged from 9.35 angler-hours/ha (2002) to 18.02 (2006). The majority of interviewed anglers, during the open water season, reported targeting walleye (mean: 68%). Black bass were targeted by 17% of anglers and yellow perch by 14%. Ice season effort ranged from a low during the 2005 walleye season of 0.34 angler-hours/ha, a result of incomplete and inconsistent ice cover, to 4.4 angler-hours/ha during the 2007 season. Anglers reported fishing for walleye and yellow perch (56%) more often that each species individually (walleye: 18%; yellow perch 0.19).

Annually, anglers caught a mean of 0.23 walleye/angler-h, 0.41 yellow perch/angler-h, and 0.19 black bass/angler-h. Catch rates of walleye during the open water season increased from 2002-2004 (0.23 – 0.63 fish/angler-h) and declined to a mean of 0.2 walleye/angler-h during 2005-2007. Yellow perch catch rates declined from 2002 through 2005 (range: 0.44 – 0.07 fish/angler-h) and increased in 2006 (0.58 fish/angler-h) and 2007 (0.52 fish/angler-h). Black bass catch rates were relatively consistent, ranging from 0.15 to 0.24 fish/angler-h.

Ice angling catch rates were variable for both walleye and yellow perch. Anglers caught a mean of 0.15 walleye/angler-h (range: 0.05 – 0.26 walleye/angler-h). Yellow perch catch rates ranged from 0.03 to 1.0 fish/angler-h (mean: 0.49 fish/angler-h).

Annual mean harvest rates were 0.09 walleye/angler-h, 0.29 yellow perch/angler-h, and 0.03 black bass/angler-h. Open water walleye harvest rates increased from 2002 to 2004 (0.04 to 0.14 fish/angler-h) and remained relatively consistent for the duration of the survey. In October of 2004, the minimum length limit for walleye was changed from 18 inches to 15 inches. Yellow perch open water harvest rates trended similarly to yellow perch catch rates (range: 0.05-0.39 fish/angler-h). Black bass open water harvest rates were low (range: 0.008 – 0.04 fish/angler-h), which may reflect a preference for catch and release by bass anglers.

Total harvest was 224,700 walleyes, 389,000 yellow perch, and 41,200 black bass. Mean angling mortality was estimated as 7% (range: 2 – 12%) for walleye and 5% (range: 0.9 – 10%) for yellow perch.

Comparisons of angler success rates estimated from roving and access point surveys indicated that there were no significant differences between harvest rates for either year and for catch rates in 2006. However, in 2002 there were significant

differences between walleye ($p = 0.0002$) and yellow perch ($p = 0.04$).

Catch and harvest rates of walleyes and yellow perch were compared to the number of cormorant feeding days during the study period. These comparisons suggested a significant negative linear relationship with cormorant feeding days only, which is likely a result of the 2004 regulation change rather than an indication of direct negative impacts of cormorants on angler catch rates.

Introduction

Oneida Lake has long been known as the premier walleye *Sander vitreus* and yellow perch *Perca flavescens* fishery in New York State. In recent years, black bass (smallmouth bass *Micropterus dolomieui* and largemouth bass *M. salmoides*) have attracted increasing interest, particularly from tournament anglers. Centrally located, Oneida is the largest inland water body in New York State and ranks fourth in angling effort for all water bodies adjacent to, or within the State's borders (Connelly et al. 1997). As estimated by Connelly et al. (1997), angler expenditures on Oneida Lake in 1996 were in excess of $10 million, indicating that the fishery plays a large role in the local economy. Additionally, Oneida Lake has recently received national attention as the site of B.A.S.S. Elite series tournaments, which bring additional economic benefit and may attract more out-of-state anglers than before.

The Cornell Biological Field Station has been monitoring walleye, yellow perch, and other fish populations, as well as limnological variables, of Oneida Lake since 1956. These data represent a valuable understanding of the biology and ecology of Oneida Lake; however, data pertaining to angler use and success have been collected in only a few years. Creel surveys were conducted from 1957 to 1959 (Grosslein 1961), and in 1997 (VanDeValk et al. 2002). Additionally, an angler diary program was conducted from 1994 to 1998 (VanDeValk 2003). These data have improved our understanding of angling quality on the lake, but large gaps in our understanding of how anglers affect the fishery and how anglers respond to changes in the fishery remain.

Oneida Lake has experienced significant system-wide perturbations since the mid 1980s. The introduction of zebra mussels *Dreissena polymorpha*, population expansion

of double-crested cormorants *Phalacrocorax auritus*, changes in the fish community (specifically increases in white perch *Morone americana*, gizzard shad *Dorosoma cepedianum* and smallmouth bass), accompanied declines in walleye and yellow perch populations (VanDeValk et al. 2008). Monitoring revealed the changes in fish populations; however, potential changes to the quality and quantity of fishing opportunities were not assessed. In light of the gap in knowledge about angler use and success on Oneida Lake, a creel survey was initiated at the beginning of the 2002 walleye angling season and continued until the end of the walleye season in March 2005. During that period, the Oneida Lake standard walleye population assessment (VanDeValk et al. 2008) revealed that the adult walleye population was approaching the long-term average with a large year class from 2001 soon to recruit to the fishery, and as a result, in October 2004, the walleye minimum length limit was changed from 18 to 15 inches. As a result of this change, the creel survey was extended an additional three years, to the end of March 2008, in an attempt to identify any impacts to the fishery.

The objectives of the current study were to:

1. Measure angler use, catch, and harvest per angler on Oneida Lake from April 14, 2002 through March 15, 2008.
2. Calculate total harvest of walleye, yellow perch and other species during the survey time period.
3. Compare total harvest for walleye and yellow perch to their respective in lake populations to estimate angling mortality.
4. Determine if access point surveys can provide a representative index of catch and harvest rates for future monitoring.
5. Assess influence of the reductions in double-crested cormorant numbers on angler catch and harvest rates.

Methods

The Oneida Lake creel survey was a complimented aerial-roving stratified random sampling design.

Angler Effort Estimation

Tower Counts

Counts of angling parties were conducted from a 10m tower on Shackelton Point using a Kowa Prominar TSN – 4, 20-60x spotting scope. The clerk counted visible angling parties (open water: boats; winter: shanties and anglers) before and after the sampling period on roving survey sample days (sample day selection below) and at two randomly selected times on non-sampling days. For counting purposes, the lake was divided into 4 triangular areas with the tower as the apex (Figure 1).

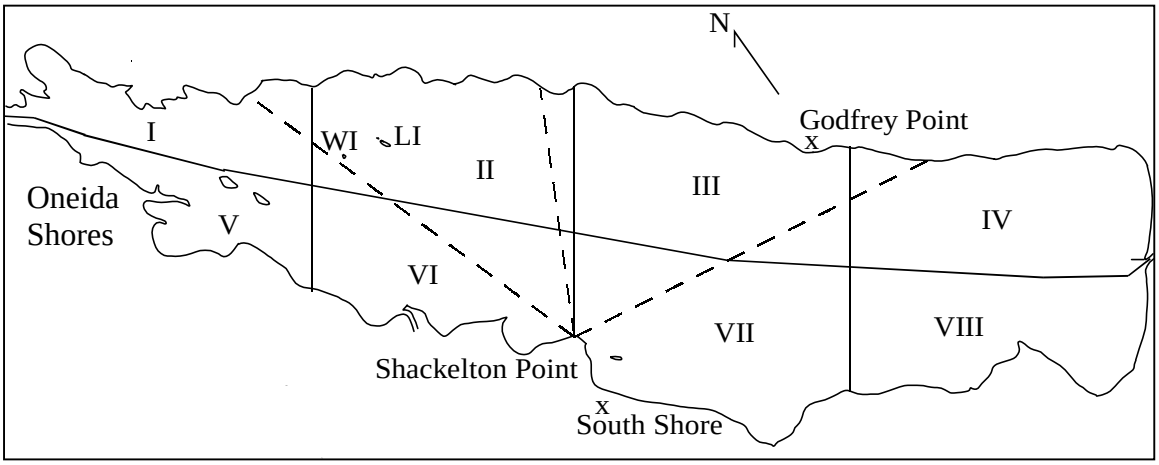

Figure 1. Oneida Lake with tower count (dashed lines) and roving survey (solid lines) section boundaries marked.

The clerk counted all boats (open water) or anglers and shanties (winter) visible in each area and categorized them as: fishing or non-fishing. The open water category definitions were: 1. Fishing – a boat with no visible wake that is consistent with a vessel

typically used for fishing, 2. Non-fishing – Wake (a boat, typically used for fishing, with a visible wake) or 3. Non-fishing - Other (any boat with or without a visible wake that is not consistent with typical fishing boats (e.g., sailboat, personal watercraft, “cigarette” boat)). A common recreational practice on Oneida Lake is for boats to tie up together into groups, usually on sandy areas in bays or other areas protected from the wind. Groups of boats tied up as such, no matter the type, were considered to be “Other” boats. Categories for winter tower counts were: 1. Angler – an angler on the ice, and 2. Shanty – any shelter on the ice. Recreational snowmobiling is a popular activity on Oneida Lake and, as a result, any snowmobile under power was not recorded. Recreational snowmobilers were easily detectable based on their speed and lack of additional equipment, and as a result, a snowmobile pulling a shanty was recorded as a shanty. If an angler was standing or sitting in very close proximity to a lone shanty, only the shanty was recorded, as many anglers will search for fish in a small radius about the shanty. Additional information recorded by the clerk included date, time of day, furthest visible channel marker to the east and to the west (as a measure of visibility), percentage of cloud cover, precipitation (if any), wind direction and magnitude, and comments about the count session.

Open Water Aerial Adjustment

The entire lake is not visible from the tower; three points and 3 islands obstruct the view of portions of the lake. As a result, VanDeValk et al. (2002) developed an aerial adjustment for the open water season to account for unseen portions of the lake. Flyovers simultaneous with tower counts were conducted to develop a correction factor for tower counts. We used the aerial adjustment to expand the tower counts to whole-lake counts. The equation of the relationship for the open water season is:

$$a = \exp(0.703 \times b + 1.88) \quad (1)$$

where *a* is the aerial adjusted count and *b* is the tower count.

Ice Aerial Adjustment

In 1998, VanDeValk et al. (2002) conducted simultaneous flyovers during winter; however, conditions only allowed for 2 samples. In an effort to increase the precision of the aerial adjustment, count comparisons were conducted during this project, using the methods described by VanDeValk et al. (2002).

Sample Design and Analysis

VanDeValk et al. (1999) found that angler effort was roughly equal between weekdays and non-weekdays and, as a result, sample days were stratified to allow equal sampling effort for category. Federally observed holidays were considered non-weekdays; in which case, 2 of the 3 “non-weekday” days were randomly selected. Roving surveys data collection (see below) was conducted 4 days each week (two weekdays and two non-weekdays). Mean daily counts, calculated for each day tower counts were conducted, were multiplied by the number of hours of daylight, for that day, to estimate the total daily effort in boat-hours. Total weekly, monthly and/or seasonal effort was calculated by expanding the mean daily total effort by the number of days, by strata, for the period; monthly and/or seasonal.

Open water and Ice Angler Interviews for Estimation of Catch and Harvest Rates

Data were collected to quantify trip-based effort and success rate of anglers on Oneida Lake using roving creel survey methods as described in VanDeValk et al. (1999). The sampling day was divided into 2 six hour periods during the open water season (8:00-14:00 and 14:00-20:00). During the ice season, only one sampling period was used

(9:00-15:00). Within the period, the clerk would make a complete circuit of the lake interviewing anglers as encountered.

Inherent in roving creel surveys is the potential for length-of-stay bias (Pollock et al. 1994). As the clerk moves through the fishery, interviewing anglers, other anglers may move out of the fishery, creating a relationship between trip length and probability of interview. This bias is not problematic if there is no difference in angling trip metrics (e.g., catch rate) for differing trip lengths. However, if anglers are catching their limit and exiting the fishery or, conversely, expanding their trip length by culling fish, success rate estimates can be inaccurate. To reduce potential length-of-stay bias, checkpoints were incorporated into the sampling circuit (Pollock et al. 1994), and were created by sectioning the lake into 8 approximately equivalent areas (Figure 1). The clerk spent 45 minutes in each section regardless of the number of sample units (angling parties) present. The starting section for each sample day, as well as the direction of travel, was randomized to reduce potential spatial bias.

The clerk traveled through the fishery using a 5m Sylvan boat with a 25 hp tiller driven Johnson outboard motor during the open water season of 2002. During the 2004 to 2006 open water seasons, the clerk used a 5.5m Starcraft bow-rider with a 60 hp Johnson outboard motor (2004-2005) and a 90 hp Mercury outboard motor (2005-2006). During the 2007 open water season, the clerk used a 5.5m Crestliner bow-rider with a 60 hp Evinrude outboard motor (which failed early in the season), followed by the 90 hp Mercury. Winter surveys were conducted using a Skidoo Tundra snowmobile (2003 – 2004) and a Polaris Indy 340cc snowmobile (2004 – 2008). Ice conditions did not allow for the use of a snowmobile in 2005.

Upon entering each section, the clerk would count the number of boats or ice

anglers immediately visible using Bausch & Lomb Discoverer 10 X 40 binoculars. Angling parties tended to congregate around known productive areas, and as such, a rough approximation of the percentage of total parties by section within the unit would be made. The clerk would then attempt to interview a proportional number of anglers per group in an effort to collect a spatially representative sample while maximizing sample size. Not all boats or ice anglers were visible from each section entry point, so the total number of boats or ice anglers per area would necessarily be adjusted as the clerk moved through the section.

During the open water season, the clerk approached an angling party to a distance that permitted communication, but prevented the possibility for vessel contact (a distance that varied based on weather conditions). As a result, no fish were examined except for those volunteered for display by the angler. Ice anglers were approached on foot after parking the snowmobile, but no specific request was made to inspect fish. The interview was initiated by the clerk identifying him/herself and asking if the angler would be willing to participate in the survey. Upon agreement, the angler would be asked: how many fish they had caught by species and/or, the number of fish they had kept by species, the number of legal sized fish released by species, fishing start time, target species, if they trailered their boat to the lake (open water season only), and their zip code. Additionally, the clerk recorded the time of the interview, sample identification number, number of anglers by sex, and the number of anglers less than 16 years old. At the completion of the survey, the clerk offered the angling party an opportunity to make any comments, which were also recorded when offered. Interviews in which the angler reported fishing for less than 30 minutes were not included in the analysis to reduce the potential influence on variance estimates from extreme values for short trips (Pollock et

al. 1994).

The mean-of-ratios catch rate estimator (R_1) was used, to quantify angler success during pre-determined periods of time (e.g., day, week, month, etc.), for incomplete trips using the equation:

$$\hat{R}_1 = \frac{\sum_{i=1}^{N} \frac{c_i}{L_i}}{n} \qquad (2)$$

where N is the number of parties in the fishery, n is the total number of interviews for the period, c_i is the number of fish caught (harvested (h_i) for harvest rates) at the time of interview, and L_i is the length of the angling trip prior to the interview.

The variance formula for R_i is:

$$V(\hat{R}_1) = \frac{\sum_{i=1}^{N} (\frac{c_i}{L_i} - \bar{R}_1)^2}{n(n-1)} \qquad (3)$$

where *N* is the number of parties in the fishery (determined by tower counts), *n* is the number of parties interviewed, and other parameters as defined in Equation 2.

Access Point Survey Design (Interns)

Cornell University undergraduate interns interviewed anglers exiting the fishery at boat launches from June until August in 2002, 2004 and 2006 in order to generate complete trip rate estimates for comparison to roving interview results (incomplete trip estimates). Data collected in 2004 were determined to be unreliable and were not used in subsequent analyses. Interns followed the roving clerk schedule to allow for comparison of rates derived from each method. In 2002, intern sample areas were the South Shore and Godfrey Point State Boat Launches (Figure 1). Sample areas in 2006 also included

the Oneida Shores Boat Launch (an Onondaga County Park).

Intern interviews consisted of the same angler success rate data as collected during roving interviews, as well as additional human dimensions or market performance surveys. The 2002 and 2006 intern reports are attached as appendices. Estimates of complete trip rates collected at boat launches were compared to incomplete trip estimates from roving creel data with Mann-Whitney paired rank-sum tests of daily estimates.

The ratio-of-means estimator was used to calculate complete trip catch and harvest rates (Pollock et al. 1994):

$$\begin{aligned} \hat{R}_2 &= \frac{\sum_{i=1}^{n} \frac{c_i}{n}}{\sum_{i=1}^{n} \frac{L_1}{n}} \\ &= \frac{\bar{c}}{\bar{L}} \end{aligned} \qquad (4)$$

where c_i is the total number of fish caught or harvested by all interviewed anglers for that period, L_i is the total number of hours fished by all interviewed anglers for that period, and n is the number of anglers interviewed.

The variance formula for R_2 is:

$$V(\hat{R}_2) = \frac{\sum_{i=1}^{n} L_i(\frac{c_i}{L_i} - \bar{R}_2)^2}{n \sum_{i=1}^{n} L_i} \qquad (5)$$

with parameters as defined in equation 4.

Total Effort, Catch and Harvest

Estimates of effort, catch and harvest rate were pooled by month for each of the open water and winter seasons to determine the total number of hours spent angling, fish caught, and fish kept by season and year. Angling year is defined as the start to the end of the walleye angling season. For example, 2002 refers to angling-year 2002-2003.

Total effort was calculated using the equation as described by Grosslein (1961):

$$E = \bar{y} \times H \qquad (6)$$

where $\bar{y}$ is the mean daily count and *H* is the hours of daylight for that day. Total effort for a given period of time (e.g., month, season) was calculated by summing daily effort across the period.

The variance formula for *E* is (Grosslein 1961):

$$V(\hat{E}) = H^2 \times V(\bar{y}) \qquad (7)$$

where H^2 is the hours in the period of interest and $\bar{y}$ is the mean number of anglers per sample period.

Daily catch and harvest were estimated using (Pollock et al.1994):

$$\hat{C} = \hat{E} \times \hat{R} \qquad (8)$$

where *E* is described in Equation 7 and $\hat{R}$ is defined in Equations 3 and 5. Estimates of mean daily effort, catch and harvest rate were multiplied by the number of days, of each stratum, within the period (monthly) to calculate totals for the period. Total catch variance is the variance of a product (Pollock et al. 1994):

$$\hat{V}(\hat{C}) = E^2\hat{V}(\bar{R}) + R^2\hat{V}(\hat{E}) \qquad (9)$$

A more refined estimate of angler success, targeted catch or harvest rate, was calculated by computing either Equation 3 or 5 (incomplete or complete trip, respectively) for only those anglers who were targeting a specific species.

Angler catch and harvest rates for walleye and yellow perch were compared to estimated cormorant feeding days, using simple linear regression techniques. Cormorant

feeding days were estimated in 2002 and 2003 from a linear model with colony size on Lake Ontario and number of migrants as predictor variables. Feeding days for the rest of this project were estimated based on weekly counts on Oneida Lake (R. Debruyne pers. comm.).

When means are presented in this text, they are followed by 2 standard errors of the mean (i.e. mean ± 2SE) which approximates 95% confidence intervals.

Results

Open Water Angling Effort

Effort data (tower counts) were collected from the first day of the walleye angling season (first Saturday in May) each year except 2002 during which data collection began on April 14. Angler effort was extremely limited in April so counts before the beginning of walleye season were discontinued and the 2002 data were not used. The open water portion of the survey was generally completed by the beginning of November (mean end date: November 5); however, in 2005, angler interviews were terminated at the end of September as a result of a combination of equipment issues, weather, and low angler effort. In all, 1,018 tower counts were made on 628 dates (mean counts/year 170 ± 41.68; range 119 – 222). The maximum number of boats counted in a single count (adjusted) was 374 (May 6, 2006).

Except for a slight decline between 2006 and 2007, open water angling effort increased annually from a low in 2002 of 9.35 angler-h/ha (194,000 angler-h) to 18.02 angler-h/ha in 2006 (373,000 total angler-h; Figure 2a, Table 1). Within individual years, effort increased from May to a peak in July followed by a steady decline through October (Figure 2b).

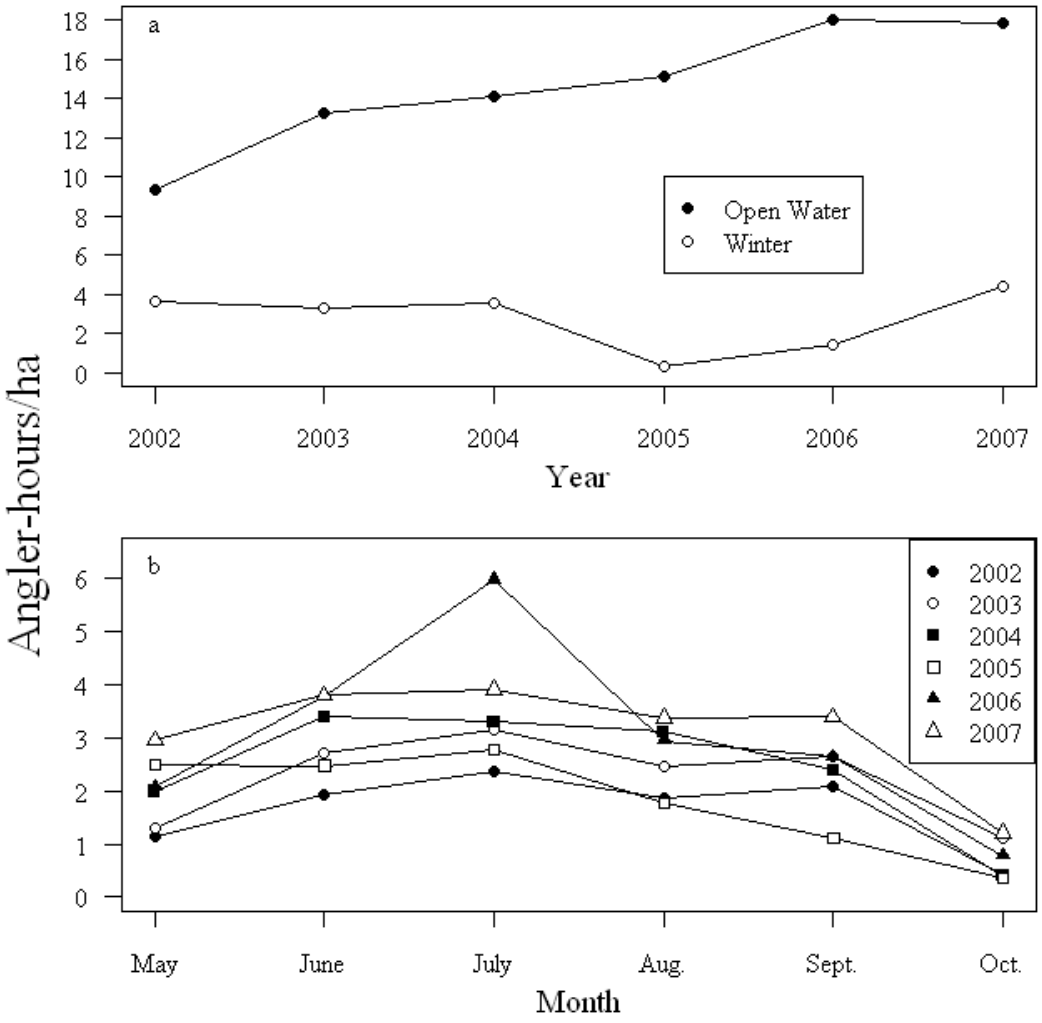

Figure 2. a) Annual angling effort (in angler-hours/hectare) during open water and winter seasons, 2002-2007. b) Monthly angling effort during open water, 2002-2007.

The relationship between effort and catch rate, as determined by regressing annual open water effort by annual open water mean catch rate, was not significant ($F = 0.23$, $R^2 = 0.05$, $p = 0.66$, Figure 3a); However, the relationship between effort as a function of harvest rate was significant ($F = 14.43$, $R^2 = 0.78$, $p = 0.02$; Figure 3b). The total number of open water angler trips increased throughout the study period despite the apparent decline in effort between 2006 and 2007 (Table 2). Walleyes represented 50% or more of targeted open water effort in all years (Table 3). The proportion of anglers targeting bass was relatively consistent, fluctuating between 12-17%, while the

proportion of anglers targeting yellow perch was more variable, with a low of 8% in 2004 and a high of 26% in 2007.

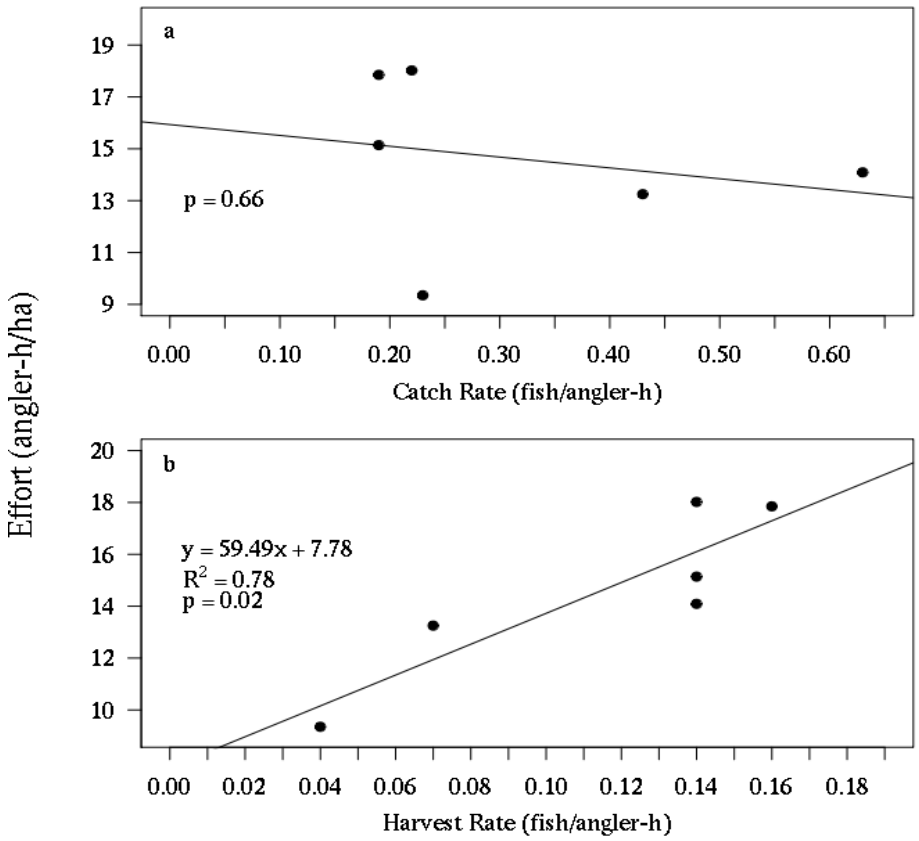

Figure 3. a) Angler effort as a function of walleye catch rate (a) and harvest rate (b).

Open Water Catch Rates (all trips)

A total of 6,376 angler interviews, of which 5,875 were usable (i.e., anglers had been fishing > 30 min prior to being intercepted by clerk), were conducted on 382 sample dates over the course of the study. The mean annual number of interviews for the open water season was 979 (±114; range 819-1161); the daily mean was 16 interviews (± 6; 0 – 49).

Over the course of the study, walleye catch rates averaged 0.32 fish/angler-h (± 0.02; range 0.19 – 0.63 fish/angler-h). Across years, walleye catch rates increased from 2002 to 2004, dropped between 2004 and 2005, and remained relatively stable through

the end of the survey (Figure 4, Table 4). Within years, walleye catch rate was generally higher in May and June and declined throughout the rest of the open water season (Figure 5a).

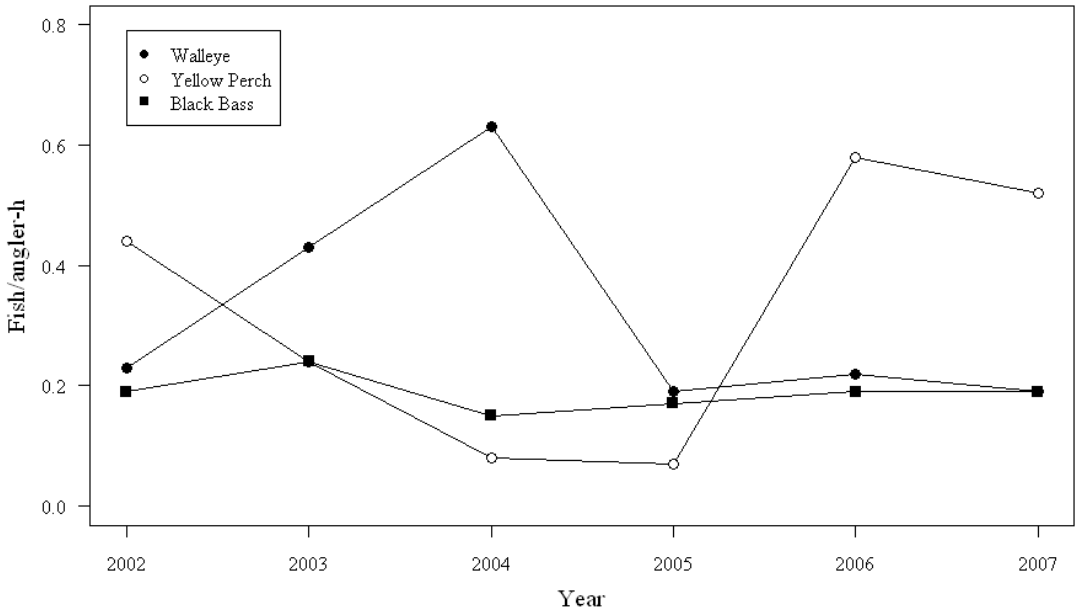

Figure 4. Annual mean catch rates for walleye, yellow perch, and black bass during the open water season (2002-2007).

Yellow perch catch rates were high in 2002 (0.45 fish/angler-h), declined to a low in 2005 (0.07 fish/angler-h) and increased to 0.58 and 0.52 fish/angler-h in 2006 and 2007, respectively (Figure 4, Table 4). Monthly rates were generally low throughout the summer until sharp increases in September and October (Figure 5b). Black bass catch rates were relatively steady throughout the survey (mean: 0.19 ± 0.02; Figure 4, Table 4). Within years, catch rates were variable throughout the season with peaks in July and September (Figure 5c).

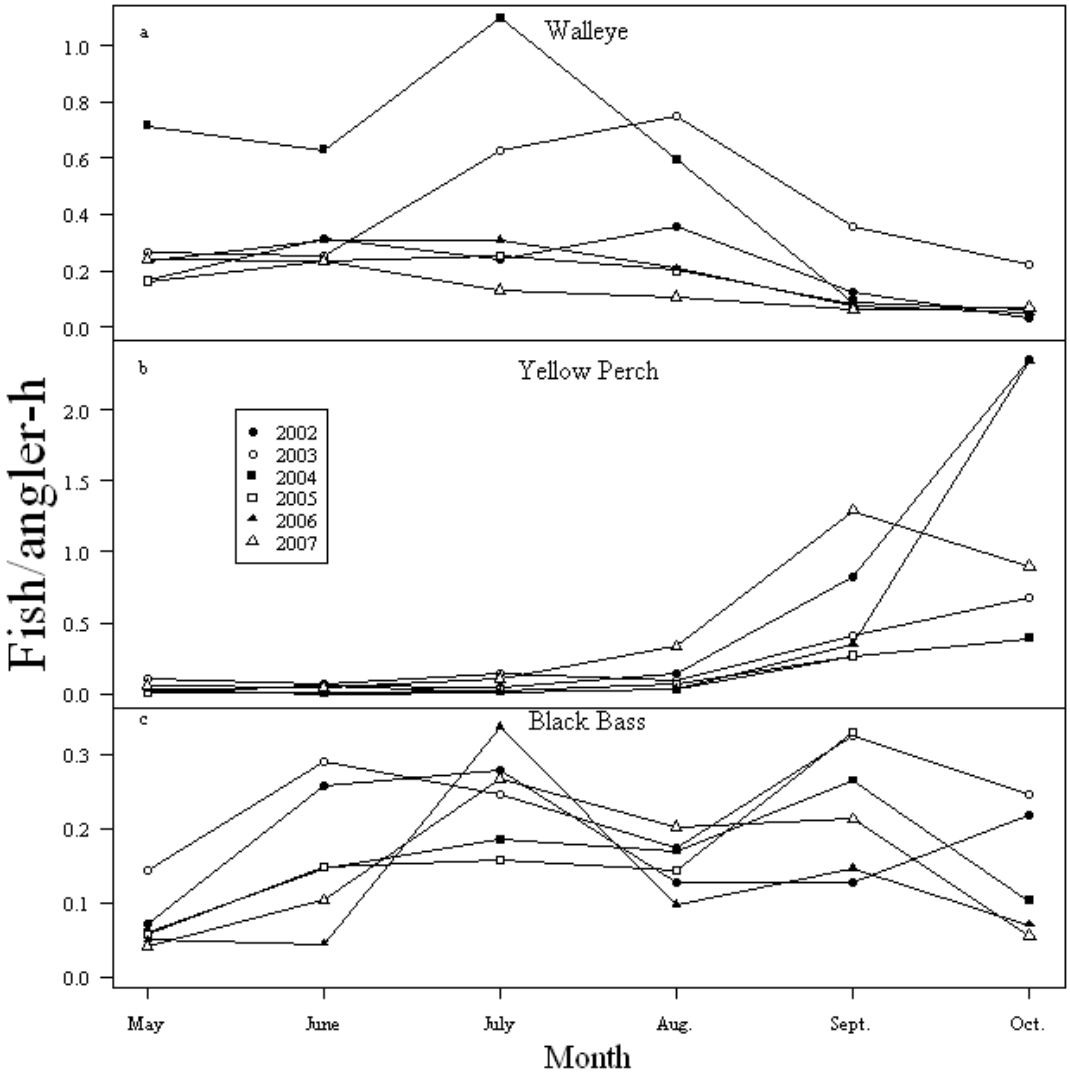

Figure 5. Monthly catch rates for walleye (a), yellow perch (b), and black bass (c) during the open water season, 2002-2007.

Open Water Targeted Catch Rates

Although catch rates estimated from interviews with all anglers provide an adequate assessment of the success of the average angler and are used in calculation of total catch, targeted catch rates (those based only on catch rates of anglers seeking a specific species) better describe an angler's ability to achieve their desired catch and may be more useful when management is directed towards achieving defined catch rates for a given species. Walleye targeted catch rates were 24 to 37% higher than catch rates

estimated for all trips (all anglers regardless of preference) in this survey (range: 0.3 to 0.75 fish/angler-h; Figure 6; Table 5). Yellow perch targeted catch rates ranged from 0.64 to 2.99 fish/angler-h and black bass rates ranged from 0.62 to 0.84 fish/angler-h (Figure 6; Table 5).

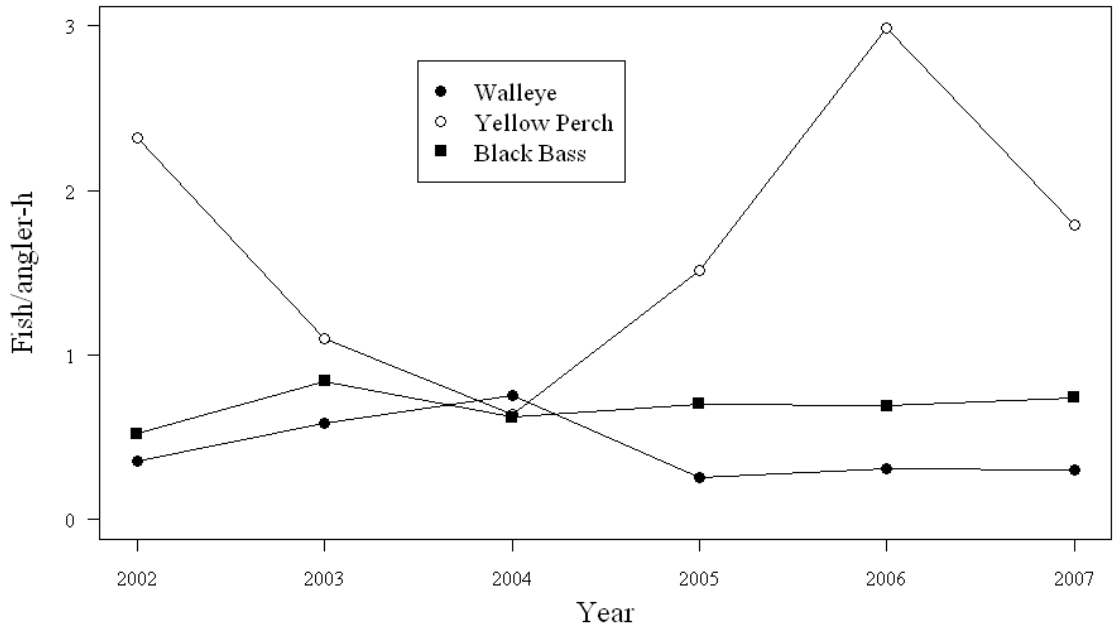

Figure 6. Annual catch rates by anglers specifically targeting walleyes, yellow perch, or black bass during the open water angling season (2002-2007).

Open Water Total Catch

All trip catch rates were combined with estimates of total effort to produce estimates of total catch. Walleye total catch over the entire open water survey period ranged from 39,346 to 153,526 fish (mean: 81,000 ± 79,200 fish; Figure 7, Table 6). Yellow perch total catch ranged from 17,292 to 124,023 fish with a mean of 59,000 fish (93,200; Figure 7, Table 6). Total catch of black bass was between 27,595 and 68,473 fish (mean: 48,000 ± 50,000; Figure 7, Table 6).

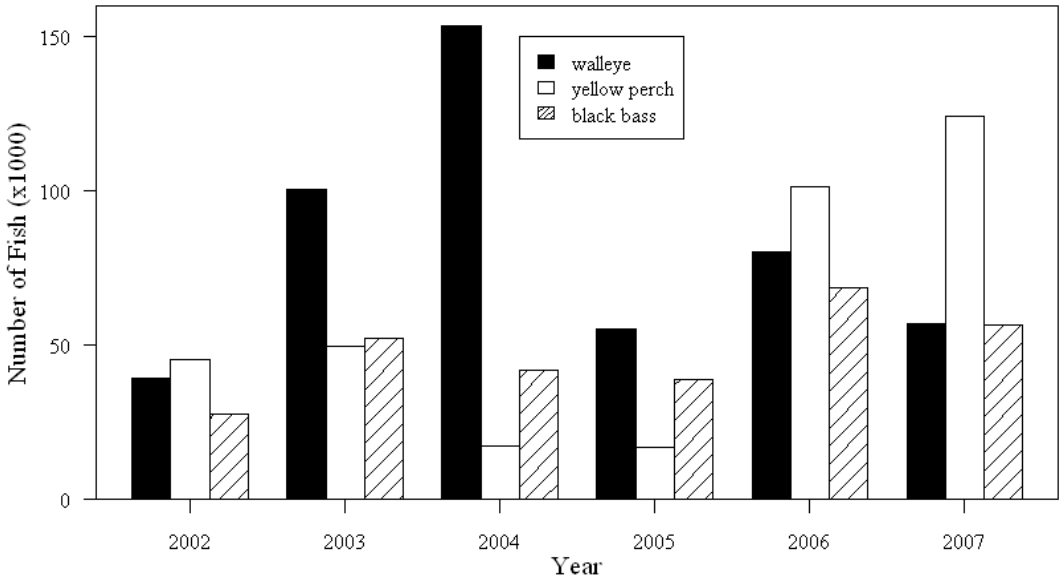

Figure 7. Total catch, during open water angling seasons, of walleyes, yellow perch and black bass (2002-2007).

Open Water Harvest Rates (all trips)

Open water walleye harvest rate increased steadily from 2002 through 2004 and remained stable until a small increase in 2007 (mean: 0.12 fish/angler-h; Figure 8; Table 7). Yellow perch harvest rates declined between 2002 and 2005 and then increased through the end of the project (mean: 0.21; Figure 8, Table 7). Black bass angling tends to be a catch and release fishery; therefore, harvest rates were low throughout the survey (mean: 0.03 fish/angler-h; Figure 8, Table 7).

Open Water Targeted Harvest

Targeted harvest rates for walleyes were 21 to 56% higher than all trips (range: 0.06 – 0.25 fish/angler-h; Figure 9; Table 8). Yellow perch targeted harvest rates were 250 to 1970% higher (range: 0.51 – 1.56 fish/angler-h; Figure 9; Table 8) and black bass targeted rates were 50 to 500% higher (range: 0.04 to 0.18 fish/angler-h; Figure 9; Table 8).

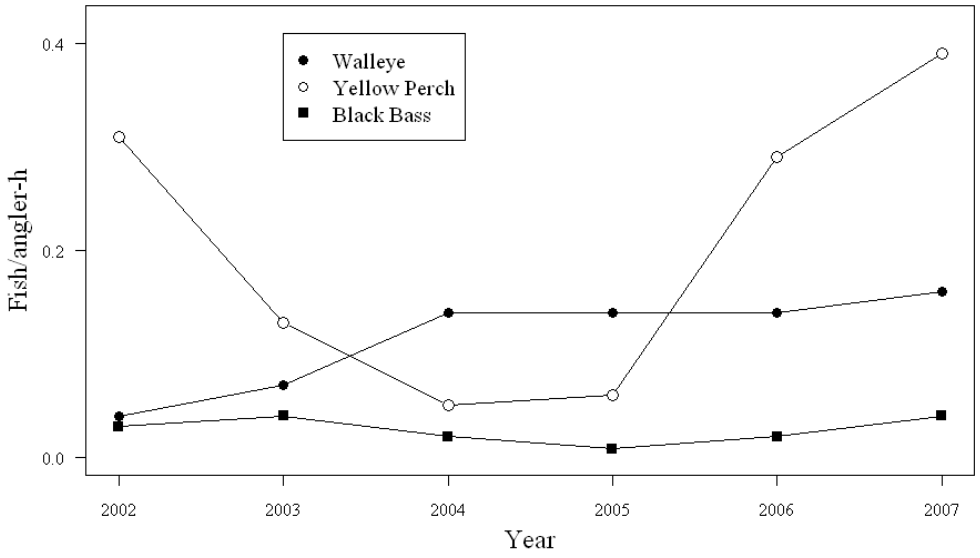

Figure 8. Annual harvest rates, during the open water angling season, for walleyes, yellow perch and black bass (2002-2007).

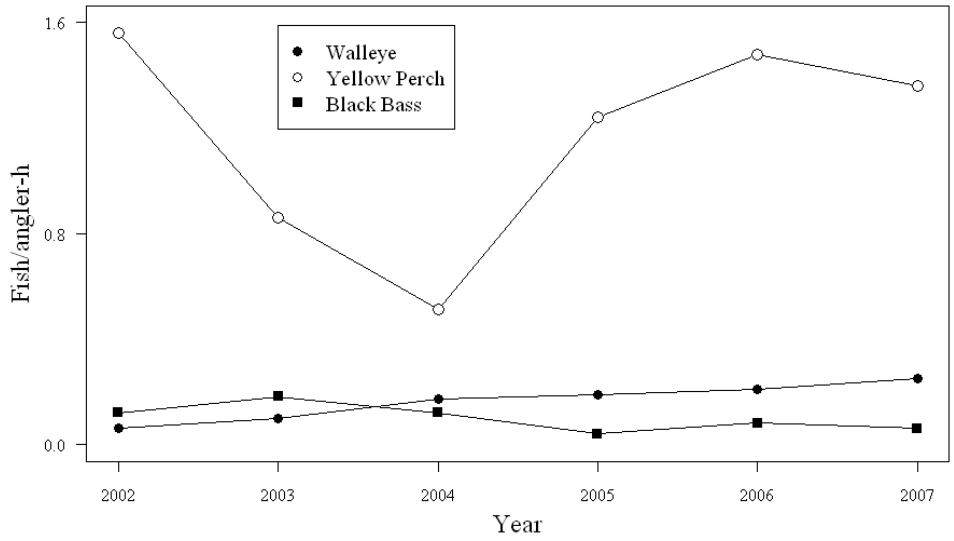

Figure 9. Annual targeted harvest rate for walleye, yellow perch and black bass (2002-2007)

Open Water Total Harvest

Total walleye harvest during the open water season increased annually to a maximum in 2006 (mean: 34,000 ± 31,500 fish; Figure 10, Table 9). Yellow perch harvest was low, as compared to previous Oneida Lake surveys (VanDeValk et al. 2002; Grosslein 1961), but increased during the last 2 years of the project (mean: 39,000 ± 54,700 fish; Figure 10,

Table 9). Black bass total harvest was low (mean: 6,900 ± 9,300 fish; Figure 10, Table 9).

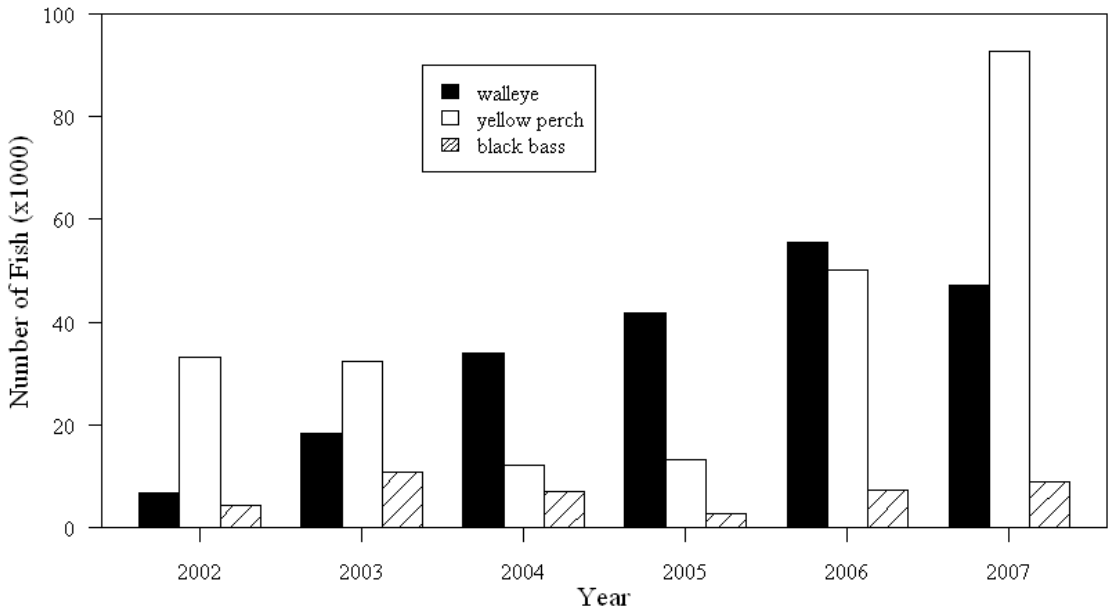

Figure 10. Total open water harvest of walleye, yellow perch and black bass (2002-2007).

Winter Angler Effort:

In 2004, four concurrent aerial/tower counts were conducted during winter; the results of that comparison were used for all years of this survey (Figure 11). The equation for tower count adjustment to aerial count is:

$$a = \exp(1.14 \times b - 0.16) \qquad (10)$$

where *a* is the aerial count and *b* is the tower count.

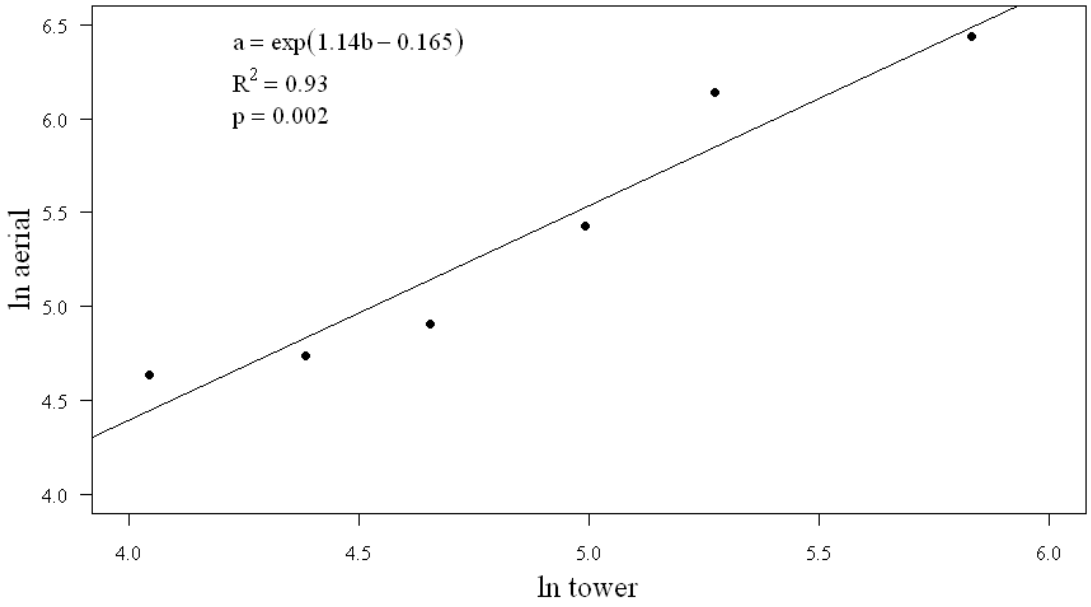

Figure 11. Aerial count as a function of tower count, based on simultaneous aerial and tower counts on 2 dates in 1998 and 4 dates in 2004.

Ice angling effort estimates were based on 258 tower counts on 170 dates. Timing of winter season tower counts was dependent on ice formation, but generally began in late January (mean: January 20). The winter creel survey interviews were terminated on March 15; however, tower counts were continued until effort was considered minimal (mean: March 21). The maximum number of anglers counted in a single count (adjusted) was 1,013 (March 15, 2003).

Mean annual winter angler effort was 57,000 angler-h (2.76 angler-h/ha), and ranged from 7,038 (0.34 angler-h/ha; 2006) to 91,080 (4.4 angler-h/ha; 2008; Figure 2a). Meaningful monthly effort comparisons are not possible because of variable ice conditions across years.

Winter Catch Rate

The roving portion of the winter survey began in January (mean start: January 22) and ended in March (mean end: March 14). A total of 2,074 interviews were conducted on 106 dates, of which 1,922 interviews were usable (intercepted anglers had been fishing for >30 min). Overall, 50% of anglers reported fishing for walleyes and yellow perch, 13% for walleyes only, and 27% for yellow perch only (Table 3).

Winter all trip catch rates for walleyes were up to 85% lower than during the open water season (Figure 12, Table 10). Mean walleye winter catch rate during the entire survey was 0.15 fish/angler-h (± 0.008; range: 0.05 to 0.26). Yellow perch all trip catch rates were higher in winter than open water in all years except 2005 and 2006 (Figure 12, Table 10).

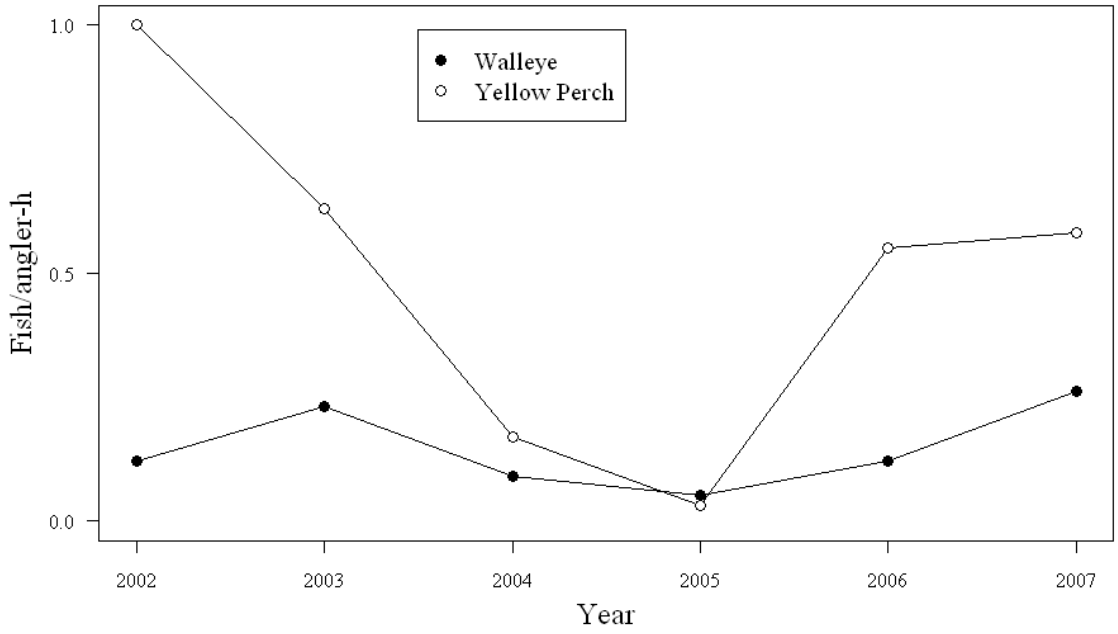

Figure 12. Annual winter catch rate of walleyes and yellow perch (2002-2007).

Winter Targeted Catch Rates

Targeted catch rates for walleyes in winter were 12 to 100% higher (range: 0.10 – 0.34 fish/angler-h; Figure 13; Table 5) than all trip catch rates, and yellow perch targeted

catch rates were 13 to 335% higher (range: 0.13 – 1.22 fish/angler-h; Figure 13; Table 5) than all trip rates.

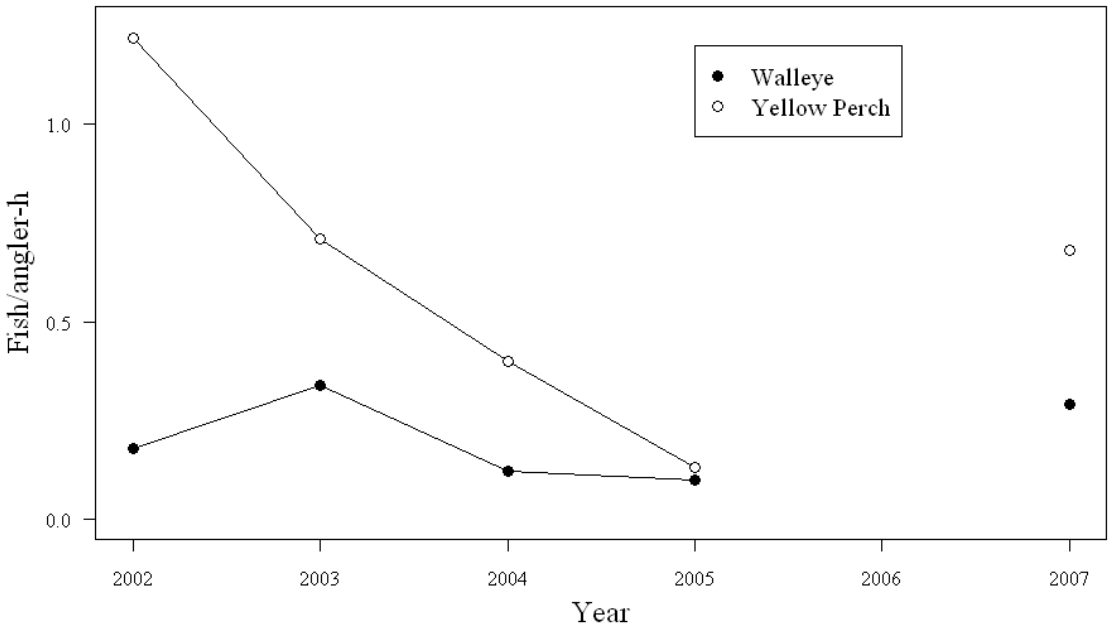

Figure 13. Targeted catch rates, in winter, of walleyes and yellow perch (2002-2007). Target species data were lost in 2006 as a result of computer malfunction and are not available for analysis.

Winter Total Catch

Ice anglers caught a total of 54,000 walleyes and 197,000 yellow perch over the course of the study (Figure 14, Table 11).

Winter Harvest Rate

Harvest rates of walleyes in winter were lower than the open water season (range: 0.02 – 0.14 fish/angler-h; Figure 15, Table 12). Yellow perch harvest rates in winter were typically higher than during the open water season (range: 0.06 to 0.77 fish/angler-h) and decreased from a high in 2002-2003 through 2005, increased in 2006 and declined again in 2007 (Figure 15, Table 12).

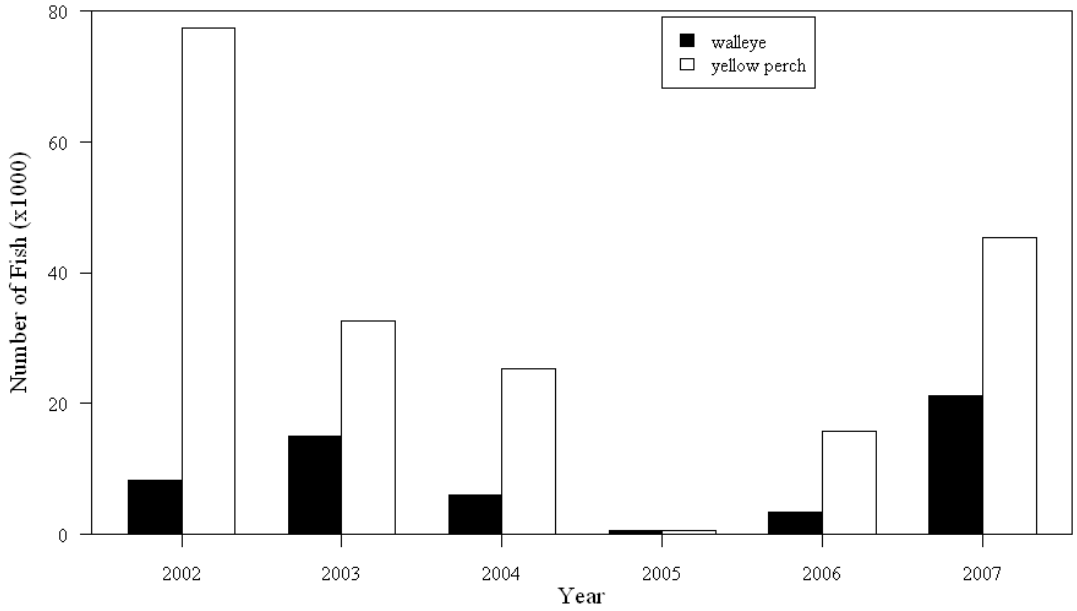

Figure 14. Total catch of walleyes and yellow perch in winter (2002-2007).

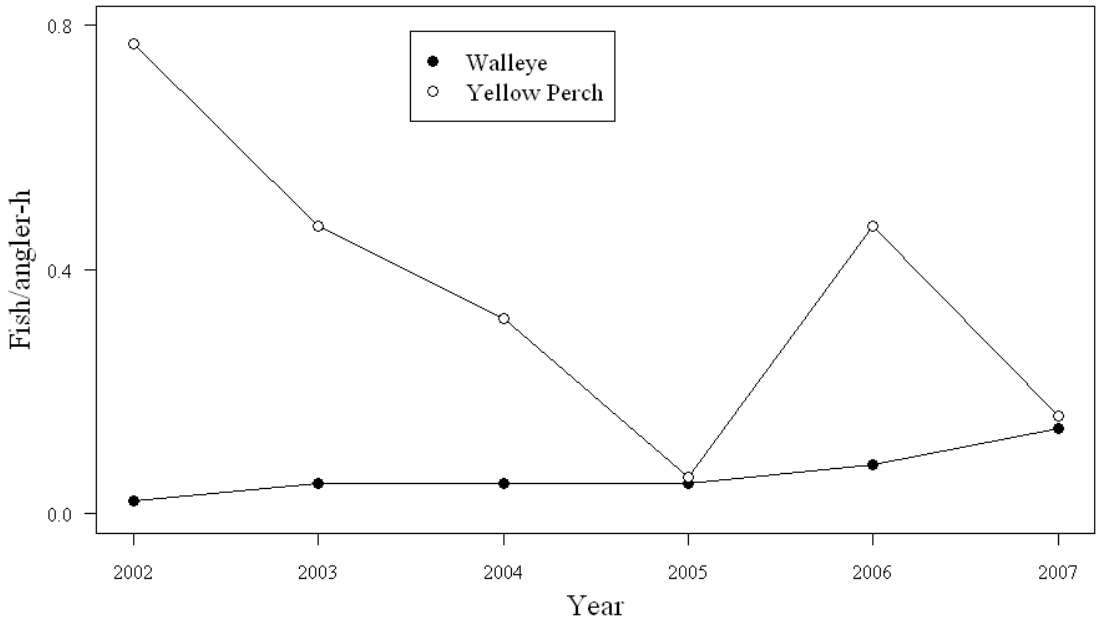

Figure 15. Winter mean harvest rate of walleye and yellow perch (2002-2007).

Winter Targeted Harvest Rate

Targeted harvest rates for walleyes in winter were 20 to 50% higher than rates for all anglers (range: 0.03 – 0.17 fish/angler-h; Figure 16; Table 8), and yellow perch targeted rates were 19 to 230% higher (range: 0.09 – 0.94 fish/angler-h; Figure 16; Table

8).

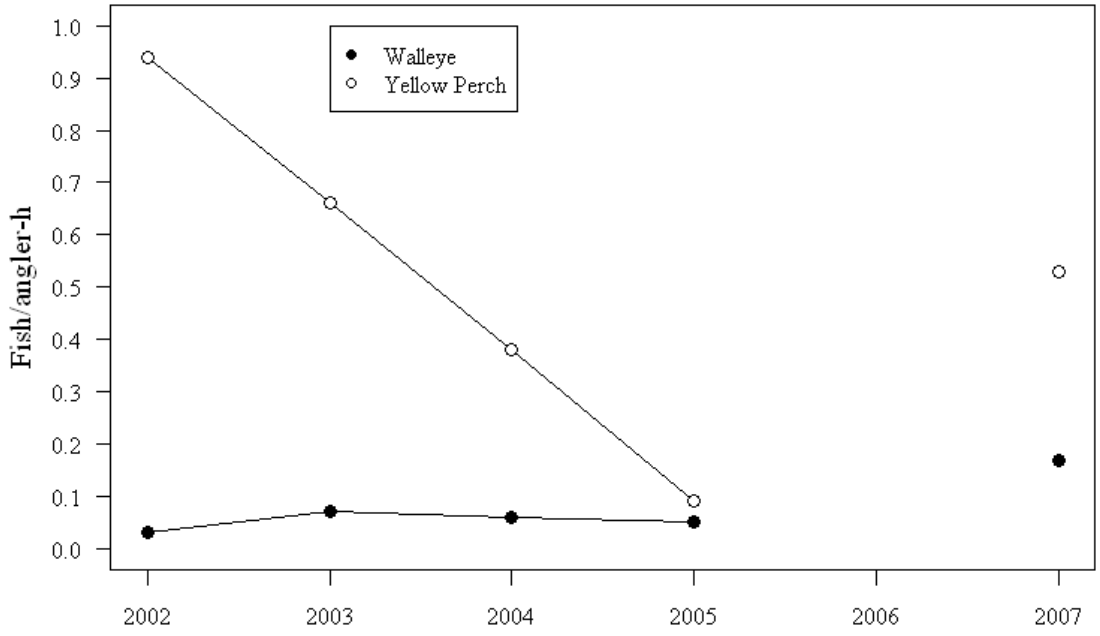

Figure 16. Winter targeted harvest rate for walleyes and yellow perch (2002-2007). Target species data were lost in 2006 and as a result, are not available for analysis.

Winter Total Harvest

Walleye total winter harvest was low throughout the entire survey (range: 248 – 11,287; Figure 17, Table 13), but increased by 483% between 2006 and 2007. Yellow perch total winter harvest ranged from 482 to 60,013 fish during this survey (Figure 17, Table 13).

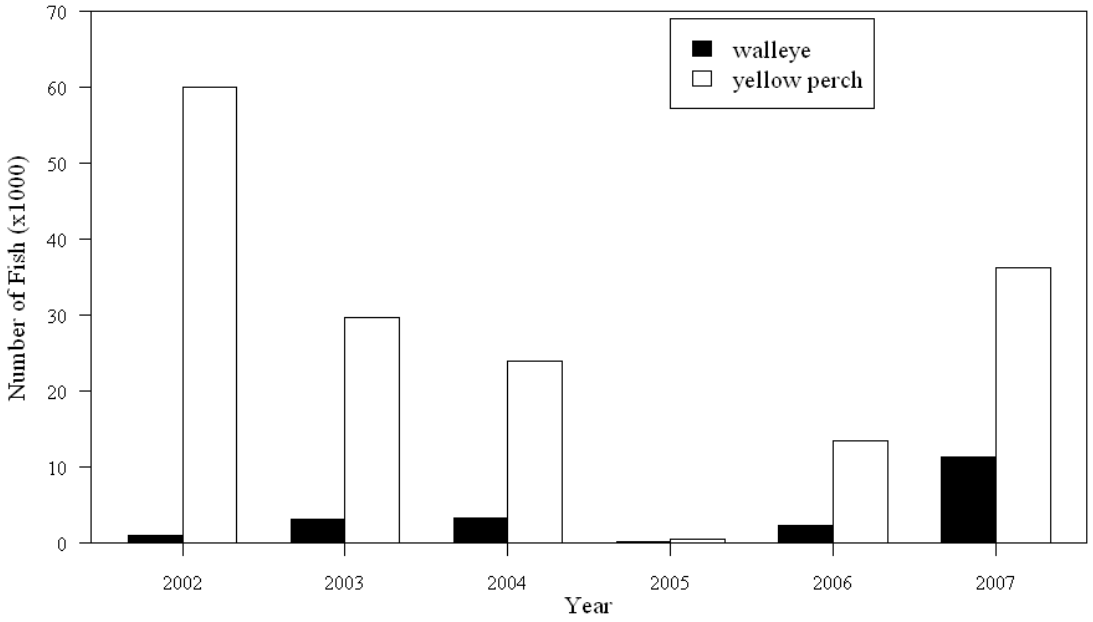

Figure 17. Total harvest of walleyes and yellow perch during winter (2002-2007).

Open Water Roving (Incomplete trip) and Access (Complete trip) Rate Comparisons

Comparisons of roving survey (incomplete trip) estimates of angler catch and harvest rates to access point (complete trip) rates yielded inconsistent results. Data were collected by interns in June, July and August of 2002 and 2006; the paired sample size was 21 and 16 dates, respectively. Complete trip catch rates were significantly higher than incomplete trip rates for walleyes and yellow perch, but not black bass in 2002 (walleye: $p = 0.002$; yellow perch: $p = 0.04$; black bass: $p = 0.16$; Table 14); harvest rates were not significantly different for any species (Table 14). There were no significant differences between complete and incomplete trip-derived catch or harvest rates in 2006 (Table 14).

Cormorants

Cormorants had a measurable impact on both walleye and yellow perch populations on Oneida Lake after their establishment in the 1980s (VanDeValk et al.

2002). Cormorant feeding days declined during this creel survey period from a high in 2002 of 104,200 to a low in 2007 of 21,100 feeding days, reflecting increasing management efforts to reduce cormorant impacts on the lake. Regressing angler effort as a function of cormorant feeding days revealed a significant relationship ($F = 16.85$; $R^2 = 0.81$; $p = 0.015$; Figure 18). Neither walleye nor yellow perch catch rates responded significantly to variability in cormorant feedings days (Figure 19). Yellow perch harvest rates were also uncorrelated to cormorant feeding days, but walleye harvest rates did show a significant response to variability in cormorant presence (Figure 19). However, increases in walleye harvest rates likely reflect a change in the minimum length regulation from 18" to 15", and may not be directly related to increases in cormorant management (see discussion below).

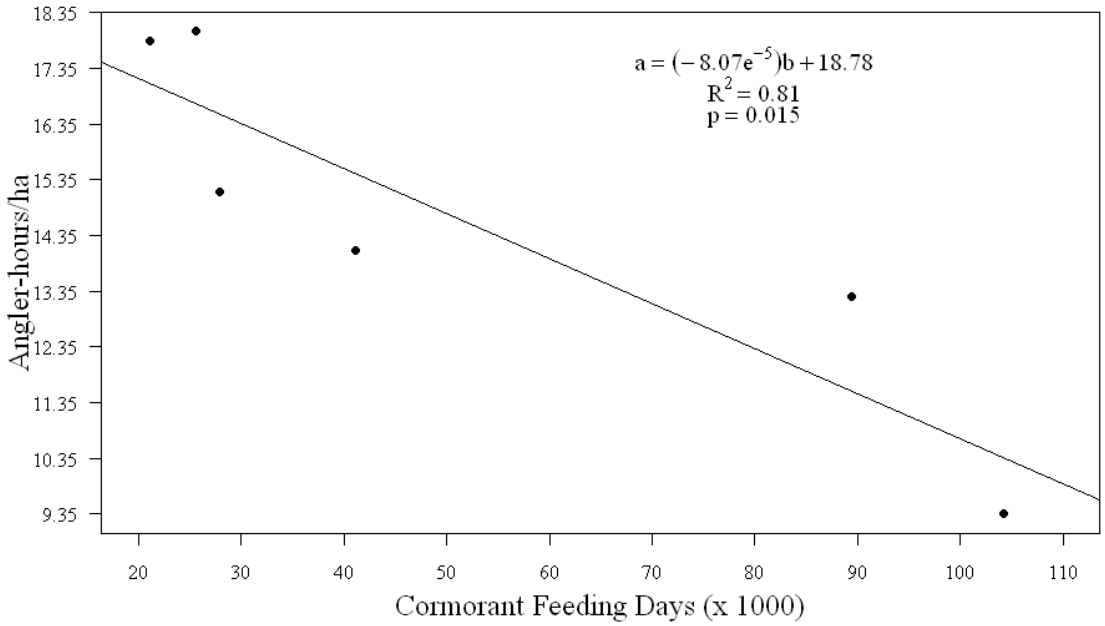

Figure 18. Angler effort (angler-h/ha) as a function of cormorant feeding days, Oneida Lake, 2002-2007.

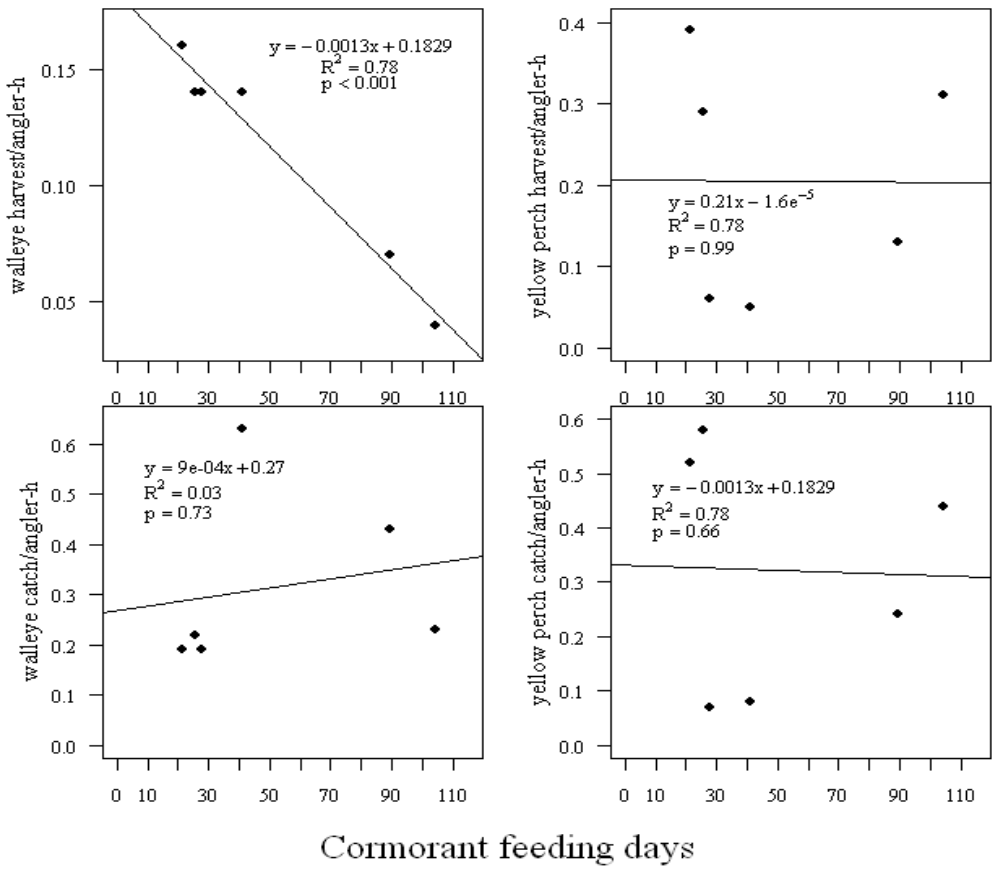

Figure 19. Walleye and yellow perch catch and harvest rates as a function of cormorant feeding days (2002-2007).

Discussion

Open Water Angler effort:

Overall, angling effort increased throughout this project. However, effort estimates for 2002 to 2007 were lower than historically reported from Oneida Lake. The mean open water effort for the current study period was 14.62 angler-h/ha, more than 50% lower than reported in 1957-1959 (40.7, 37.3 and 63.3 angler-h/ha, respectively; Grosslein 1961), but similar to 1997 (14.4 angler-h/ha; VanDeValk et al. 1999). Our estimates of recent effort on Oneida Lake are also lower than reported for other popular lake fisheries in New York. Greene and Sanford (1995) reported annual daytime effort

estimates on Canadarago Lake, NY in 1989 and 1990 of 60.6 and 39.75 angler-h/ha, respectively, and Sanderson (2003) reported 62.33 angler-h/ha during the 2000 angling season on Conesus Lake, NY.

Increasing angler effort was consistent throughout this survey and similar to the recent data from VanDeValk et al. (1999). The primary reasons for the increase are not easily determined. Increasing angling success rates (see discussion section: Open Water Catch Rate), liberalization of harvest regulations for walleye with concurrent increases in harvest rates (see discussion section: Open Water Harvest Rate), increasing positive press from black bass related angling organizations, and reduced negative press related to cormorant impacts from local stakeholder groups likely all contributed to observed increases in effort.

Oneida Lake bass angling has gained enormous popularity recently through word of mouth by local organizations and through the hosting of Bassmaster Elite and Memorial tournaments. This positive press has drawn anglers from throughout the nation, including bass fishing "hotspots" such as Florida and Alabama. The bass fishery has potential to become an extremely important part of the fishing tourism economy of the area, and may result in an increase in total fishing effort on the lake. Given the high proportion of catch and release anglers within the bass angling community, increases in bass fishing effort do not appear to represent an immediate threat to the health of the lake's bass population.

Open water tower count estimates, adjusted based on aerial counts (Equation 1), should be considered conservative estimates, as aerial counts were conducted only during fair weather conditions (VanDeValk et al. 1999). As a result, on days in which visibility is limited, it must be assumed that boats seen from the tower represent the proportion of

the angling population represented in the tower portions of the tower/aerial model. In other words, if the clerk can only see 3 miles out from the tower it must be assumed that there are no boats further than 3 miles away from the tower. This assumption is not realistic and therefore, it can be assumed that tower counts underestimate angling effort on reduced visibility days. However, on Oneida Lake, reduced visibility usually indicates unfavorable boating conditions and presumably reduced angling effort, while decreased visibility impairs accurate counts, it may do so primarily on days with low effort.

An additional source of error seen during the open water seasons was difficulties in determining boating activity when conducting tower counts. Whether or not a boat was angling near the jetty at Sylvan Beach (approximately 13 miles away) in July, for example, was difficult to determine. In an effort to reduce bias associated with activity determination, progressive counts were employed in addition to tower counts. Analyses of tower/progressive count comparisons are ongoing, and results of those comparisons are part of a Master's thesis project and will be submitted under separate cover (Krueger in prep).

Open Water Catch Rate (all trips)

Walleye catch rates compared favorably to other North American Lakes. Festa et al. (1987) suggested that walleye catch rates of 0.10 to 0.25 fish/angler-h should be considered good to very good fishing, and rates in excess of 0.25 fish/angler-h as excellent fishing. Walleye catch rates from this study were within the first category most years of the study and in 2003 and 2004 were in the excellent range. Green and Sanford (1995) reported walleye open water catch rates of 0.30 and 0.17 fish/angler-h on Canadarago Lake in 1989 and 1991, respectively. Beard et al. (1997) estimated a mean catch rate of 0.21 for 58 lakes in northern Wisconsin from 1990 through 1992 (range:

0.006 – 0.750 fish/angler-h).

Yellow perch catch rates were high throughout most of the current survey. These rates were similar to those from 1997 (0.38 fish/angler-h; VanDeValk et al. 1999) and exceeded 1958 and 1959 catch rates (0.17 and 0.13 fish/angler-h, respectively; Grosslein 1961). In Canadarago Lake, anglers caught 0.09 and 0.06 yellow perch/angler-h in 1989 and 1990, respectively (Green and Sanford 1995), and in Conesus Lake, 0.01 yellow perch/angler-h (Sanderson 2003).

Yellow perch angling success in Oneida Lake tends to be low throughout most of the open water season and increases with the onset of fall (Figure 5). As a result, seasonal estimates of yellow perch catch and harvest rates may not accurately represent the quality of the fishery as perceived by anglers. Estimates of total catch and harvest are unaffected by temporal trends because exploitation estimates are determined on a monthly basis and summed across the season, but strong temporal trends in effort do have implications for how angler success is gauged. In quantifying yellow perch success, as with any species-specific assessment of fishing quality, targeted catch and harvest rates are superior to all trip rates as those estimates ignore periods in which yellow perch catch or harvest is incidental. Given the strong seasonal nature of yellow perch angling on Oneida Lake, the most accurate measure of annual variations in fishing quality may be derived by focusing on the fall and ice fisheries where much of the effort is concentrated rather than calculating rates across the entire season.

Black bass catch rates were relatively steady throughout the survey (Figure 4). Smallmouth bass catch rates were higher during this survey (mean: 0.17 fish/angler-h) than the 1997-1998 creel survey (0.09 fish/angler-h; VanDeValk et al. 1999), and Grosslein's (1961) 1957-1959 survey (mean: 0.03 fish/angler-h). It should be noted that

Grosslein (1961) did not differentiate between catch and harvest rates, so reported rates for bass may reflect creeled fish and underestimate actual catch rates if release rates were high. Increases in black bass catch rates on Oneida Lake may be at least partly attributable to apparent increases in numbers of adult smallmouth bass as observed in standard gill net surveys (VanDeValk et al. 2008). Additionally, much of the effort expended towards black bass in Oneida Lake occurs as part of tournaments that include experienced and focused bass anglers. Increases in bass catch rates in more recent surveys over those of the 1950s may also reflect the advent of more specialized anglers in the bass fishery.

Oneida Lake catch rates of bass compare favorably to other lakes in New York State. Wilkinson (1997) reported mean catch rates of 0.37 smallmouth bass/angler-h and 0.27 largemouth bass/angler-h (range: 0.11 to 0.43 for smallmouth; 0.20 to 0.46 for largemouth) from an angler diary program on the New York Barge Canal. Green and Sanford (1995) estimated bass catch rates at 0.02 smallmouth/angler-h and 0.0025 largemouth/angler-h in Canadarago Lake in 1989-1990; similar rates were reported for Conesus Lake in 2000 (0.06 smallmouth/angler-h; 0.22 largemouth/angler-h; Sanderson 2003).

Black bass catch rates for all trips tended to be lower in May than the rest of the open water season (Figure 6). Until the 2007 open water season, black bass angling was prohibited through the month of May which reduced the catch rate to incidental catches by anglers targeting other species. The recent opening of a catch and release season for black bass prior to the opening of the traditional season may result in increased effort by anglers targeting bass earlier in the season.

Open Water Targeted Catch Rates

Targeted catch rate represents the capacity of anglers to catch the species they are seeking and as such may be a more accurate measure of angler success within specific fisheries. Walleye targeted catch rates estimated during this survey (mean: 0.42 fish/angler-h; Table 14) were higher in all years than targeted estimates in 1997 (0.21 fish/angler-h; VanDeValk et al. 1999); targeted rates were unavailable for the creel surveys conducted from 1957 to 1959. Yellow perch targeted rates were lower, in most years of this survey (mean: 1.73 fish/angler-h; Table 14), than 1997 rates (2.5 fish/angler-h; VanDeValk et al. 1999)

Open Water Total Catch

During open water, mean annual total catch of walleyes (81,000 fish) was higher than 1997 (53,000; VanDeValk et al. 2003) and 1957 (40,000; Grosslein 1961), but lower than 1958 and 1959 (112,000 and 463,000; Grosslein 1961). Walleye total catch increased throughout the first 3 years of the survey, but the marked decline between 2004 and 2005 was curious. Angler effort increased between those 2 years by 1.5 angler-h/ha, but catch rate declined by 0.44 walleyes/angler-h. Those changes coincided with a length limit change from 18 to 15 inches. However, by definition, catch rate should not be affected by changes in minimum length. VanDeValk et al. (in press) accounted for 89% of the variability in angling catch rates with a model using walleye growth rate (used a surrogate for prey availability). In other words, as prey availability (and hence walleye growth rate) increased, angler catch rates, or walleye catchability, decreased. As a result, differences in catch rate between 2004 and 2005 may have been primarily a function of prey fish biomass.

Mean annual catch of walleyes as a proportion of the total number of adult fish

(age-4 and older) was 0.22 fish (range: 0.09 – 0.40; Table 15). While total catch also includes catch of walleyes less than 4 years old, based on these results, without regulations to limit harvest of walleyes on Oneida Lake, anglers could potentially take a significant proportion of the adult population at current levels of effort, if multiple catches of the same fish were minimal. However, percent of adult walleye stock harvested annually did not exceed 12% during the current survey. Continued periodic monitoring of harvest rates of walleyes from Oneida Lake should be considered in light of the potential for anglers to impact population size if recruitment remains below long-term levels.

Total catch of yellow perch during the open water season was lower than the 1997 survey in all years except 2007. In general, there was an increase in total catch as the survey progressed which likely reflects increasing total effort on the lake as well as a higher proportion of effort targeting yellow perch in the last two years of the survey, but may also have resulted from increasing availability of yellow perch to angling.

Density estimates of yellow perch age-3 and older indicate that the proportion of the adult population caught annually by anglers ranged from 0.02 to 1.06. While our total catch calculations would include fish less than 3 years old, these numbers suggest that anglers have the potential to catch a large proportion of the of the adult perch population in a year. In light of generally low release rates by yellow perch anglers, it is possible that high catches of yellow perch have contributed to the slow recovery of the population after cormorant hazing was initiated.

Black bass total catch increased over the survey period, even though catch rates remained relatively stable. Therefore, increases in bass catch are more closely related to increases in overall angler effort. The results of this survey suggested that the overall

proportion of anglers targeting bass was 15% of total effort, and that there was little change in the proportion over time. However, it should be noted that proportions of angling effort are based on target species reporting from interviews, and that anglers targeting largemouth bass tend to fish in areas difficult for the clerk to access (eg. very shallow water). Additionally, tournament anglers, which may represent a large percentage of bass angling effort, frequently declined interviews when involved in tournaments. As a result, black bass angling effort may have been underrepresented.

Open Water Harvest Rate (all trips)

The increase in angling effort during the current survey could have been a response to increased harvest rates. Walleye were the primary target species on Oneida Lake (mean proportion of total effort: 0.68), and we found that harvest rate accounted for 78% of the observed variability in effort over the course of this study. These results suggest that angler effort on Oneida Lake is positively related to angler success when success is defined as harvest rate. In light of apparent reductions in mean walleye year class size during recent years (VanDeValk et al. 2008), continued increases in effort may limit or halt expansion of the adult walleye population or lead to decreases in walleye abundance in the absence of occasional large year classes to buffer the fishery.

Harvest rates of walleyes during this survey were lower than in 1997 (0.18 fish/angler-h; VanDeValk et al. 1999) even after the minimum length was decreased from 18” to 15”, but higher than 2 of 3 years in the late 1950s (1957 = 0.04; 1958 = 0.07; 1959 = 0.14 fish/angler-h; Grosslein 1961). Current rates were higher than those for other New York Lakes. Sanderson (2003) reported open water walleye harvest rates in 2000 at 0.003 fish/angler-h in Conesus Lake and Green and Sanford (1995) reported rates of 0.009 (1989) and 0.015 (1990) fish/angler-h from Canadarago Lake.

Yellow perch harvest rates during this survey were similar to rates reported by Grosslein (mean: 0.21 fish/angler-h; 1961), but lower than reported by VanDeValk et al. (0.38 fish/angler-h; 1999). Rates from this survey were higher than Canadarago Lake in both 1989 (0.029 yellow perch/angler-h) and 1990 (0.013 yellow perch/angler-h; Green and Sanford, 1995), as well as on Conesus Lake in 2000 (0.006 yellow perch/angler-h; Sanderson 2003).

Black bass harvest rates during this survey were low, but higher than both Canadarago (0.002 fish/angler-h in 1989 and 1990; Green and Sanford, 1995) and Conesus (0.006 fish/angler-h; Sanderson, 2003). Black bass anglers tend to practice "catch and release" fishing on Oneida Lake, and as a result, it is not surprising that harvest rates would be low. Mean legal-sized fish release rate for bass during this survey was 0.13 fish/angler-h (range: 0.11 – 0.15 fish/angler-h), about 5 times the rate at which bass were harvested.

Open Water Targeted Harvest Rates

Targeted harvest rates may be the best determinant of angler success for walleyes and yellow perch on Oneida Lake since both fisheries are heavily harvest oriented. Angler release of legal size walleyes during this survey was 0.01 fish/angler-h (approximately 3% of the catch rate), which suggests that anglers targeting walleyes are motivated by harvest rather than catch and release of legal fish. Additionally, based on comments from interviews, anglers targeting yellow perch release only those fish that are too small to be deemed harvestable (mean release rate: 0.38 fish/angler-h). As a result, overall targeted harvest rates of walleyes (0.15 fish/angler-h; Table 15) and yellow perch (1.18 fish/angler-h; Table 15) represent the rate at which many anglers on Oneida achieve the goal of their angling trip. It does not appear that higher catch rates of sub-legal or

harvestable fish are as important to anglers on Oneida Lake as opportunities to harvest, and management goals directed at angler satisfaction in Oneida Lake may best be based on harvest rates rather than catch rates.

Open Water Total Harvest

Total harvest of walleyes increased throughout the survey period (except for a slight decline in 2007 from 2006). The total harvest estimates from this survey are similar to 1997 (38,800 fish; VanDeValk et al. 1999) but are less than 2 of 3 years in the late 1950s (1957: 40,000; 1958: 112,000; 1959: 463,000; Grosslein 1961). To note again, Grosslein (1961) did not estimate released fish, so we compared harvest rate/total harvest with both current catch and harvest statistics. According to Grosslein (1961), anglers in 1959 harvested over 50% of the adult walleye population. While that level of harvest did not occur on Oneida during this project, anglers did harvest up to 12% of the adult walleye population in a single year. In light of apparent reductions in mean walleye year class size during recent years (current estimates suggest mean annual recruitment into the fishery may be as low as 50,000 fish/year; VanDeValk et al. 2008), continued increases in effort may limit or halt expansion of the adult walleye population or lead to decreases in walleye abundance in the absence of occasional large year classes to buffer the fishery.

Yellow perch total harvest declined and rebounded throughout the duration of this survey. Overall, yellow perch harvest was slightly lower than 1997 (53,000 fish; VanDeValk et al. 1999), but substantially lower than Grosslein's (1961) survey (seasonal mean: 198,000). It should be noted that differences in yellow perch harvest between the late 1950s and the current survey are a function of angler effort (seasonal mean: 14.62 [current] and 34.7 angler-h/ha [Grosslein 1961]) and not harvest rate (seasonal mean: 0.21 [current] and 0.25 fish/angler-h [Grosslein 1961]).

Total harvest of black bass was low (seasonal mean: 6,900 fish/year). Anglers kept a mean of 15% of smallmouth bass caught during this survey, compared to 29% in 1997 (VanDeValk et al.1999). It is possible that greater participation of tournament bass anglers in interviews, and therefore estimated harvest rates, would result in a lower estimated harvest percentage. Based on comments from bass anglers, catch and release of bass is popular, and tournaments generally prohibit harvest of bass during competition, and most anglers reported preferring walleye and yellow perch for harvest. While largely anecdotal, interview information suggests that much of the bass harvest on Oneida Lake is conducted by anglers that do not achieve their harvest goals for walleye and yellow perch, rather than by anglers specifically targeting bass. If increases in fishing effort directed at bass occur, and largely represent traditional bass anglers, it is possible that it will not result in significant increases in the harvest of bass.

Winter Angler Effort

Annual differences in ice angler effort estimates were in large part a result of high variability of ice duration and conditions. Complete coverage of the lake occurred earliest in 2003 (January 4), which allowed for 70 days of lake-wide ice angling for walleyes (until March 15) and 101 days of complete cover. In 2006, the lake froze and broke apart several times and the only portion of the lake with safe ice cover was the north east corner (North Bay/Sylvan Beach). As a result angler effort in 2005 was 0.34 angler-h/ha, as compared to 3.26 angler-h/ha in 2003. Annual variability of ice fishing effort, therefore, does not likely provide an accurate gauge of interest in the activity, but rather reflects a measure of opportunity.

The winter aerial adjustment was based on two counts during the 1999 survey; however, the addition of 4 more flyovers in 2004 allowed for the calculation of a more

reliable equation. Regardless of adjustment quality, frequent poor visibility during the winter angling season increased the potential for error of effort. All winter flyovers were conducted in fair weather conditions--similar to the open water comparison--conditions which on Oneida Lake in winter were rare. Blowing snow and long distances inhibited visibility to the further reaches of the lake; areas which generally were popular when ice cover was incomplete. In 2006, angler effort estimates were a result of shore based counts, as ice cover was unpredictable and infrequent throughout the entire season. Only the northeast portion of the lake experienced any consistent cover and as a result was the only area on the lake that received estimable angling effort. As with the open water survey, progressive counts of winter anglers were conducted while the clerk was recording interviews. Comparisons of instantaneous (tower) and roving counts for effort estimation are ongoing and will be part of a Master's thesis that will be submitted under separate cover (Krueger in prep).

Winter Catch Rate (all trips)

Logistical issues related to the winter survey created difficulties intercepting anglers at certain times during the season. In order to complete the circuit of the lake, the ice sheet had to be capable of supporting a snowmobile over its entire area; unfortunately, that was not always possible. During the 2007 angling season, complete lake coverage didn't occur until January 22; however, several portions of the lake were solid enough to travel by snowmobile. Anglers using these areas were fishing far enough offshore that clerk travel to those anglers by foot from available parking areas was not feasible, given the sample design constraints. Due to these circumstances, caution should be used interpreting results from seasons when ice conditions limited travel (2005 and 2007 angling seasons).

Walleye winter catch rates were generally 50% lower than open water rates; however, in 2007, winter rates exceeded open water by 36% for reasons we cannot assess with available data. Catch rates during this survey were higher than in 1997 (0.05 walleyes/angler-h; VanDeValk et al. 1999), but lower than 2 of 3 years in Grosslein's (1961) survey (1957: 0.11, 1958: 0.53 and 1959: 0.52 walleyes/angler-h).

Winter yellow perch ice fishing catch rates were higher than open water rates in 4 of 6 years (mean difference: 58%; Table 4, Table 8). The overall mean catch rate for yellow perch was higher than all years in the late 1950s (mean: 0.3 fish/angler-h; Grosslein 1961) but lower than 1997 (1.6 fish/angler-h; VanDeValk et al. 1999).

Winter Targeted Catch Rates

Targeted catch rates for walleyes were similar to rates for all anglers during the winter. Throughout the survey, the proportion of anglers who reported targeting at least walleyes ranged from 0.5 to 0.95, with many of the remainder targeting walleye and yellow perch combined (Table 3). As a result, the lack of difference between targeted and all trips catch rates may simply represent the fact that the majority of the total angling population in winter targets walleyes or both walleyes and yellow perch. Given the nature of the winter fishery, targeted catch rates may not add the refinement in assessing specific fisheries they do during the open water season.

Winter Total Catch

Total catch of walleyes in winter was low and variable (Table 8). The mean winter catch for all years was more than an order of magnitude less than the mean from 1957 to 1959 (205,000 walleyes; Grosslein 1961). The magnitude of total catch in winter is highly dependent on the duration of ice cover. Winter catch rate for walleyes was equal in 2003 and 2007; however, there was a 5,000 fish difference in total catch,

primarily owing to intermittent and unpredictable ice cover.

Except for 2003 and 2005, total catch of yellow perch in winter was lower than during the open water season. Catches during this survey were lower than 1998 (53,000 yellow perch; VanDeValk et al. 2002), and all 3 years in the late 1950s (1957: 257,000, 1958: 141,000, and 1959: 196,000 yellow perch; Grosslein 1961).

Winter Harvest Rate (all trips)

Harvest rate of walleye in winter was lower than open water, and similarly increased throughout the survey. Rates during this survey were lower than in the late 1950s (mean: 0.39 walleye/angler-h), but higher than catch rates reported by VanDeValk et al. (0.05 walleye/angler-h; 1999). Yellow perch harvest rates were higher than the 1950s (mean: 0.3 yellow perch/angler-h; Grosslein 1961), but lower than in 1997 (1.6 yellow perch/angler-h; VanDeValk et al. 1999)

Winter Targeted Harvest Rate

Similar to targeted catch rates, walleye winter targeted and all trip harvest rates were similar (Table 15). No difference was detectable for yellow perch either (Table 15). Again, these data suggest that angling in winter is dominated by anglers targeting walleye and yellow perch and therefore targeted harvest rates are no better as a success rate indicator than all trip harvest rates.

Winter Total Harvest

Total harvest of walleyes during winter was variable throughout the survey. Total harvest was very low in the winter of 2005-2006, which was a result of inconsistent ice cover; harvest in 2007 was high, despite the short duration of the ice angling season, and likely attributable to the unusually high catch and harvest rates, which were more than double most other years of the survey.

Open Water Roving (Incomplete trip) and Access (Complete trip) Comparisons (Interns)

Comparisons of catch and harvest rates derived from roving and access points provided an opportunity to assess potential differences in rates estimated from incomplete and complete trips. However, the limited number of years available for comparison and inconsistent results make evaluation difficult. Oneida Lake has diffuse access, and as a result, it is possible to assume that a creel survey at 3 public boat launches would not accurately represent the angling population, as many anglers do not use boat launches to access the lake. Though we found no difference in harvest rate for either year, there were significant differences in walleye and yellow perch catch rates in 2002. These results suggest that additional years of access/roving comparisons would be necessary to identify trends in differences between rate estimators. Given that access point surveys can be conducted with a smaller investment than a roving survey on the scale we conducted, further investigation of the reliability of rates derived from access point surveys is warranted if more frequent monitoring of angling on Oneida Lake is to be conducted.

Cormorants

The relationship between angler walleye harvest rate and cormorant feeding days was highly significant ($p < 0.001$; Figure 19), which suggests that decreased cormorant presence on Oneida Lake led to increased angler harvest potential. However, several factors are associated with increasing walleye harvest rates (see: *Open Water Harvest Rates*) and the true relationship may be difficult to determine. Reduction of the minimum length from 18” to 15” likely contributed more directly to the increase in walleye harvest rates than cormorant management. Models of walleye catch rate, and yellow perch harvest and catch rate were not significant (Figure 19), lending additional support to the walleye harvest regulation driving the increase in harvest rate. However, cormorant

management may well have contributed to observed increases in angling effort on Oneida Lake (Figure 18). While the regulation change created increased opportunities to harvest walleye and likely attracted more anglers, cormorants received significant amounts of negative press locally prior to the implementation of the management program – so public knowledge of the reduction of cormorants on the lake may also have encouraged more anglers to visit the lake. Our data do not allow separation of these affects to determine which was most important to observed increases in angler effort.

Conclusion

Our results indicate that angling, if effort continues to increase and catch rates towards the upper end of those observed were realized, can represent a significant source of mortality in walleye and yellow perch populations in Oneida Lake. At levels observed during this study, walleye harvest was very near annual recruitment rates into the fishery because mean year class strength of walleyes in recent years has been well below long term averages. Without the influence of a large year class, it is unlikely that the walleye population will exhibit significant growth towards historic levels, but within the limits we observed, the fishery appears sustainable at current levels. Angling may be contributing to the slow recovery of the yellow perch population, particularly because of the poor recruitment observed in recent years.

In light of the potential for angling to impact walleye and yellow perch populations at their current levels, we would recommend consideration of maintaining some level of monitoring of effort and harvest rates on Oneida Lake so that potential increases in effort or harvest levels can be detected and management actions taken if necessary.

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Tables

Table 1. Total effort (angler-h) per hectare for all years.

	Open Water		Winter		Total	
Year	Effort	2 SE	Effort	2 SE	Effort	2 SE
2002	9.35	0.08	3.6	0.16	12.95	0.18
2003	13.25	0.12	3.26	0.06	16.51	0.13
2004	14.09	0.12	3.5	0.13	17.59	0.17
2005	15.14	0.16	0.34	na	15.48	0.16
2006	18.02	0.21	1.43	0.05	19.45	0.24
2007	17.85	0.16	4.4	0.3	22.3	0.34

Table 2. Number of angler trips by month for all years (2002-2007).

	2002	2003	2004	2005	2006	2007
May	838	946	1,518	2,171	1,895	2,456
June	1,380	1,861	2,429	2,309	2,699	2,622
July	1,667	2,281	2,319	2,589	4,195	2,863
August	1,356	1,889	2,284	2,107	2,154	2,554
September	1,230	1,498	1,448	1,692	1,628	2,263
October	356	969	339	390	693	565
November	100	118	29	0	0	0
January	1,303	801	1,745	4,960	88	2,516
February	3,548	4,692	3,215		2,366	3,983
March	2,130	787	1,880		4,219	1,039
Total	13,926	15,844	17,207	16,219	19,937	20,861

Table 3. Proportion of total trips by species during open water and winter angling seasons. During open water, anglers reporting fishing for more than one of the listed species was added as targeting all of the reported species (sum proportions may be greater than 1). In winter "any" refers to either no species reported or any other species than walleye or yellow perch.

	Open Water				Winter			
Year	Walleye	Yellow perch	Black bass	Any	Walleye	Walleye & Yellow perch	Yellow Perch	Any
2002	0.50	0.18	0.17	0.21	0.10	0.40	0.39	0.11
2003	0.70	0.13	0.15	0.12	0.22	0.42	0.25	0.11
2004	0.82	0.08	0.12	0.04	0.09	0.69	0.13	0.09
2005	0.75	0.02	0.17	0.06	0.35	0.60	0.05	0.00
2006	0.67	0.19	0.16	0.04	na	na	na	na
2007	0.62	0.26	0.17	0.05	0.16	0.70	0.14	0.00

Table 4. Open water catch rate and 2 standard errors for walleye, yellow perch and black bass, 2002-2007.

	Walleye		Yellow perch		Black bass	
Year	Rate	2SE	Rate	2SE	Rate	2SE
2002	0.23	0.022	0.44	0.052	0.19	0.019
2003	0.43	0.032	0.24	0.061	0.24	0.026
2004	0.63	0.049	0.08	0.063	0.15	0.019
2005	0.19	0.018	0.07	0.066	0.17	0.021
2006	0.22	0.028	0.58	0.071	0.19	0.031
2007	0.19	0.018	0.52	0.072	0.19	0.026

Table 5. Targeted catch rates of walleye, yellow perch (open water and winter), and black bass (open water), 2002-2007.

	Walleye		Yellow perch		Black bass
Year	Open Water	Winter	Open Water	Winter	Open Water
2002	0.35	0.18	2.32	1.22	0.52
2003	0.58	0.34	1.10	0.71	0.84
2004	0.75	0.12	0.64	0.40	0.62
2005	0.25	0.10	1.51	0.13	0.70
2006	0.31	na	2.99	na	0.69
2007	0.30	0.29	1.79	0.68	0.74

Table 6. Open water total catch and 2 standard errors for all species, walleye, yellow perch and black bass, 2002-2007.

	All species	Walleye		Yellow perch		Black bass	
Year	Catch	Catch	2SE	Catch	2SE	Catch	2SE
2002	151,846	39,346	9,229	45,422	12,203	27,595	4,818
2003	262,065	100,396	21,334	49,469	16,339	52,178	10,269
2004	250,221	153,526	21,149	17,292	3,782	41,702	6,266
2005	149,254	55,353	4,763	16,841	3,354	39,005	5,827
2006	305,088	80,260	19,301	101,370	20,307	68,473	31,036
2007	296,827	56,891	13,433	124,023	32,182	56,517	14,022

Table 7. Open water harvest rates for walleye, yellow perch and black bass 2002-2007.

	Walleye		Yellow perch		Black bass	
Year	Rate	2SE	Rate	2SE	Rate	2SE
2002	0.04	0.005	0.31	0.043	0.03	0.006
2003	0.07	0.008	0.13	0.31	0.04	0.007
2004	0.14	0.016	0.05	0.115	0.02	0.005
2005	0.14	0.013	0.06	0.016	0.008	0.005
2006	0.14	0.018	0.29	0.064	0.02	0.005
2007	0.16	0.013	0.39	0.052	0.04	0.005

Table 8. Targeted harvest rate of walleye, yellow perch (open water and winter) and black bass (open water), 2002-2007.

	Walleye		Yellow perch		Black bass
Year	Open Water	Winter	Open Water	Winter	Open Water
2002	0.06	0.03	1.56	0.94	0.12
2003	0.10	0.07	0.86	0.66	0.18
2004	0.17	0.06	0.51	0.38	0.12
2005	0.19	0.05	1.24	0.09	0.04
2006	0.21	na	1.48	na	0.08
2007	0.25	0.17	1.36	0.53	0.06

Table 9. Open water total harvest for walleye, yellow perch and black bass with 2 standard errors, angling years 2002-2007.

	Walleye		Yellow perch		Black bass	
Year	Harvest	2SE	Harvest	2SE	Harvest	2SE
2002	6,701	1,620	33,135	10,871	4,271	855
2003	18,264	4,205	32,504	11,520	10,734	2,395
2004	33,909	6,556	12,235	2,848	7,133	937
2005	41,702	3,124	13,360	3,082	2,733	944
2006	55,648	10,618	50,267	6,423	7,229	1,736
2007	47,062	10,042	92,569	22,016	9,073	584

Table 10. Winter catch rate for walleye and yellow perch with 2 standard errors, angling years 2002-2007.

	Walleye		Yellow perch	
Year	Rate	2SE	Rate	2SE
2002	0.12	0.02	1.00	0.15
2003	0.23	0.07	0.63	0.09
2004	0.09	0.02	0.17	0.09
2005	0.05	0.06	0.03	0.05
2006	0.12	0.03	0.55	0.12
2007	0.26	0.09	0.58	0.18

Table 11. Winter total catch with 2 standard errors, angling years 2002-2007.

	all species	Walleye		Yellow perch	
Year	Catch	Catch	2SE	Catch	2SE
2002	111,758	8,230	2,830	77,271	11,444
2003	61,433	15,101	1,591	32,666	3,879
2004	37,598	5,950	1,391	25,375	4,279
2005	1,282	603	na	608	na
2006	29,922	3,419	1,809	15,798	1,000
2007	73,330	21,158	3,677	45,290	13,297

Table 12. Winter harvest rates for walleye and yellow perch with 2 standard errors, angling years 2002-2007.

	Walleye		Yellow perch	
Year	Rate	2SE	Rate	2SE
2002	0.02	0.006	0.77	0.100
2003	0.05	0.018	0.47	0.090
2004	0.05	0.015	0.32	0.090
2005	0.05	0.031	0.06	0.040
2006	0.08	0.027	0.47	0.100
2007	0.14	0.047	0.16	0.150

Table 13. Winter total harvest of walleye and yellow perch with 2 standard errors, angling years 2002-2007.

	Walleye		Yellow perch	
Year	Harvest	2SE	Harvest	2SE
2002	1,074	383	60,013	38,447
2003	3,177	2,959	29,674	46,386
2004	3,269	1,436	23,928	8,134
2005	248	na	482	na
2006	2,335	155	13,552	1,095
2007	11,287	8,858	36,298	42,621

Table 14. Mean catch and harvest rate (in parentheses) from roving/access comparison with p-values ($\alpha = 0.05$) for 2002 and 2006. All rates were compared using the non-parametric Mann-Whitney Test.

	2002			2006		
	Roving	Access	p-values	Roving	Access	p-values
Walleye	0.25(0.05)	1.05(0.07)	0.0002(0.72)	0.33(0.18)	0.24(0.14)	0.08(0.17)
Yellow perch	0.08(0.08)	0.11(0.03)	0.04(0.47)	0.02(0.02)	0.12(0.11)	0.08(0.28)
Black bass	0.31(0.04)	0.56(0.02)	0.16(0.63)	0.27(0.01)	0.22(0.04)	0.45(0.51)

Table 15. Total walleye catch and harvest as percentage of adult population, 2002-2007.

Year	Walleye Catch	Walleye Harvest	number of adults	% Catch	% Harvest
2002	39045	6631	317500	12.29775	2.088361
2003	98210	17897	366000	26.83332	4.889768
2004	153525	33909	386600	39.71171	8.771114
2005	40052	31015	470000	8.521633	6.598964
2006	78634	54175	448000	17.55224	12.09274
2007	56891	47062	432000	13.16921	10.89398

Appendix A

2002 Oneida Lake Angler Survey

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Summer Internship

Abstract

The 2002 Oneida Lake Angler Survey was conducted to continue the work of earlier surveys. Past surveys have produced valuable information about the catch rates of different species in the lake, as well as the popular opinions of the anglers. This information has proved to be integral in the policy decisions that influence the walleye management in the lake. The survey in 2002 was conducted at two public boat launches, two shore angling access points and at popular bass tournaments on the lake. Anglers were asked about their catch, their fishing background, and opinion questions about walleye regulations and the effect of the cormorants. As a supplement to this information, marina owners and bait shop owners were also interviewed with questions about trends in their business, as well as similar opinion questions. Based on these data the walleye catch rate for open water was 0.22 fish/boat-h, and that rate increased to 0.41 when the bass tournament data was not included. The walleye catch rate for those specifically targeting walleye was 0.53 fish/ hour. The other questions led to information about the average Oneida Lake angler, who had been fishing for approximately 20.2 years and traveled 67.0 miles to get to the lake. Roughly 50% of these fishermen have changed their tactics in the past few years, and most (43%) spend about the same percentage of their fishing time on Oneida Lake. Anglers had mixed opinions about what would be the best walleye size and bag limit, and 58% of them felt strongly that the cormorants were having a negative effect on the fish. The trends were not as clear in the marina and bait shop owner results. Many have given up on some parts of their business, for example selling gas, due to economic reasons. Over the past few years some marinas have seen a decrease in the number of boats docked (42%), launched (47%), and rented (20%), but many have also said these numbers have stayed roughly the same or even increased. Finally, there was no real consensus among business owners as to what has had the largest effect on the Oneida Lake fishery, although popular answers included the increased walleye limits, the cormorants, the zebra mussels, and less promotion of and negative press about the lake.

Introduction

The Oneida Lake Angler Survey was first established in 1995 to be used as a supplement to the Angler Diary Program. The Diary Program was thought to have a bias toward more experienced fishermen and therefore was not an accurate representation of the average Oneida Lake fisherman. The Cornell Biological Field Station initiated the survey in order to keep in touch with both catch rates for the various species in the lake and angler opinions on issues relevant to the fishery.

The survey was conducted every year from 1995 to 1998, and then again in 2002. It was conducted in the summer and gathered a plethora of valuable information. The survey has been supported by not only Cornell but the New York State Department of Environmental Conservation.

The information presented in these surveys has been particularly relevant to Oneida Lake because of its long history of fishing. Early on in the lake's

history it was renowned for its eel and salmon population (Forney, 1980). Since then the lake has evolved into a lake that has walleye, yellow perch, and to a lesser extent small and large mouth bass as its dominant sport fish (Mills, et al, 1998). Many local businesses have been centered on the fishery, and therefore the management of the fishery has always been a key concern for the Oneida Lake community. The survey has given the anglers an opportunity to express concerns and suggestions about the fishery management.

PART I: Angler Survey

Methods

Survey Design

The survey consisted of two parts. The first part was (Appendix 1) was designed to gather basic background information about the anglers, such as how many people were fishing, how long they had been fishing, and where they were from. This first section also asked what species the anglers were targeting and how many of each species had been caught. This number was then broken down into how many fish had been kept and if any legal sized fish had been released.

The second part of the survey (Appendix 2) was aimed at gathering information on the prevailing opinions of anglers at Oneida Lake. The first question asked how many years the angler had been fishing on Oneida, and served as an information gathering question to see if the next two questions were applicable. If the anglers had been fishing Oneida for at least two years, they were asked if they had changed their tactics in response to changes in the water clarity of the lake. Those with at least two years of experience were also asked if they spend a higher, lower, or the same percentage of their fishing trips coming to Oneida Lake when compared to past years.

All of the anglers were asked the last two questions, no matter how long they had been fishing Oneida. They were asked for an opinion on the best walleye size and bag limit given the current fishing conditions, and if they felt that cormorants were significantly affecting the fish populations in the lake. Finally anglers were given a chance to add an additional comments that they felt were relevant and important. This part of the survey was put together by the Cornell Biological Field Station to focus on certain topics of interest, as well as to continue asking questions that had been used in the past to see trends over time.

Survey Method

The surveys were conducted from June 8th to August 4th, 2002. The survey times were chosen to attempt to maximize the number of anglers reached. The surveys were conducted every weekend day, as well as two randomly selected weekdays each week. The time of day was also randomly selected to be either morning or evening; 8:00 AM to 2:00 PM or 2 PM to 8PM, respectively. Surveys were not conducted on days of extreme weather conditions, in order to save man hours.

In order to reach as many anglers as possible as they were completing their fishing trips, the surveys were conducted at two public boat launches on opposite sides of the lake, South Shore Boat Launch and Godfrey Point Boat Launch (see Appendix 3). The starting location was randomly selected, and then halfway into the interview period the interviewer would drive to the other location.

In order to reach the population of anglers who fish from the shore, at some point during the interview period the interviewer would also stop at either Sylvan Beach or Oneida Shores. These locations were selected for their easy access and their location at opposite ends of the lake, which allows for access to a greater variety of anglers from different areas of Central New York.

To eliminate as much bias as possible, all survey questions were asked in the same manner using the same phrasing. Anglers were all questioned as they were fishing if on shore, or as they were pulling their boats out of the water, if they were fishing on the open water.

Results

Catch Rates

The catch rates of several species were calculated from the data given by the anglers (see Tables 1-4). Of particular interest was the walleye catch rate, which was 0.22 fish per hour on open water. This number was calculated based on the data given by anglers fishing from a boat, and excluded those fishing from shore. Also excluded was one outlier angler, who was said to have caught 125 walleye in under 7 hours. The walleye catch rate was also calculated without the information given by those fishing in bass tournaments, and the result was 0.41 fish per hour. This calculation was considered useful because besides not targeting walleye, the anglers in the tournaments often did not keep an accurate count of the fish they caught that were not bass. To narrow the field even further, the walleye catch rate for those anglers fishing specifically for walleye was calculated to get a figure of 0.53 fish per hour. Finally, the walleye catch rate for those fishing from shore was found to be a discouraging 0 fish per hour.

When compared to the past, these open water catch rates show a significant increase from the catch rates calculated the last time a survey such as this was conducted in 1998. In that year the open water catch rate was 0.05 fish per hour. The 2002 results were on par with results from other years though. In 1994 through1997 the catch rates were as follows: 0.35, 0.36, 0.21, 0.21, and 0.36 (Strakosh, 1995; Patronski, 1996; Hooper, 1997; Beitler, 1998)(see Figure 1).

Another important part of the walleye catch was the walleye harvest rate. In this dimension one can see a drastic change since the last time this survey was conducted (see Figure 2). In 1998 68% of the walleye caught by the anglers were kept (Beitler, 1998). This year the harvest rate dropped to 12%.

The catch rates for other popular species were also calculated for the open water and for fishing from shore. The largemouth bass results were a rate of 0.15 fish per hour on the open water, 0.04 fish per hour on the open water if the bass tournaments were not included, and 0.03 fish per hour if fishing from shore (Table 2). The smallmouth bass catch rates showed a similar trend: 0.31 fish per hour open water rate, 0.20 fish per hour without the bass tournaments, and 0.03 fish per hour from shore (Table 3). Finally the yellow perch catch rates were calculated to be 0.02 fish per hour in open water, 0.04 without the bass tournaments, and 0.07 if fishing from shore (Table 4). These rates were best compared to past rates if the catch rate without the bass tournament data was used. In this case, the only rate that showed significant change was the yellow perch catch rate, which dropped from 0.09 in 1998 to 0.04 in 2002 (see Figures 5

and 6).

Other Angler Information and Opinions

Anglers were also asked certain questions for background information, including their zip code. From this information an average distance traveled per angler was estimated. Overall people traveled an average of 67.0 miles to fish Oneida Lake. This figure has been broken down into several individual categories (see Table 5). Anglers who were at the lake for a bass tournament traveled farther on average, and therefore skewed the overall result. Those anglers fishing in a tournament traveled approximately 104.2 miles, whereas the other anglers had an average of 43.1. Those who were fishing from shore also traveled less, going an average of 26.5 miles to fish Oneida.

The survey also inquired as to how many years the anglers had fished Oneida, and that average turned out to be 20.2 years. This number was very similar from numbers gathered in past years: in 1996 the average angler had fished for 20 years and in 1997 the number was 21 years (See Table 6). If the anglers being surveyed had fished Oneida for at least 2 years, they were asked if they had changed their tactics at all in response to the changes in water clarity. As in past years, this question broke into a roughly 50-50 split of those who had and those who hadn't changed tactics: 50.4 had, 49.6 had not. (For a further breakdown of this figure and those to follow, refer to Table 7).

Anglers were then asked if the percentage of their fishing trips that were spent on Oneida Lake had gotten higher, lower, or stayed the same over the past few years. Most people, about 43%, said that they fished Oneida about the same amount as they always have. On the ends, 32% came to Oneida more often and 25% came less often. This figure was also heavily influenced by the bass tournament data, because 49.2% of those at the tournaments said they came to Oneida Lake more now than in the past, and only 10.3% said that they came less (see Figures 5 and 6).

The question regarding potential walleye limits was also strongly influenced by bass tournament fishermen, because many of these anglers had no opinion on the matter. The overall results were that 6% of people preferred a 3 fish, 15 inch limit; 23% favored 5 fish, 15 inch; 28% liked 3 and 18; 16% liked the slot; 4.6% had some other suggestion, and 23% had no opinion. If the bass tournament data is then factored out, only 6.4% of the people surveyed had no opinion, but they still showed no clear consensus as to what regulations would be best for the walleye fishery (see Figures 7 and 8).

Finally, there was a very clear trend in the question on the effects of cormorants on the Oneida Lake fishery. Of those surveyed, 58% said that the cormorants were having an effect on the lake, and only 13% said that it wasn't. The others were either unfamiliar with the cormorant issue (15%) or had no opinion (14%). This showed a dramatic increase in the number of people responding that yes, the cormorants were effecting the fish from 1998, when only 38% said so (see Figure 9). Another noticeable trend in this question's responses was that those anglers fishing from shore were far less aware of the cormorant issue: 46% had never heard of cormorants.

PART II: Marinas and Bait Shops

Methods

Survey Design

This questionnaire was designed to address the issues of interest to those at the Cornell Biological Field Station, and also to touch upon the issues raised by Jack Henke in his 2000 paper “Biological and Socioeconomic Effects of the Proliferation of Double Crested Cormorants On Oneida Lake, New York”. The marinas and bait shops Henke included in his study were contacted, as were several other businesses around in the lake that were found in the Yellow Pages.

The business owners were asked questions related to their businesses and trends they had noticed, as well as opinion questions. For example, the marina owners were asked questions about trends in boat rentals, launches, and dockage, as well as questions about trends in customer demographics (see Appendix 4). Bait shop owners had questions more tailored to their business, such as bait and lure sales, as well as the questions about customer demographics (see Appendix 5). The opinion questions asked of both businesses were similar to those asked of the general angler population: questions about walleye regulations, cormorants, and what they feel has effected the Oneida Lake fishery the most.

Survey Methods

The marina and bait shop owners were contacted in advance by phone to set up appointments for the interview. Those who could not be reached by phone or who were unable to meet in person often were willing to fill out the survey on their own time and return it by mail. Although these surveys were often not as complete as the personal interviews due to a lack of dialogue, they still provided valuable information.

Results

Marina and bait shop owners were quite willing to discuss their businesses. Many of them have been in business for several decades, and have seen their businesses change quite a bit. In fact, 58% of the marina owners have stopped offering certain services in recent years. Selling gas was the service most often abandoned, because of the high costs, high competition, and the environmental hazards that selling fuel represented. Some marinas have also found it too difficult to compete with larger sporting good stores and so stopped selling bait.

Marina owners were also asked to look at trends in total number of boats launched, docked, and rented over the past ten years. The results were very mixed, with 53%, 41%, and 20%, respectively claimed a decrease in this part of their business. However, many stayed the same, and some even increased (35%, 24%, and 40% respectively). Boat rentals were doing especially well, with 80% either staying the same or increasing in their boat rental frequency. The information about boats launched and docked was further broken down to look at the percentage of the boats that were fishing boats. It was found that for 53% of businesses the percentage of boats launched and docked that were fishing boats either stayed the same or increased. The trend in gas sales were also examined, and it was shown that 22% of those who offer gas had experienced an increase in sales, 33% had stayed the same, and 44% had decreased their sales (see

Table 8).

The owners were also asked questions about their customers and marketing techniques. Most (74%) indicated that their client base had remained similar in demographics such as age, hometown, and gender. Some however, 16% to be exact, did mention a decrease in the number of patrons from areas such as Pennsylvania. Marina owners also tended to not be very involved in advertising, and had always relied on word of mouth for their business. Recently 33% of the owners did change their marketing a bit by expanding to more newspapers and the Internet, and all except one who did that saw at least a small increase in their business.

Finally, the owners were given an opportunity to voice their opinions about increasing the fishing license fee, the renovated public boat launches, and the effects of zebra mussels and cormorants. In regards to the license fee, 67% of the owners said that they would not support a fee increase. Also, all of the 33% who said they would support an increase qualified their answer to say that they would support it if and only if the money went back into the fishery, and seemed skeptical about the chances of that happening. The opinions about the public boat launches were evenly split: 50% of owners thought that they had effected their business and 50% said that they had no effect. The zebra mussels raised a little more controversy; 67% of owners thought that they had no effect on their business, 27% claimed that there was a small negative effect, and 7% (one marina) said that there was a large negative effect on business. The opinions on the cormorants were not that friendly. While 44% said that the birds had little or no effect on business, 56% were very adamant about the strong negative effect the cormorants have had on their business.

The last question asked was open ended, and allowed the owners to speculate as to what has had the largest effect on the Oneida Lake fishery. Answers were incredibly varied, and most people mentioned two or three factors. The most common factors were cormorants, the change in the walleye limit which especially discouraged tourists (owners feel that a fisherman wouldn't drive six or eight hours for three fish), the zebra mussels, selling the walleye fry to other lakes. Owners also commented that there has been less promotion of the lake recently, and that has combined with the negative press the lake and the cormorants have generated to have a significant effect on business. Some people speculated that perhaps fishermen are just giving up. (For a full break down of suggested factors, see Table 9).

Discussion

When comparing the 2002 results to the past results it is vitally important to note that this year was the only year to include data from several large bass tournaments, including one with roughly 100 anglers who fished for bass only for eight hours. Therefore all of the calculations have been broken into open water results and open water without the bass tournament results. For example, the data on the catch rates was very strongly effected by these tournaments to the point where in order to compare these rates to the past it would probably be more accurate to use the calculations that do not include the bass tournament information. Using this theory, the result of 0.41 walleye per hour for open water fishing that does not include bass tournaments, when compared to the past, was

the highest rate recorded. This was an interesting result given that in 2002 many anglers have complained about the lack of walleye in the lake. The rate of 0.53 walleye per hour for those who were targeting walleye was also quite a strong number and demonstrated excellent fishing conditions, despite the griping.

Many anglers have complained about the lack of walleye in the lake, but that was clearly not a problem in the summer of 2002. What did change substantially, however, was the harvest rate. The 2002 rate was almost one-fifth of that in 1998, and that was discouraging to many anglers (Beitler, 1998). This downward trend has been attributed mostly to an increase in the size limit and decrease in the bag limit (from 5 fish, 15 inches to 3 fish, 18 inches). The percentage of legal sized fish released has remained constant, and so the main problem for anglers was that they could not find fish that were big enough. Many anglers spoke of catching that 17 and one-half inch fish and having to throw it back. This was discouraging to many local fishermen, and many marina owners interviews also speculated that this could be discouraging tourists as well. The difficulty of finding a legal sized fish to take home takes away some of the incentive for out of state anglers to drive a long way to fish Oneida.

Although both anglers and marina owners were not thrilled with the walleye limit, many did not know what walleye regulations would be better. This was clearly shown by the responses to the question on walleye limits. Anglers seemed very willing to do whatever it takes to keep the population up, but they were unsure as to what exactly would do it. Some suggested keeping the limit higher for a few years, and then dropping it back to the old 5 fish, 15 inch limit. The important thing to note was that the anglers are willing to work with whatever limits the New York State Department of Environmental Conservation comes up with.

This idea that the walleye fishery has been declining was held by many, and has led to people doing things such as changing their fishing tactics, fishing other lakes, and blaming the cormorants for the problem. However, it was found that not everybody has changed tactics, and most haven't decreased their amount of fishing time at Oneida Lake. The lake has been getting a lot of negative publicity in recent years, and that has influenced the popular opinion, even if the data does not back it up. Anglers would often say that no one fished Oneida anymore, but then continue on to say that they haven't decreased their trips to the lake.

This phenomenon of public opinion being influenced by a few has been most clearly demonstrated in the cormorant issue. In 1998 only 38% of people surveyed felt that the cormorants were a problem (Beitler, 1998), and in 2002 58% did. This change was noticed after the 2000 publication of a paper by Jack Henke and put out by the Oneida Lake Association, in which he points to the cormorant as the cause of the decline in fishing at Oneida and the economic decline for local marinas and bait shops. Henke's investigation of the decline in local business was what sparked the marina owner interviews portion of this study. After having spoken with the marina owners, it became apparent that things have definitely changed on the lake. However, it has not all been change for the worse, and certainly not all of the change can be attributed to the single factor of the cormorants. It has been shown that cormorants do eat young walleye and yellow perch, but they only eat about as much as the anglers harvest

(VanDeValk, 2002).
Rather than attribute all blame to the cormorants, it should be remembered that many people suggested that bad publicity from articles such as Henke's have been partly to blame. Oneida Lake used to be touted as one of the best walleye lakes in the Northeast, and now people only mention the lake to complain about it. However, the walleye fishing has been going well and the bass fishing has also been picking up, as evidenced by the large tournaments that were held in the summer of 2002.

The Oneida Lake community has shown that it really cares about the lake. However, they have been losing faith in it because they have been hearing nothing but bad things about it. It should be remembered that lakes have always fluctuated in fish, bird, and plant populations. These changes in turn have always effected and will always effect the fishery of the lake. The past has shown, however, that things generally balance themselves out. A few bad years should not be a reason to give up on a lake, and the overriding feeling of the anglers interviewed was that they didn't want to give up. However, they needed some encouragement. If all that the have read says negative things, they of course feel negatively about the lake. Perhaps with a renewed effort to promote Oneida Lake, some of the businesses that have lost business could recover and anglers would have a reason to support the lake again.

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VanDeValk, A, et al. 2002. Comparison of angler and cormorant harvest of walleye and yellow perch in Oneida Lake, New York. Transactions of the American Fisheries Society 131:27-39.

Appendix 1

1. How many years have you been fishing Oneida Lake? _____

2. Have you had to change your fishing tactics in response to changes in water clarity since you've been fishing?

   Yes _____ No _____

3. Compared to the past, do you spend a higher, lower, or the same percentage of your fishing trips on Oneida Lake?

   Higher _____ Lower _____ Same _____ Don't Know _____

4. Under the current walleye population in Oneida Lake, which angling regulation scenario do you think would result in the best current and future fishing opportunities?

   5 fish bag limit, 15 inch minimum length requirement _____
   3 fish bag limit, 18 inch minimum length requirement _____
   A slot limit _____
   Other _____

5. Do you feel that the cormorants are significantly affecting fish populations in Oneida Lake?
   Yes ____ No _____ No Opinion _____ Unaware of Cormorant Issue ____

6. Any additional comments? _____
   _____

Measurements							
Yellow Perch							
White Perch							
Pike							
Pickerel							
Bullhead							
Bluegill							
Pumpkinseed							
Rockbass							
Black Crappie							
Catfish							

Other							

Appendix 2
Marina Name _____ Date _____
Owner/Manager Name _____

1. How many years has your business been open? _____
2. What services do you currently offer your customers?
   Boat Launch _____ Boat Docking/Slips _____ Boat Rental _____
   Gas _____ Bait Shop _____ Camping _____
   Cottages/Cabins _____ Ice Shanties _____ Other _____
3. Have you offered any other services in the past? Yes/No
   (If yes) What services and during what years: _____
   _____
   Why do you no longer offer these services? _____
   _____

The next four questions involve trends over time. Please answer them by considering the last 10 years of business.

4. Has the total number of boats launched from your marina increased, decreased, or stayed the same?
   Increased _____ Decreased _____ Same _____ Unsure _____
   If you were to estimate the percentage of the boats launched that were fishing boats, has that percentage increased, decreased, or stayed the same?
   Increased _____ Decreased _____ Same _____ Unsure _____
5. Has the percentage of slips filled increased, decreased, or stayed the same?
   Increased _____ Decreased _____ Same _____ Unsure _____
   If you were to estimate the percentage of the boats in the slips that were fishing boats, has that percentage increased, decreased, or stayed the same?
   Increased _____ Decreased _____ Same _____ Unsure _____
6. Has the frequency of the boat rentals increased, decreased, or stayed the same?
   Increased _____ Decreased _____ Same _____ Unsure _____
7. Have your gas sales increased, decreased, or stayed the same?
   Increased _____ Decreased _____ Same _____ Unsure _____

That concludes the portion of the interview involving trends over the past 10 years. Please answer the rest of the questions as they are asked.

8. Has your business changed its marketing strategy over the past few years? Yes/No
   If yes: How so? _____
   _____
   Has the new marketing helped business? _____
9. Describe your typical customer. For example, would a typical customer be male or female, old or young, a local or a tourist, etc. _____
   _____
   How does this description compare to the average customer of the past?
   _____
10. Do you feel the newly renovated public boat launches are affecting your business? Yes/No If yes: How so? _____
    _____

11. Do you support the increased fishing license fee that will take effect next year?
Yes/No Why or why not? _____
_____

12. What effect, if any, do you think the zebra mussels have had on Oneida Lake?
_____
On your business? _____
_____

13. What effect, if any, do you think the cormorants have had on Oneida Lake?
_____
On your business? _____
_____

14. What do you think is having or has had the largest effect on the Oneida Lake fishery and why?
_____
_____
_____
_____
_____

15. Any other comments? _____
_____
_____
_____

Appendix 3

Bait Shop Name _____ Date _____
Owner/Manager Name _____

1. How many years has your business been open? _____
2. What do you currently offer other than bait sales? _____
_____
3. Have you offered any other services in the past? Yes/No
(If yes) What services and during what years: _____
_____
Why do you no longer offer these services? _____
_____

The next three questions refer to trends you may have noticed over the last 10 years.

4. Has the sale of live bait increased, decreased, or stayed the same?
Increased _____ Decreased _____ Stayed the Same _____
5. Has the sale of frozen bait increased, decreased, or stayed the same?
Increased _____ Decreased _____ Stayed the Same _____
6. Has the sale of lures increased, decreased, or stayed the same?
Increased _____ Decreased _____ Stayed the Same _____

That concludes the portion of the interview involving trends over the past 10 years. Please answer the rest of the questions as they are asked.

7. Has your business changed its marketing strategy over the past few years? Yes/No
If yes: How so? _____
_____

Has the new marketing helped business? _____

8. Describe your typical customer. For example, would a typical customer be male or female, old or young, a local or a tourist, etc. _____
_____
How does this description compare to the average customer of the past?
_____

9. Do you feel the newly renovated public boat launches are affecting your business?
Yes/No If yes: How so? _____
_____

10. Do you support the increased fishing license fee that will take effect next year?
Yes/No Why or why not? _____
_____

11. Under the current walleye population in Oneida Lake, which angling regulation scenario do you think would result in the best current and future fishing opportunities?
5 fish bag limit, 15 inch minimum length requirement _____
3 fish bag limit, 18 inch minimum length requirement _____
A slot limit _____
Other _____

12. What effect, if any, do you think the zebra mussels have had on Oneida Lake?
_____
On your business? _____
_____

13. What effect, if any, do you think the cormorants have had on Oneida Lake?
_____
On your business? _____
_____

14. What do you think is having or has had the largest effect on the Oneida Lake fishery and why?
_____
_____
_____
_____
_____

14. Any other comments? _____
_____
_____
_____

Table 1

Walleye Catch Rates			
	WE Caught	Hours Fished	Catch Rate
Total, Open Water	1016	4146.33	0.25
Open Water w/o Bass Tournaments	946	2018.33	0.47
Targeting WE	916	1495.82	0.61
Total, Open Water, W/O Outlier	891	4132.83	0.22
Open Water w/o Bass Tourn. and Outlier	821	2004.83	0.41
Targeting WE, W/O Outlier	791	1482.32	0.53
Fishing From Shore	0	189.41	0

Table 2

Largemouth Bass Catch Rates			
	LMB Caught	Hours Fished	Catch Rate
Total, Open Water	608	4146.33	0.15
Open Water w/o Bass Tournaments	72	2018.33	0.04
Bass Tournaments	536	2128.5	0.25
Fishing From Shore	5	189.41	0.03

Table 3

Smallmouth Bass Catch Rates			
	SMB Caught	Hours Fished	Catch Rate
Total, Open Water	1286	4146.33	0.31
Open Water w/o Bass Tournaments	409	2018.33	0.2
Bass Tournaments	877	2128.5	0.41
Fishing From Shore	6	189.41	0.03

Table 4

Yellow Perch Catch Rates			
	YP Caught	Hours Fished	Catch Rate
Total, Open Water	83	4146.33	0.02
Open Water w/o Bass Tournaments	81	2018.33	0.04
Bass Tournaments	2	2128.5	<0.01
Fishing From Shore	13	189.41	0.07

Figure 1

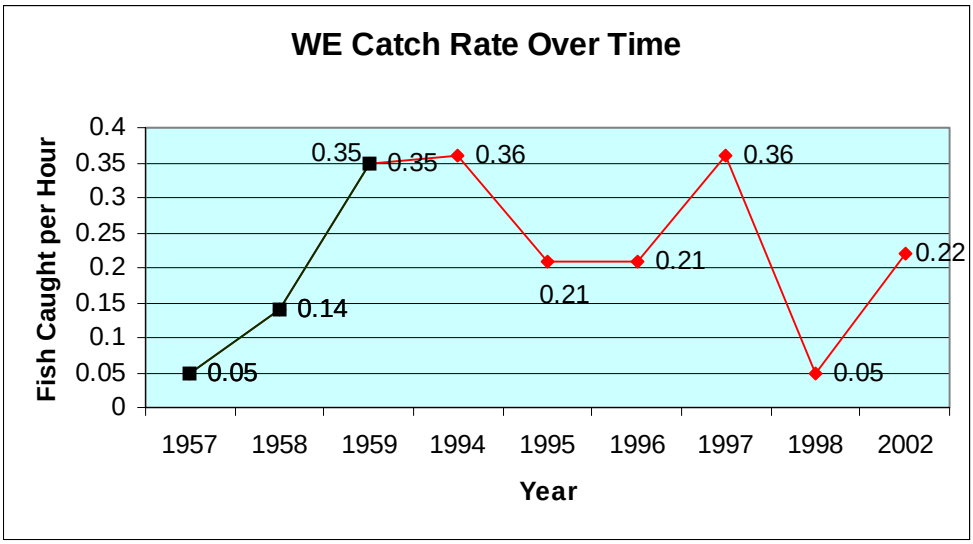
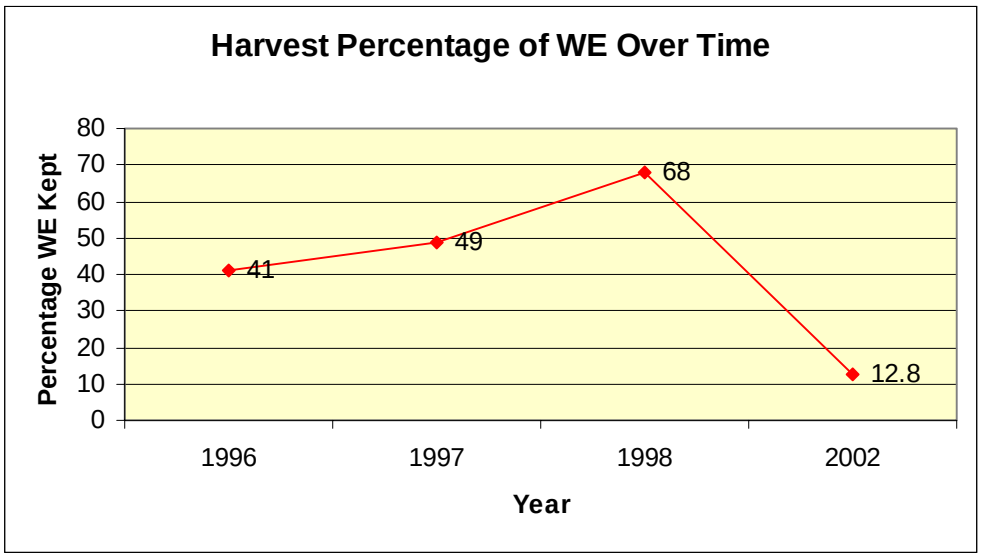


Figure 2



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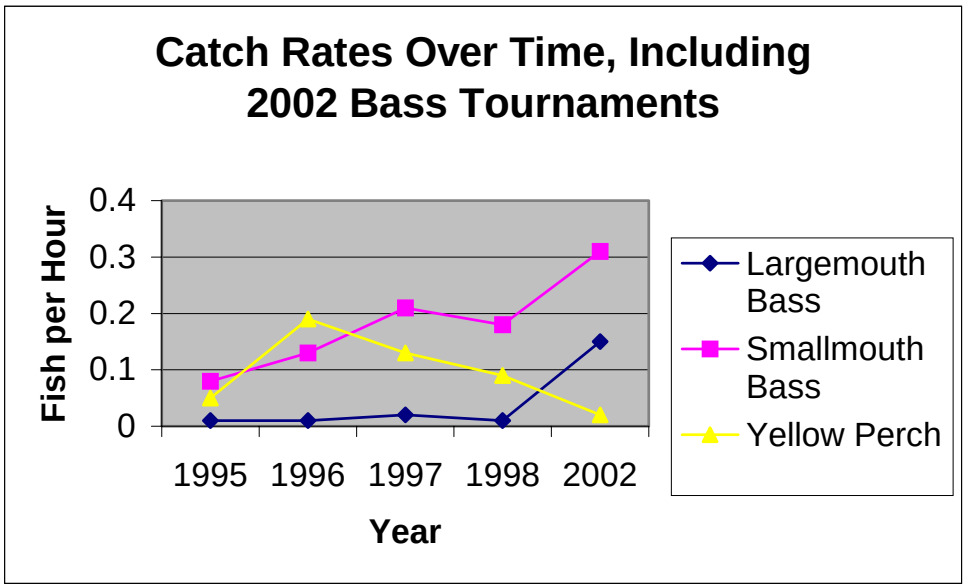

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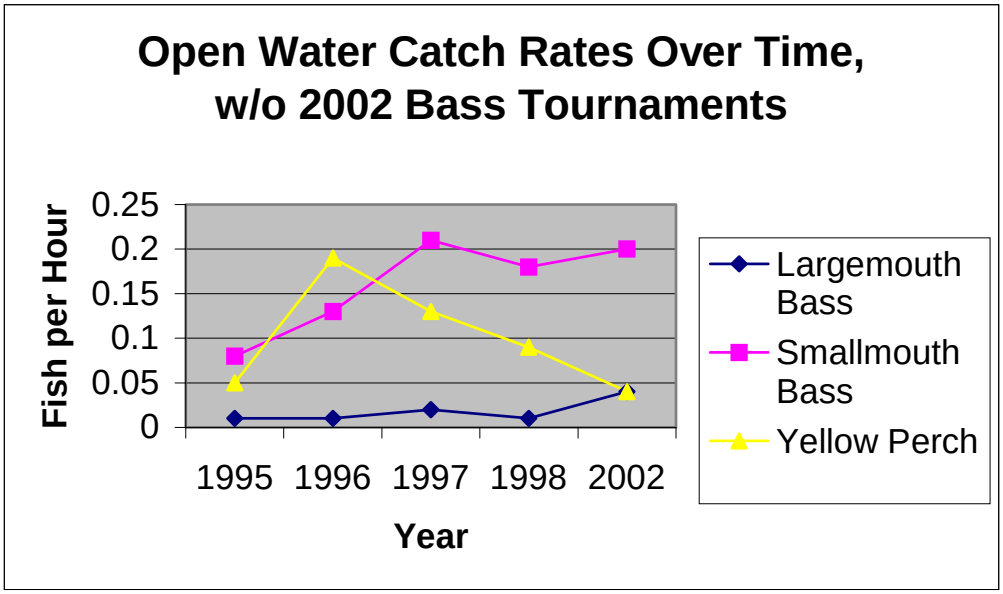


Table 5

Average Distance Travelled			
Breakdown	Total Mi. Traveled	People in Data Set	Av. Mi. Travelled
Overall	30506.6	455	67.0
Anglers Fishing From Boat	28644.1	386	74.2
Anglers Fishing From Shore	1828.0	69	26.5
Anglers Here for Bass Tournament	18645.0	179	104.2
Overall, W/O Bass Tournament	11627.5	270	43.1
Fishing from Boat, W/O BT	9765	201	48.6

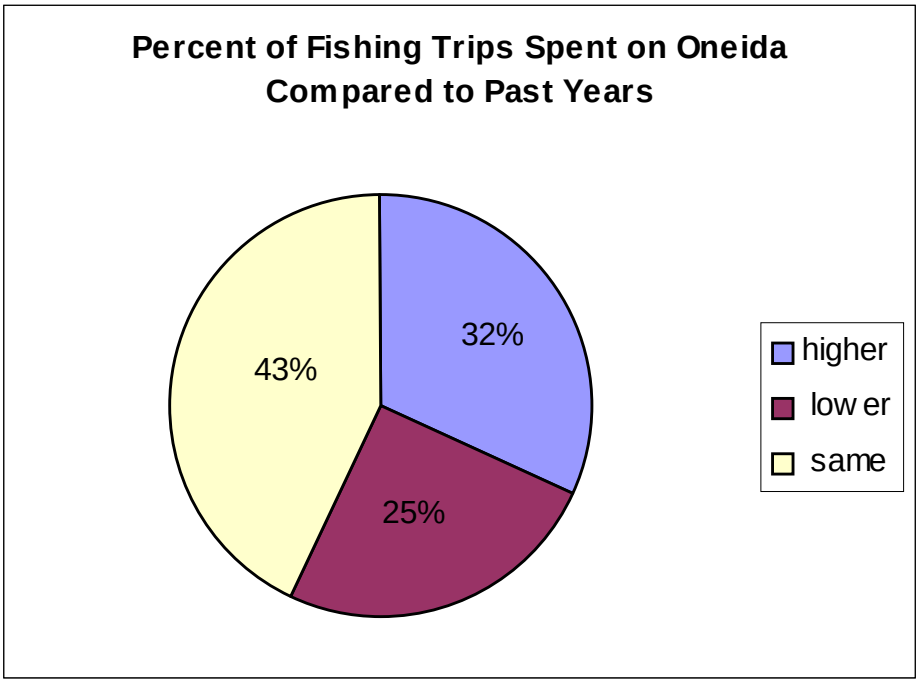
Table 6

Average Years Fished Over Time			
Year	Average	Min	Max
1996	20		
1997	21		
2002	20.2	first time	70

Table 7

Questionaire Results					
		Total, Boat and Shore	Open Water w/o Bass Tournaments	Bass Tournaments	Shore
Changed Tactics (if fishing >2 yrs):					
	Yes	50.4	55.2	50.6	29.2
	No	49.6	44.8	49.4	70.8
Percent Fishing Oneida					
	Higher	32	22.2	49.2	33.8
	Lower	25	32.6	10.3	26.4
	Same	43	45.2	40.4	39.7
WE Regulations					
	3, 15	6	8.1	3.9	4.3
	5, 15	23	26.4	12.4	30.4
	3, 18	28	32.8	17.8	30
	Slot	16	20	14	4.3
	No Opinion	23	6.4	51.2	26
	Other	4.6	6.4	0.8	5.8
Cormorants					
	Yes	58	61	66.9	27.9
	No	13	13.9	14	10.3
	No Opinion	14	14.7	11	14.5
	Unaware	15	10.4	7.9	46.4

Figure 5



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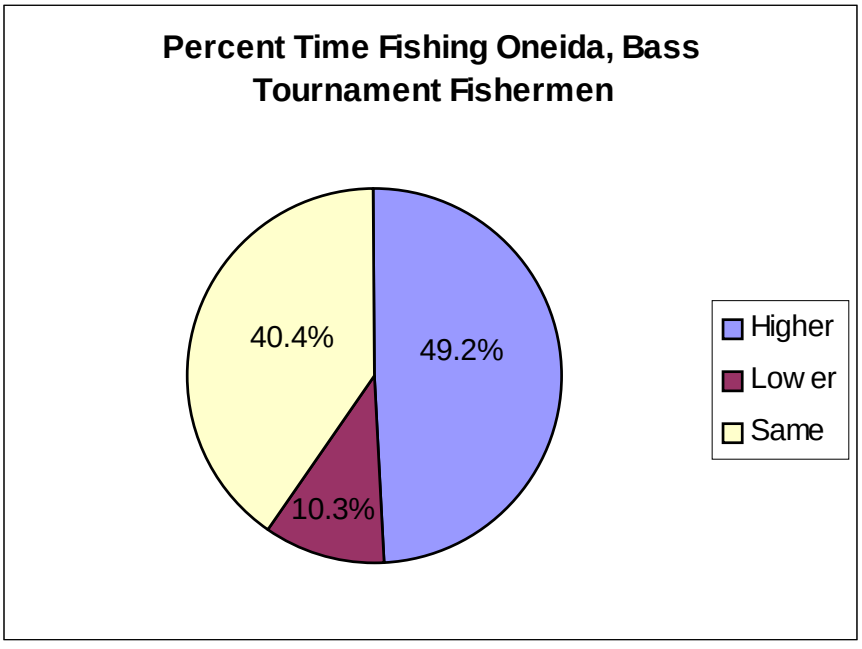


Figure 7

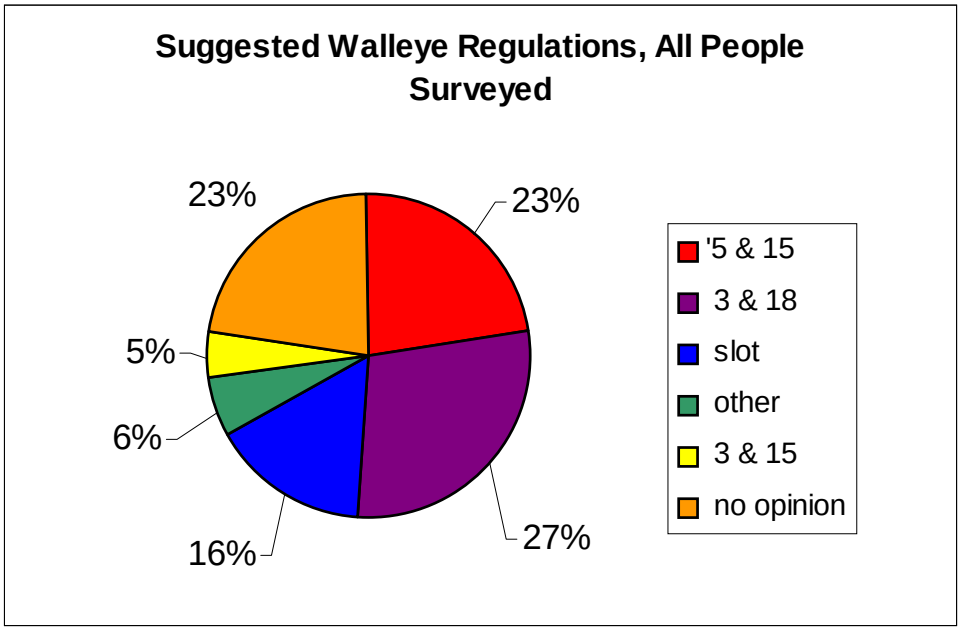


Figure 8

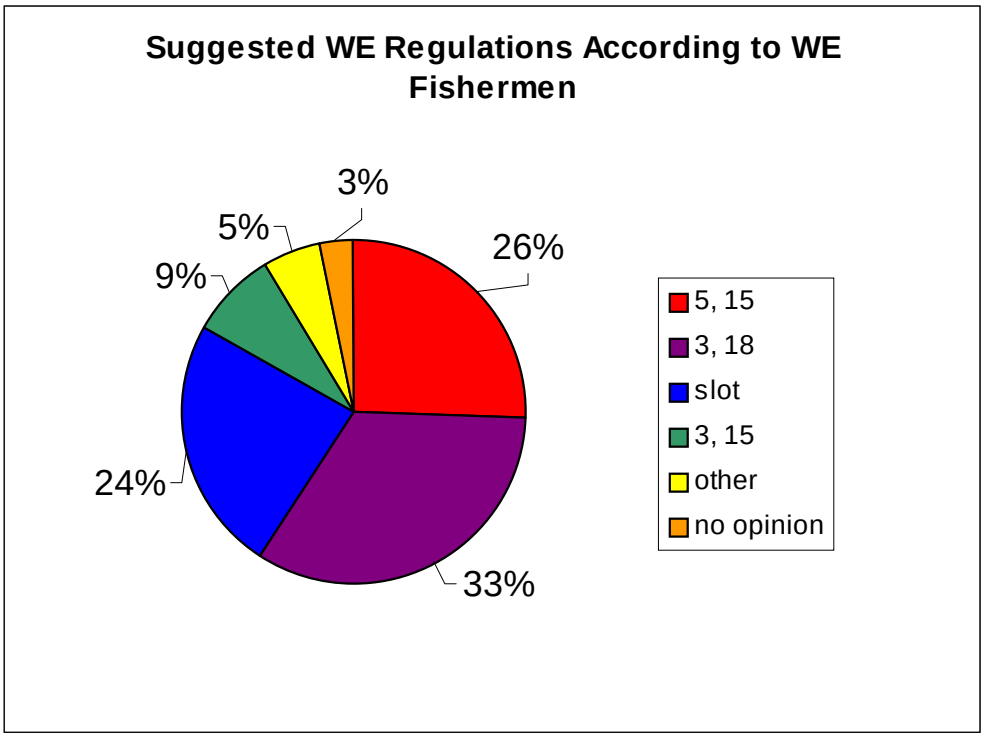


Figure 9

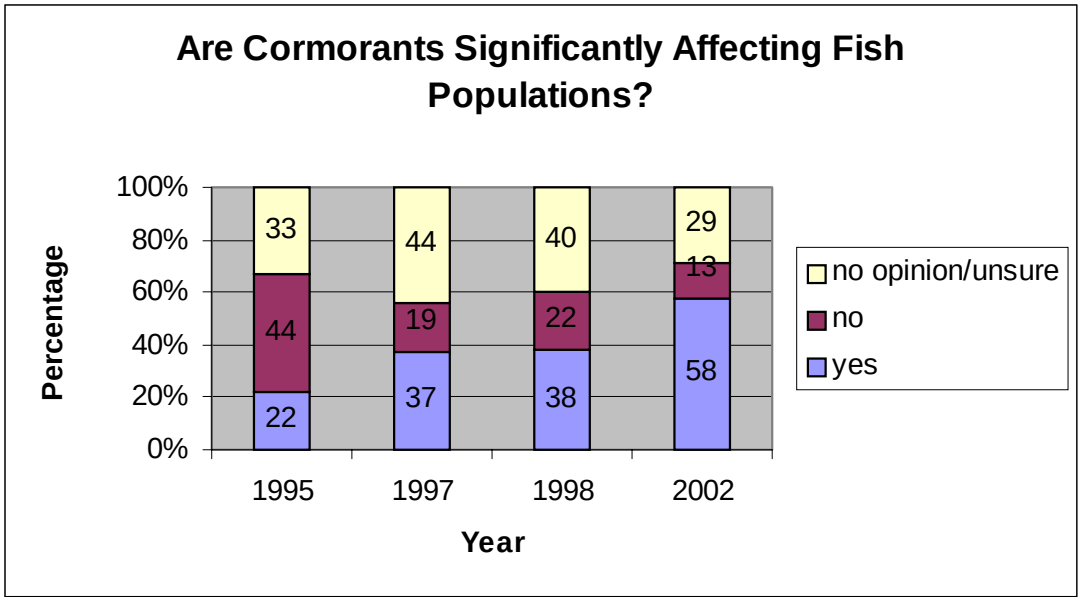


Table 8

Marina Owners Questionnaire Responses			
	Increase	Decrease	Same
Total Boats Launched	35	53	12
% Launched - Fishing	6	47	47
% Slips Full	24	41	35
% Slips Full-Fishing	6	47	47
Frequency Rentals	40	20	40
Gas Sales	22	44	33
	Yes	No	
Changed Marketing	33	67	
Support Increase in License Fee	33	67	
Public Launches had an Effect?	50	50	

Table 9

Factors Mentioned as Having Most Effect on Fishery	
Factor	Number of Votes
Cormorants	7
Change in the WE Limit	6
Selling WE Fry to Other Lakes	4
Zebra Mussels	4
Bad Advertising	3
Fishermen Giving Up	2
Recreational Boaters	2
Too Expensive	1
Fishing Not Popular	1
Pollution	1
Less Tourism	1
Migration South	1
Low Water Level in Lake	1

Appendix B

Awareness of angling regulations and angler demographics on Oneida Lake
2006 Oneida Lake Angler Survey

Christina Manto

Advised By: Randy Jackson
In Conjunction With: Scott Krueger

Cornell Biological Field Station
Summer 2006

Introduction:

Oneida Lake, New York State's largest inland body of water (20,700 ha), is an important resource for anglers targeting specific sport fishes including; walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), and black bass (*Micropterus dolomieui* and *salmoides*) (Connelly and Brown 1991). Not only is the lake important for anglers, it also provides economic support to communities surrounding the lake. According to Connelly *et al.* (1997), Oneida Lake ranked third in New York State for net economic value at $9,418,000. Thus anglers are vital to the lake and the area as both economic and sociocultural stakeholders. Yet, it is also important to recognize the predatory impact anglers have on the species in lakes. In the late 1950's, it was estimated that anglers had removed 50% of Oneida Lake's walleye population (Grosslein 1961).

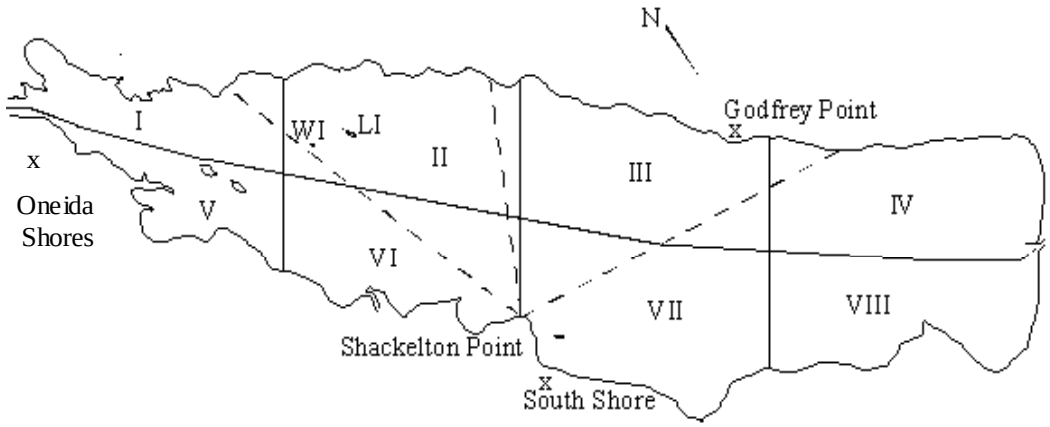
Since 1956, the Cornell Biological Field Station has monitored both the physical and biological characteristics of the Oneida Lake ecosystem, with particular attention given to interactions between predators and prey. However, the impact of an important predator—humans—has received considerably less attention. A creel survey measures fishing in an area over a certain time period, often serves to monitor fish populations, and can aid in making management decisions (Hayne 1991). The Oneida Lake Angler Survey, an aerial-roving creel survey, was designed to identify the impact of angling on the lake. An aerial-roving survey measures the success rate of anglers at a certain moment and the creel clerk eventually uses the data obtained to estimate total fishing over some period of time. Another type of survey—the access point survey—where a clerk is stationed at a certain access point on the lake and intercepts anglers leaving the water also estimates success rate, but for completed fishing trips (Hayne 1991). Surveys have been conducted during the open-water and ice fishing seasons in 1957-59, 1997-98 and 2002 through the present. The survey reported here is a complement to the Oneida Lake Angler Survey and is designed to facilitate testing differences between catch and harvest rates from complete (access) and incomplete (roving) trip interviews. Additionally, to identify angler attitudes concerning regulation changes and to assess the level of awareness of angling regulations, an additional questionnaire was added to the open water season 2006 survey. This report summarizes the results of both the quantitative and qualitative surveys.

Methods:

A standard boat launch access site survey was utilized to discern angler success and awareness. This survey method is designed to intercept anglers returning to access sites from the open water. Oneida Lake has diffuse access, much of which is private residences and marinas. Public boat launches were used as access sites and since public shore fishing access is relatively limited, it was not included in the survey design. The data collected reflects completed trips by anglers. The purpose of using this design was to estimate catch rate (referring to fish caught per hour of angling effort hereafter, angler-h) and harvest rate (number of fish kept per unit of effort) (Pollock et al. 1994). In addition to the quantification of angler success, qualitative data, including people's awareness of fishing regulations on Oneida Lake for the New York State Department of Environmental Conservation (hereafter DEC), was collected.

The survey was performed from June through August 2006. Sample dates included both weekend days and two randomly selected weekdays each week. National holidays were considered weekend days and 2 of the 3 "weekend" days in that week were randomly selected. The clerk interviewed anglers during one of two randomly selected shifts, (8:00

AM - 2:00 PM or 2:00 PM - 8:00 PM), at one of three randomly selected boat launches (Godfrey Point, South Shore, and Oneida Shores County Park) (Fig. 1). In an effort to increase efficiency, surveys were not conducted during severely inclement weather. Anglers were all asked the same questions, using the same phrasing to avoid leading the response.



p of Oneida Lake indicating the locations of the three public access sites where survey was conducted. (Oneida Shores County Park, Godfrey Point boat launch, and South Shore boat launch).

The second set of questions asked was developed in conjunction with the DEC (Appendix 2). The purpose of asking the days fished during both the open water and ice fishing seasons was to deduce the angler's familiarity with and experience fishing, particularly on Oneida Lake. The angler was then asked whether he or she was aware of the regulations regarding the three primary gamefish in the lake. If yes, the clerk then asked the angler to recite the regulations. The angler was also asked his or her opinion regarding a proposed regulation change and a controversial regulation. The final question an angler was asked concerned where he or she most often found out about fishing regulations.

Catch and harvest rates were calculated using the ratio of means estimator for the access point survey and the mean of ratios estimator for the roving survey (Pollock *et. al.* 1994). Though the clerk interviewed anglers on 16 dates, estimates were based on dates in which both the roving and the access point clerk were both sampling to facilitate comparisons between methods (n=14). All comparisons are made with a level of significance of 0.05.

RESULTS

Catch Rates

The catch rates of walleye, yellow perch, and black bass were calculated from data retrieved from anglers. The access point creel clerk conducted 205 interviews between June 14 and August 7, 2006. Walleye catch rate was calculated to be 0.24 fish/angler-h. With the removal of an extreme outlier, the mean yellow perch harvest rate decreased from 0.11 to 0.03 fish/angler-h and the catch rate dropped from 0.12 to 0.04 fish/angler-h. The mean catch rate for black bass was 0.23 fish/angler-h.

Catch rates for anglers targeting certain species tend to be a more refined estimate of angling success. Targeted catch rates for walleye, black bass and yellow perch were 0.31,

0.40, and 1.19, respectively.

Harvest Rates

Anglers harvest rates for walleye, black bass and yellow perch were; 0.15, 0.04, and 0.11 respectively. Targeted harvest rates were 0.18 (walleye), 0.08 (black bass), and 1.17(yellow perch).

Other Angler Information and Opinions

Based on the qualitative questions, anglers reported an average 27 years of fishing. Anglers fished 52 days of the year, 21 of which were on Oneida Lake. Only 11% of anglers questioned were members of the Oneida Lake Association (OLA).

In terms of awareness of fishing regulations by anglers for walleye, black bass, and yellow perch, anglers were asked to recite both the creel and minimum length limits. Anglers either got both numbers correct, one of the two, or were completely incorrect about creel and minimum length. There is a significant difference between anglers thinking that they knew the regulation and actually knowing the regulations for all species.

Of 164 anglers interviewed, 135 (83%) were able to recite the correct creel and minimum lengths for harvestable fish. Of the remaining 29 interviewees, 17 people (10%) were able to correctly recite one of the two regulations correctly and the remaining 12 individuals (7%) did not know either regulation correctly.

Angler satisfaction proved to be very positive. On a scale of 1 to 5, with 5 being most satisfied, the mean satisfaction with the management of Oneida Lake's fisheries was 4.12. Of the 164 interviewees, 46.9% rated 5, 31.4% rated 4, 15.6% rated 3, 5.0% rate 2, and only 1.3% rated 1.

Beginning in the license year of 2006-7, the regulation on black bass season changed statewide, with a special regulation on Oneida Lake. The previous regulations stated that black bass season would open on the third Saturday in June. The new regulation stated that bass season on Oneida to be catch and release from opening of walleye season on 1st Saturday in May until traditional opening (third Saturday in June) when harvest is allowed. Anglers were asked their opinions on this regulation change and responded that they were in favor, opposed, or held no opinion on the regulation change. Of the 159 respondents, 83 (52%) claimed to be in favor of the change, while 38 (24%) were opposed and the remaining 38 (24%) held no opinion about the imminent change (Figure 2). Responses of anglers targeting a walleye reflect the percentages of the overall opinions (Figure 3). Black Bas anglers responses differed from the general angling population (78% for, 10% against, and 20% no opinion.)

Figure 2. Exit interview opinions for all anglers about the new bass regulation.

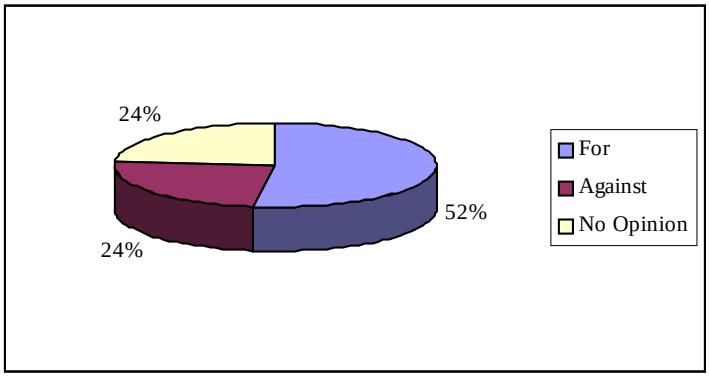


Figure 3. Exit interview opinions about the new bass regulations for anglers targeting walleye.

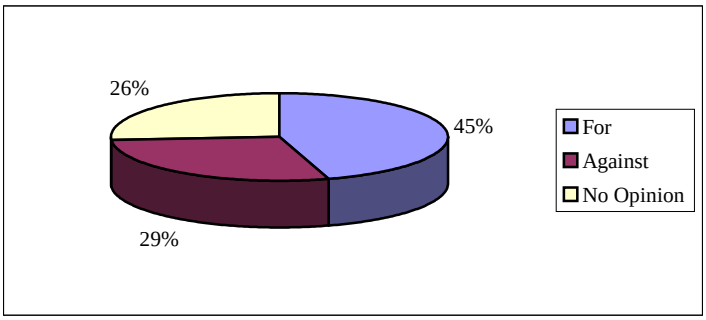
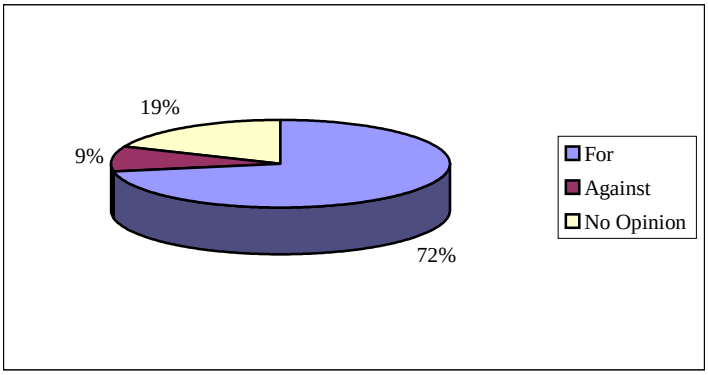


Figure 4. Exit interview opinions about the new bass regulations for anglers targeting bass.



The final question was in reference to where anglers were most likely to learn about fishing regulations. The vast majority of interviewees stated that they most often found out information from the DEC regulation booklet that they received when purchasing their licenses (94%). The second most common source for information about fishing regulations was the DEC web page (25%). The third most common response was that anglers were finding out from multiple sources (18%). Other sources anglers were finding out regulations from included bait shops, sportfishing magazines, creel clerks,

people discussing regulations on opening day of the season, newspapers, and word of mouth.

Discussion:

When comparing the roving survey to the access point survey, several things were confirmed. There appeared to be no significant differences between the roving and access surveys in terms of catch and harvest rate estimation by species.

According to Festa *et. al.* (1987), a walleye catch rate range of 0.1 to 0.2 fish/angler-h is considered very good fishing and any catch greater than 0.25 fish/angler-h is considered excellent fishing. These generalizations suggest that the Oneida Lake walleye catch rate (0.24 fish/angler-h), was quite good. In terms of targeted catch rates, (i.e. the success of those anglers specifically trying to catch walleye) fishing was excellent (0.31 walleye/angler-h).

The walleye and yellow perch fisheries on Oneida Lake tend to be harvest based, and as a result, harvest rates may be better indicators of angler success than catch rates. Previous research has indicated that the release of legal sized walleyes tends to be low, and harvest rates and catch rates of yellow perch tend to be similar (CBFS unpublished data). Harvest rates reported by anglers were high, and not significantly different from catch rate for yellow perch ($p = 0.57$).

As indicated in results, outliers can skew rate estimates. One angler reported catching 75 yellow perch, which proves, this data is very vulnerable to movement of the mean by extremes in catch. The inclusion of this one interview would result in an increase of 0.08 fish/angler-h in the yellow perch harvest and catch rate estimates.

In reference to membership with the Oneida Lake Association, many of the local anglers interviewed indicated that they were once members of the OLA, but simply had decided to not rejoin. On several occasions, these interviewees stated that they had not been prompted by the association to rejoin and thus did not feel inclined to expend the effort to find out the necessary information to renew their memberships. “this might be a good spot to talk about satisfaction with bureau. Citation: Connelly *et.al.* (1997).

In the cases of anglers being asked if they knew Oneida’s fishing regulations and then being prompted to recite them, there was a significant difference between anglers thinking that they knew the regulation and actually knowing the regulations for all species. This may be somewhat expected, as there was a recent change in walleye regulations (reduced minimum length limit in license year 2004-5).

It appeared that anglers opposed to the bass season regulation change were often fearful that an additional 6 weeks of targeted angling pressure would mean taking the fish off of spawning beds. Some of these individuals were anglers specifically targeting black bass. Yet other individuals targeting black bass were in favor of the prospect of an extended season because it would mean more time on the open water and they felt little harm would come to the fish if it were released. It is also important to keep in mind those anglers targeting black bass often stated that they practice catch and release tactics—meaning even if the fish they capture is not over the creel limit and surpasses the minimum length—they will release the fish anyway (a point plausible based on the discrepancy in catch and harvest rates for black bass).

Anglers opposed to the current regulation of selling of panfish without a commercial fishing permit often cited their reasoning to be a result of the yellow perch faced in previous years on Oneida Lake. Anglers in opposition feared that the current status of Yellow Perch were still facing fallout from earlier exploitation and would be glad to see this regulation rescinded. People that claimed to be in favor of the regulation said they

personally had sold panfish for profit and saw it as a benefit more than a negative action toward the fishery. In the instances where people had no opinion on the matter, reasoning was often times that the interviewees did not target species so the regulation had no effect on them. Based on these results, not only is the Oneida Lake fishery strong, but there is a high level of similarity between the roving and access point methods.

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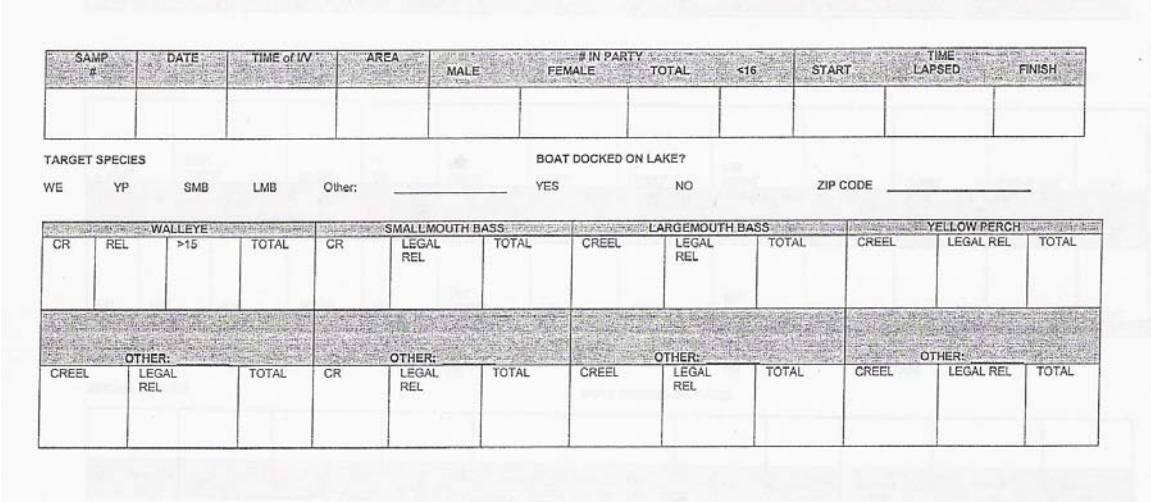
Appendix 1:



SAMP #	DATE	TIME of I/V	AREA	# IN PARTY MALE	FEMALE	TOTAL	<16	TIME START	LAPSED	FINISH

TARGET SPECIES WE YP SMB LMB Other: _____

BOAT DOCKED ON LAKE? YES NO

ZIP CODE _____

WALLEYE CR	REL	>15	TOTAL	SMALLMOUTH BASS CR	LEGAL REL	TOTAL	LARGEMOUTH BASS CREEL	LEGAL REL	TOTAL	YELLOW PERCH CREEL	LEGAL REL	TOTAL

OTHER: CREEL	LEGAL REL	TOTAL	OTHER: CR	LEGAL REL	TOTAL	OTHER: CREEL	LEGAL REL	TOTAL	OTHER: CREEL	LEGAL REL	TOTAL

Appendix 2:

How many years have you been fishing Oneida Lake?
How many days a year do you typically fish any water?
How many times a year do you typically Fish Oneida Lake during the open water season?
How many times a year do you ice fish Oneida Lake?
Are you a member of the Oneida Lake Association (OLA)?
On a scale of 1-5, with 5 being most satisfied, how would you rate your satisfaction with the management of Oneida Lake fisheries?

Would you mind if I ask you about your familiarity with fishing regulations on Oneida Lake? Our goals is to assess public awareness of Oneida Lake fishing regulations and I assure you your answers will be completely confidential.

Do you know what the walleye regulations are on Oneida Lake (minimum and creel)? – if they say yes get them to state it (Oneida regulation is 15 inch minimum, 3 fish a day creel. Statewide regulation is 15" minimum and 5 fish daily limit)
Do you know what the black bass regulations are on Oneida Lake (minimum and creel)? – if they say yes get them to state it (Oneida regulation is 12 inch minimum, 3 fish daily limit –same as statewide)
Do you know what the panfish (yellow perch and sunfish) regulations are on Oneida Lake (creel)? – if they say yes get them to state it (regulation is no minimum length –i.e., any size may be harvested and 50 fish daily creel limit—same as statewide)
Are you aware that black bass season will change this fall? (if say yes, what new season will be) former regulation was a closed season until 3rd Saturday in June, new season on Oneida will be catch and release season from opening of walleye season on 1st Saturday in May until traditional opening when harvest will be allowed. Statewide will be catch and release only from December 1 until traditional season opens)
Are you in favor of this change (yes/no)?
Are you aware that panfish caught using a recreational license can be sold for profit without any additional permits
Are you in favor of this change (yes/no)?
What is your most important source of information for finding out fishing regulations? (word of mouth, signs at lake, DEC syllabus, DEC webpage…)

Table 1. Comparison period walleye harvest and catch rate from roving and access point surveys.

Date	Roving harvest/ angler-h	Access harvest/ angler-h	Roving catch/ angler-h	Access catch/ angler-h
6/14/2006	0.13	0.029	0.19	0.12
6/15/2006	0.12	0.11	0.19	0.14
6/17/2006	0.15	0.022	0.24	0.09
6/30/2006	0.36	0	0.58	0
7/1/2006	0.22	0.17	0.24	0.34
7/3/2006	0.26	0.36	0.28	0.49
7/5/2006	0.12	0.16	0.47	0.24
7/16/2006	0.17	0.10	0.43	0.10
7/17/2006	0.22	0.12	0.33	0.16
7/21/2006	0.29	0.24	0.31	0.24
7/27/2006	0	0.20	0.05	0.34
7/29/2006	0.21	0	0.34	0
8/4/2006	0.06	0.39	0.17	0.82
8/7/2006	0.22	0.17	0.36	0.24
period mean	0.18	0.15	0.30	0.24

Table 2. Black bass harvest and catch rate from roving and access surveys.

Date	Roving harvest/ angler-h	Access harvest/ angler-h	Roving catch/ angler-h	Access catch/ angler-h
6/14/2006	0	0	0.33	0.11
6/15/2006	0	0	0.07	0.27
6/17/2006	0.10	0.10	0.23	0.38
6/30/2006	0	0	0.13	1.0
7/1/2006	0.01	0.01	0.31	0.21
7/3/2006	0	0	0.82	0.06
7/5/2006	0	0	0.86	0.15
7/16/2006	0.03	0.29	0.20	0.41
7/17/2006	0	0.04	0.22	0.26
7/21/2006	0.02	0	0.14	0.08
7/27/2006	0	0.08	0.47	0.08
7/29/2006	0	0	0.13	0.05
8/4/2006	0	0	0.17	0.19
8/7/2006	0.03	0	0.09	0.06
period mean	0.01	0.04	0.30	0.24

Table 3. Comparison period targeted and all trips harvest and catch rates for access point and roving surveys.

Survey Type	We h/e	We c/e	Bass h/e	Bass c/e	Yp h/e	Yp c/e
Access	0.18	0.31	0.08	0.40	1.17	1.19
Roving	0.23	0.38	0.05	0.82	0	0

Table 4: Yellow perch Harvest and Catch Rate Figures from Roving and Access Surveys

Date	yp h/e roving	yp h/e access	yp c/e roving	yp c/e access
6/14/2006	0	0	0	0.01948052
6/15/2006	0	0	0	0.0371134
6/17/2006	0.02017696	0	0.02017696	0.01534134
6/30/2006	0	0	0	0
7/1/2006	0.05479835	0.03487358	0.05479835	0.04359198
7/3/2006	0	0.03891892	0	0.05189189
7/5/2006	0	0.02493075	0.05698006	0.033241
7/16/2006	0	1.27298444	0	1.28995757
7/17/2006	0.01428571	0.05247813	0.01428571	0.06997085
7/21/2006	0	0.16107383	0	0.16107383
7/27/2006	0	0.02097902	0	0.03146853
7/29/2006	0.05882353	0	0.05882353	0
8/4/2006	0	0.0483871	0.01352814	0.0483871
8/7/2006	0.10109932	0.03726708	0.10109932	0.03726708
period mean	0.01779885	0.120849489	0.022835148	0.131341792

Table 5: Bass Season Regulation Change

Anglers' Sentiments Towards Bass Season Change

	Number of Individuals
In Favor	83
Opposed	38
No Opinion	38
Total Number Asked	159

Table 6: Current Panfish Regulation
Anglers' Sentiments Towards Current Panfish Regulation

	Number of Individuals
In Favor	66
Opposed	66
No Opinion	26
Total Number Asked	158