Harlem Meer and Central Park Lake Angler Creel Surveys, 2015
Final Report

Melissa K. Cohen
Regional Fisheries Manager

Jennifer H. Lee
Fish & Wildlife Technician

NYS Department of Environmental Conservation
Bureau of Fisheries
Region 2
47-40 21st Street
Long Island City, NY 11101

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ABSTRACT

Angler creel surveys using a modified version of the Roving Creel Survey were performed at Central Park Lake and the Harlem Meer between May 5 and October 31, 2015. Anglers at both lakes were counted and interviewed twice a day, four days a week, with the creel survey agent traveling by bicycle between the two waters. Since New York City and New York State fishing regulations require catch and release, catch rate was determined from angler-reported data. Catch rates and angling effort were estimated for each month and for weekdays versus weekend days. In addition to questions on fish species and numbers caught, anglers were questioned on bait and tackle used, angling satisfaction and awareness of fishing regulations and fishing-related issues.

Angler preferences differed between the two waters with over 70 percent of Central Park Lake anglers targeting carp and the majority of Harlem Meer anglers targeting any fish species. Preferences of anglers at both waters differ from those at Prospect Park Lake, Brooklyn, where over 50 percent target largemouth bass. Angling effort during the study period also differed markedly with that at Central Park Lake estimated to be 1,627 hours and that at the Meer estimated to be 19,980 hours. Catch rates were estimated as 0.43 fish/hour for any fish species at the Lake and 2.11 fish/hour for any fish species at the Meer. Central Park Lake targeted carp catch was reported to be 0.36 fish/hour; Harlem Meer targeted largemouth bass catch rate was reported as 0.61 fish/hr.

Most Central Park Lake anglers commented on lack of largemouth bass and requested stocking of this species. Results of this creel survey indicate stocking may be warranted but this should be confirmed through fisheries surveys. Most Harlem Meer anglers' comments concerned overgrowth of aquatic plants, an issue the Central Park Conservancy, along with other agencies, is actively addressing.

While, prior to this creel survey, fishing effort was presumed to be higher at the Harlem Meer than at Central Park Lake, the magnitude of this difference was unexpected. Angling effort at the Meer surpasses that at Prospect Park Lake, considered by many NYC anglers to be the best freshwater fishing location in NYC. The high angling effort at the Harlem Meer is likely due to the free fishing program administered by the Central Park Conservancy as well as the high catch rates afforded by this water's healthy fisheries populations. When considering locations to recruit new anglers the Harlem Meer should be a primary consideration.

INTRODUCTION

Central Park encompasses 843 acres in Manhattan and is bordered north and south by 110th and 59th Streets, and east and west by Fifth and Eighth (Central Park West) Avenues. Designed by Frederick Law Olmsted and Calvert Vaux, most of Central Park was constructed between 1858 and 1873 and includes several water bodies and water courses, two skating rinks - one of which is an outdoor swimming pool during summer months – several hundred acres of woodlands, lawns and paths, a nature sanctuary, a zoo, approximately forty bridges and arches including several iconic bridges, and numerous monuments. It is heavily used by both New York City residents and non-residents, receiving an estimated 37 – 38 million visits per year (CPC, 2011). According to CPC's 2011 user survey, the majority of visitors are composed of walkers, wanderers and sight-seers. Other significant uses of the park are exercise, dog walking and nature study/appreciation; the latter group includes bird-watchers (CPC, 2011). The Park is part of New York City's Department of Parks and Recreation but is managed by the Central Park Conservancy (CPC).

Central Park Lake (Figure 1a) and the Harlem Meer (Figure 1b) are two of the largest and most angling-significant waters in Central Park. While close in distance (approximately two miles), they differ in several ways. Located at 72nd Street on Manhattan's Upper West Side, Central Park Lake (the Lake) was created when the Saw Kill Stream was dammed during construction of the park and has a sinuous, mostly-vegetated, shoreline (Kadinsky, 2016). The Lake receives more visits from non-New Yorkers than does the Harlem Meer (the Meer) and, during warmer weather, hosts row boats rented through an outside vendor. The Meer is situated in what was originally a wetland connected to both the East and Hudson Rivers and is now a 10-acre freshwater pond in the northeast corner of Central Park at 110th Street and Fifth Avenue. The Meer is a popular angling location and CPC offers a free fishing program there, providing bamboo fishing rods with corn kernels for bait. In 2015, 5,334 people fished through this program (CPC, personal communication, 2017).

New York State (NYS) and New York City (NYC) fishing regulations require catch and immediate release of fish, in both the Lake and the Meer. Northern snakeheads (*Channa argus*) are excluded from NYS regulations: any snakeheads caught must be reported to the NYS Department of Environmental Conservation (DEC) and the fish may not be returned to the water. NYC additionally requires the use of barbless hooks and prohibits setting traps, fishing from boats, and wading.

Within the past ten years, DEC has performed two electrofishing surveys of the lake and five of the Meer. The lower number of surveys at the Lake is due to lack of boat launch options. Fish species found in the Lake during these surveys were golden shiner (*Notemigonus crysoleucas*), brown bullhead (*Ameiurus nebulosus*), common carp (*Cyprinus carpio*), pumpkinseed (*Lepomis gibbosus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*) and yellow perch (*Perca flavescens*). Fish species found in the Meer during electrofishing surveys were goldfish (*Carassius auratus*), common carp, grass carp (*Ctenopharyngodon idella*), golden shiner, brown bullhead, green sunfish (*Lepomis cyanellus*), pumpkinseed, bluegill, largemouth bass, black crappie and yellow perch. One northern snakehead was captured during a 2008 survey of the Meer but none were found in subsequent surveys. In 2012 an angler reported a northern snakehead catch from the Meer; none have been reported since.

Prior to this survey the amount of fishing pressure on Central Park waters was unknown but effort was assumed to be greater at the Meer than at the Lake based on observations and contact with CPC and anglers themselves. A Central Park user survey conducted by CPC estimated 40,406 fishing trips took place within the park between July 2008 and May 2009 but this is a combined figure for all waters of the park and catch rate data is not included (CPC 2011). DEC has performed two creel surveys of NYC freshwaters – both at Prospect Park Lake, in 2001 and 2014 (VanMaaren 2003; Cohen and Binns 2016). At the time those reports were written, estimated fishing effort could only be compared to waters outside NYC with the most similar waters determined to be on Long Island. With this creel survey, we can begin to form a larger assessment of NYC's most fished waters.

Assessing angler use of aquatic resources in NYC is not critical for setting fishing regulations since these are catch and release. The importance of assessing angler use of Central Park and other NYC freshwaters is in providing recreational anglers a voice among the multitude of park user groups, some of which may compete with anglers resulting in conflicts requiring management actions. Since creel surveys also assess species targeted and caught, and angler opinions and knowledge of fishing-related issues, we can better understand and, consequently, better serve our anglers.

Objectives

1. Estimate angler effort and catch rate of all fish species, with an emphasis on largemouth bass, at Central Park Lake and the Harlem Meer between May 5th and October 31st, 2015.

2. Determine angler characteristics, opinions and knowledge of fishing-related issues, rules and regulations.

METHODS

Anglers at the Harlem Meer and Central Park Lake were counted and interviewed between May 5th and November 6th, 2015. During this survey period a DEC Fish & Wildlife Technician (creel agent) surveyed shorelines every weekend day and two randomly selected weekdays for a total of four survey days per week with the exception of three days due to scheduling conflicts: a Saturday and Sunday in July and a Saturday in mid-October. Four possible survey schedules were constructed to allow for two counts and two interview sessions, per lake, each day (Figure 2). Counts and interviews were conducted during either an AM (0700-1500 hours) or PM (1100-1900 hours) shift. Each daily shift included four counts, two per lake; each count consisted of walking the lake perimeter in 30 minutes while counting anglers only as they were passed. Depending on the schedule, angler interviews were conducted the hour before or after the counts. This schedule design resulted in a total of sixteen different count times, depending on AM/PM shift, lake, and count/interview order. All randomizations for schedule assignment and AM/PM shift were determined using the RANDBETWEEN function in Microsoft Excel.

The above-described angler survey schedule is a modified version of the Roving Creel Survey method described in Pollock et al (1997) and allows for two counts and two interview sessions per lake per day. The survey schedule began with either a 30-minute count or one-hour interview session at the first lake, followed by 30 minutes of travel (by bicycle) to the second lake. 1.5 hours were allotted for counts and interviews at the second lake, in the same order as at the first lake. After a break, the creel agent performed counts and interviews, in the same order as earlier in the day, then traveled back to the first lake for a final count and interview session. Anglers were counted only as they were passed to produce a near instantaneous count. Since the perimeter of each lake could be covered within 30 minutes, randomization of starting point was not necessary as suggested in the Roving-Roving creel survey design (Pollock et al, 1997). Depending on the survey schedule, the agent interviewed anglers either before or after the count, reading the questionnaire and filling in responses (Appendix A).

Total number of interviews performed at the Lake was 137; data was used from 120 of these since fishing trips lasting less than thirty minutes were excluded. Total number of interviews performed at the Meer was 928 with 731 used after exclusion of trips lasting less than thirty minutes.

The information obtained during angler interviews included start time of fishing trip, time of interview, fish species targeted and caught, and bait and tackle used. Anglers were also asked if they were aware of fishing regulations and programs offered by the DEC and CPC. Demographic information such as age, sex, hometown/neighborhood, and ethnicity was also requested. The questionnaire was available in English and Spanish but the latter version was rarely necessary. A language barrier between the creel agent and Asian anglers prevented a few surveys. Some anglers were interviewed only once and requested not to be bothered again during the survey period. These anglers were included in angler counts as were anglers whose limited English-speaking prevented their being interviewed. Fishing trip and demographic information were collected during each interview but knowledge of regulations and fishing programs were only obtained during the initial interview. Interviews were conducted in the hour allotted; any anglers remaining into the next interview session were not included in the second

session to avoid recounting their catches. These anglers were, however, included in the instantaneous counts for calculation of fishing effort.

To maintain angler anonymity each questionnaire was labeled with a unique Angler ID composed of the date, survey shift time and interview number for that shift. For example, 0505201507-01 denotes a May 5th survey time period of 0700 hours, first angler survey of that time period. In an attempt to collect complete fishing trip information, pre-stamped and addressed postcards were offered to anglers willing to report the end time of their fishing trip and total daily catch of fish (Appendix B). Return rate was too low, however (one from a Central Park Lake angler, 30 from Harlem Meer anglers) to include this information.

Data analysis

All catch data was reported by anglers, rather than observed by the creel agent, as NYC and NYS regulations prevent harvesting fish.

Angler daily effort was calculated by multiplying the average of all instantaneous counts in a day by the average daylight hours for that month. Largemouth bass angling effort was calculated by multiplying total effort by the percentage of anglers interviewed who said they were targeting largemouth bass. Common carp angling effort was calculated for Central Park Lake anglers because a large majority (73%) of anglers interviewed there were targeting common carp.

Largemouth bass catch by Harlem Meer anglers targeting that species was estimated for weekday and weekend strata (Table 7b). Number of all fish and common carp caught at Central Park Lake were estimated for monthly strata (Table 8a) and number of all fish and largemouth bass caught at the Harlem Meer were also estimated for monthly strata (Table 8b).

Daily effort was estimated using the equation:

$$e_i = I_i \times T_m$$

Where I_i is the average of instantaneous counts for each survey day and T_m is daily fishable hours corrected for each month.

Weekday and weekend fishing effort were estimated using the following equations:

$$\hat{E}_1 = N_1 \bar{e}_1$$

$$\hat{E}_2 = N_2 \bar{e}_2$$

Where $\hat{E}_x$ is total effort for the survey period for each stratum (weekend vs weekday), N_x is the number of days per stratum and $\bar{e}_x$ is the average daily effort for that stratum.

Overall effort was calculated using the following:

$$\hat{E} = \hat{E}_1 + \hat{E}_2$$

Catch rates were determined using the mean of the ratios methods, which is appropriate when using incomplete trip information from a roving creel survey (Pollock et al, 1994). Catch reports

from interviews and total fishing hours in a trip were used to determine individual catch rates which were averaged among anglers in a day to estimate daily catch rates. Incomplete trips less than 30 minutes were not included as per recommendations by Pollock et al. (1997). Total catch of all fish, largemouth bass and common carp were calculated by multiplying total fishing effort (hours) by catch rates (fish/hour). Largemouth bass and common carp catch rates were determined using fishing trip information from only those anglers targeting those species.

The mean of ratios estimator used was:

$$\hat{R} = \frac{1}{n}\sum_{j=1}^{n}\frac{C_j}{L_j}$$

Where C_j was the incomplete catch reported by the jth angler and L_j was the incomplete trip length of the jth angler.

RESULTS

Angling Effort: Angler effort was estimated to be 1,627 hours for the Lake and 19,980.5 hours for the Meer during 100 days of angler counts between May 5th and October 31st, 2015. Average overall angler effort per month was estimated to be 271.16 hours (standard error = 26) for the Lake and 3,330.9 hours (standard error = 440) for the Meer (Tables 1a & 1b). Overall, 61% of fishing effort at the Lake and 67% fishing effort at the Meer occurred during weekdays. Weekday versus weekend fishing effort at the Lake varied throughout the study period whereas, on a monthly basis, fishing effort at the Meer was consistently higher on weekdays than on weekends (Tables 1a & 1b, Figures 3a & 3b). Highest monthly fishing effort at the Lake occurred during May whereas highest monthly fishing effort at the Meer occurred during July.

Overall effort for Lake anglers targeting carp was 1,245 hours, which was approximately 77% of total angler effort for that water. Total weekend effort for carp at the Lake (519.41) was approximately two-thirds of that for weekdays (725.64). Overall angler effort for Meer anglers targeting largemouth bass was 6,993 hours, approximately 35% of total angler effort for that water. Total weekday effort for largemouth bass at the Meer (4,788.99) was over twice as great as total weekend effort (2,204.05).

Average instantaneous angler counts indicate most fishing effort at the Meer occurs after 11:00 am, during both weekdays and weekends (Figures 4a & 4b). Fishing effort at the Lake also appears to occur later in the day although not to the same degree as at the Meer. Total number of anglers counted at the Lake was 797 and total number of anglers counted at the Meer was 1,611.

Species Targeted: The majority of the 120 anglers interviewed at the Lake were targeting common carp (73%); 28% were targeting largemouth bass and 18% were targeting any fish species. Most of the 732 anglers interviewed at the Meer (64%) were targeting any fish species and 36% were targeting largemouth bass (Table 2). One of the two anglers at the Lake targeting "other" fish species was targeting pickerel, the other was targeting northern snakeheads. Similarly, one of the two anglers at the Meer targeting "other" fish species was targeting smallmouth bass (*Micropterus dolomieu*) while the other was targeting northern snakeheads.

Catch Rates: Catch rates for anglers targeting all fish species were highest in May at the Lake and highest in June at the Meer (although catch rate at the Meer was also high in October) (Table 4, Figures 5 and 6). Common carp catch rate for anglers targeting carp at the Lake was highest in October with a second highest catch rate in May (Table 5, Figure 5). Only one largemouth bass angler at the Lake reportedly caught a largemouth bass, resulting in a catch rate of 0.004 fish/hour. Largemouth bass catch rate for Meer anglers was, like the all fish species catch rate, highest in June (Table 5, Figure 6).

Overall catch for the Lake was estimated to be 700 fish (Table 6a) and that for the Meer was estimated to be 39,162 fish (Table 6b). Total common carp catch at the Lake was estimated to be 461 fish with 385 fish caught on weekdays and 156 fish caught on weekends (Table 7a). Total largemouth bass catch at the Meer was estimated to be 4,601 fish with 2,969 fish caught on weekdays and 1,146 fish caught on weekends (Table 7b). Monthly catch estimates for each water are shown in Tables 8a and 8b.

Demographics/angling gear: Most Central Park Lake anglers were male (96%). Most Harlem Meer anglers also were male but the percentage (86%) was lower than that at the Lake.

More than half of Central Park Lake anglers were less than 30 years old, approximately 25% were less than nineteen years old. The percentage of Harlem Meer anglers less than nineteen was higher (34%) (Table 9).

Almost 70% of Central Park Lake anglers and 67% of Harlem Meer anglers were from the borough of Manhattan. Forty-four percent of anglers at the Lake and 78% of Meer anglers lived within one mile of Central Park. Visitors from other states and countries composed just under 9% of anglers at Central Park Lake and just over 5% of Harlem Meer anglers. Angler distribution by zip code shows those fishing the Lake were primarily from zip codes near that water body. Similarly, most of those fishing the Meer had zip codes near to that water body (Figures 7 and 8).

Half the Central Park Lake anglers were Caucasian (50%) and nearly one-fifth African American (19%), with Asian (18%) and Latino (12%) populations in slightly lower percentages (Table 10). Nearly half the Harlem Meer anglers were African American. Approximately one-fifth of the remaining anglers were Caucasian (23%) and one-fifth Latino (20%), with smaller percentages of Asian and Middle Eastern (Table 10).

Spinning rods were the type most used at both waters with higher percentage of Central Park Lake anglers using these than Harlem Meer anglers (Table 11). Bamboo fishing rods with line composed 15% of the types used by Meer anglers due to CPC's free fishing program (Table 11). Most surveyed Central Park Lake anglers (72%) used natural baits and a large portion of this (74%) was bread/dough (Table 12). Natural baits were used more than artificial at the Meer also, although not to as high a degree (Table 12). Corn bait was used more at the Meer most likely because corn is provided by CPC through their free fishing program.

Angler awareness/comments: Most Central Park Lake (86%) and Harlem Meer (69%) anglers were aware of CPC's attempts to encourage safe disposal of fishing line and tackle. Much lower percentages had heard of biodegradable fishing lures, 32% and 20% for the Lake and Meer, respectively. Just under half (47%) of Lake anglers were aware DEC performs fisheries surveys of Central Park waters and 30% of Meer anglers were aware (Table 13). Most said they would be willing to participate in a smartphone-based angler diary program and more knew of the CPC's free fishing programs than knew of DEC's free fishing clinics. Most knew of the fishing license requirement although the percentage was substantially lower at the Meer (Table 13). Nearly all anglers at both waters knew catch and release regulations are in place. Most anglers at both lakes had fished outside of New York City with more at the Lake (93%) than the Meer (72%) (Table 13).

The most common comment received from Central Park Lake anglers was a request to stock fish, with largemouth bass named as the species most desired to be stocked (Table 14a). Requests to improve fishing access and water quality/algae issues were other common comments (14a). Water quality/algae issues received the largest number of comments from Harlem Meer anglers with fish stocking receiving the second largest number of comments (Table 14b). The third largest amount of comments from Meer anglers concerned the free fishing program administered by CPC. Included in these were requests for more bait choices, smaller hooks, bobbers, and rods with reels as well as positive comments commending CPC for this free program. Manipulation of fish habitat (including dredging) received similar percentages of comments from anglers at both water bodies. Just over half (58%) of Central Park Lake anglers and three-quarters (75%) of Harlem Meer anglers were satisfied or very satisfied with

their fishing experiences (Table 15). Concomitantly, more anglers at the Lake expressed dissatisfaction (7%) with their fishing experiences than did Meer anglers (3%) (Table 15).

DISCUSSION

Angler Effort

During the survey period, fishing effort at the Harlem Meer (19,980.5 hours) was found to be over twelve times that at Central Park Lake (1,627 hours). On a per acre basis, fishing effort at the Meer was 22 times greater than that at the Lake and nearly seven times, or 3,220 hours, more than that found for Prospect Park Lake in 2014 (Cohen and Binns 2016). One reason for the higher fishing effort at the Meer is due to the popular free fishing program offered through CPC in which 5,334 people participated in 2015. Another reason for the greater Meer fishing effort could be fishing access. Nearly the entire shoreline of the Meer is accessible to fishing whereas fishing access at the Lake is limited due to plantings, structures and potential interference from the large number of non-angling park visitors. Almost 20% of Central Park Lake anglers surveyed during this study thought fishing access should be improved whereas only nine percent of Harlem Meer angler comments concerned fishing access.

Most effort occurred during weekdays at both waters with overall weekday fishing effort at the Meer nearly twice as high as weekend day effort. Weekday effort was also higher than weekend day effort at the Lake although not to as great a degree. These results are similar to results of the Prospect Park Lake creel survey which also found more fishing effort on weekdays. The high monthly fishing effort in July at the Meer is due to the Central Park Conservancy's free fishing program - the greatest number of youth groups fishing were encountered during July. A harmful algal bloom (HAB) the first week in August prompted cancelation of the free fishing program for the remainder of the fishing season and may have discouraged other Meer anglers since monthly fishing effort dropped by over 60% from July to August. It is not known why weekend angler effort at the Lake was zero for every July weekend day. The creel agent missed July 11th and 12th but the weather was either clear or overcast for the remaining six July weekend days. Effort on July weekdays suggests the cause was not algal blooms. Potential causes for lack of weekend effort are that anglers left NYC during those weekends or perhaps avoided the Lake due to increased tourist activity on those dates, although effort was not low on August's weekend days.

Species targeted and catch rates

Species targeted by anglers differed between the two waters as well as from Prospect Park Lake. Almost three-quarters of Central Park Lake anglers surveyed targeted common carp. Limited DEC electrofishing data supports the possibility that carp numbers are higher in the Lake than in the Meer. Most Meer anglers (64%) were targeting "any" fish species and 36% were targeting largemouth bass compared with 28% of Lake anglers who targeted largemouth bass (some of these anglers were also targeting carp). Percentage of anglers targeting largemouth bass at both waters was less than that at Prospect Park Lake (57%). Two interviewed anglers, one at each of the waters, were targeting northern snakeheads.

Targeted carp catch rates at the Lake were highest in October and May. Lower carp catch rates during summer months could partially be due to a HAB which occurred throughout the summer of 2015 but CPC data indicates the HAB at the Lake persisted throughout October. Despite targeted carp catch rate at the Lake being 0.36 carp/hr, 23% of Lake anglers surveyed requested carp stocking. Alternatively, one angler noted there were too many carp in the Lake and requested the stocking of largemouth bass. Other anglers also requested the stocking of

largemouth bass and smallmouth bass, not surprising since the targeted catch rate of largemouth bass at the Lake was 0.004 fish/hour.

Largemouth bass catch rates from DEC electrofishing surveys of the Lake in 2009 and 2010 were relatively low although fish with lengths between 12 and 15 inches were seen in greater numbers compared with other New York City lakes and ponds. Largemouth bass between eight and twelve inches were not captured during the 2009 survey and only a few fish within this length range were captured during the 2010 survey. DEC Fisheries has not surveyed the Lake since 2010; the next electrofishing survey of the Lake (scheduled for May 2017) will help assess the current status of the fish populations.

Angler catch rate for all fish species at the Harlem Meer was high (2.11 fish/hour) compared with that for the Lake (0.43 fish/hour), and was greater than twice the catch rate for Prospect Park Lake (0.94 fish/hour). Overall largemouth bass targeted catch rate (0.61 fish/hour) was slightly higher than that for Prospect Park Lake (0.57 fish/hour) and, in June, was nearly twice that for Prospect Park Lake (0.95 fish/hour). Lower largemouth bass catch rates in July, August and September could be due to algal blooms which discouraged anglers. All fish catch rates were also lower during these months but were relatively high compared with other waters; cancelation of CPC's free fishing program the first week in August due to algal blooms likely contributed to lower catch rates. Despite this, the estimated overall number of fish caught at the Meer during the study period was 2.5 times greater than the Prospect Park Lake estimate (Table 16).

DEC electrofishing data for the Meer compares well with high catch rates: data from 2013 and 2015 surveys yielded the second highest catch rates for bluegills and largemouth bass of any NYC water body surveyed. Catch rates from this creel survey support this as do catch rates from DEC's fishing clinics: NYC school students who fish at the Meer with the DEC I FISH NY program catch more fish than students at any other waterbody fished in the program. This has been the case for four consecutive years with nearly every participating student catching at least one fish.

Demographics

Most (96%) Central Park Lake anglers were male at a proportion similar to anglers at Prospect Park Lake (98%). Most Harlem Meer anglers were also male although at a lower percentage (86%) than Central and Prospect Park Lakes. The lower percentage of male anglers is due to mixed-gender youth groups participating in CPC's free fishing program. Another demographic attributable to CPC's fishing program is the higher percentage (34%) of anglers less than nineteen years of age. This is greater than the same percentage of Central Park Lake anglers less than nineteen years old (25%) and much greater than this percentage of anglers at Prospect Park Lake (8%).

Angler ethnic compositions also differed between the two waters and were reflective of surrounding neighborhoods (US Census Bureau, 2010 data). Anglers at both waters tended to be from the immediate surrounding neighborhoods despite the Lake and the Meer being within two miles of each other, suggesting anglers tend to fish near the water body closest to home. NYC angler creel surveys performed by DEC Bureau of Fisheries in 1978 & 1979 found 70% of anglers resided in the same neighborhood of the pond in which they fished (Lange, 1984). This may, at least partially, be due to lack of dependency on vehicles in these areas of Manhattan. This tendency might be worth noting when developing fishing promotion programs.

Comments/awareness

The majority of anglers at both the Lake and Meer were aware fishing is catch-and-release, only; significantly less were aware of the fishing license requirement (69% at the Lake, 58% at the Meer), indicating DEC could do more to inform the public of this requirement. CPC's effectiveness at reaching the public was apparent, as most anglers (at both waters) were aware that CPC has taken measures to reduce harm to wildlife from fishing line and tackle. Most were aware of the free fishing program offered by CPC with some having participated. More Lake than Meer anglers were aware of DEC fisheries surveys, despite DEC Fisheries having done twice as many surveys at the Meer than the Lake.

The comment heard most by Central Park Lake anglers regarded stocking fish. Future electrofishing surveys will help determine ecological status of the fish populations of this lake and guide management strategies. CPC may be amenable to stocking largemouth bass if this was an ecologically sound improvement to the fishery. Anglers also wanted better fishing access. Central Park Lake access is limited but the number of non-angling individuals is high in and around the Lake. Increased fishing access would need to be well-planned to avoid provocation of conflicts between anglers and non-anglers. The third most common comment from Central Park Lake anglers concerned water quality, specifically, the overabundant algae. City-wide HAB problems have been discussed regularly by representatives from different agencies (including DEC) and universities and it is hoped potential effective solutions will be generated and implemented in spring and summer, 2017.

The number one comment from Harlem Meer anglers concerned water quality and algae. The Meer regularly experiences HAB's but duckweed and curly leaf pondweed proliferate in the summer and interfere with angling. The second most common comment from Harlem Meer anglers concerned stocking fish but DEC's fisheries data and angler catch rates indicate this is not warranted. Comments on CPC's free fishing program and the number of participants indicates this program is popular and appreciated. This program could potentially serve as a model for other parks with fishable waters as fishing and other outdoor activities such as bird-watching and walking on park trails offer outdoor experiences unique for many NYC residents. Not all residents feel comfortable enough to begin such activities on their own, therefore facilitators, such as those at CPC, offer a valuable service. These types of programs promote public appreciation of natural resources, which may result in more advocacy for, and protection of, these resources. Because of this, such programs should be supported.

Conclusions and Management Recommendations

1. Because Central Park anglers primarily fished at the water closest to their home, fishing should be promoted in the nearest possible locations to where people live to maximize success.
2. While the majority of Central Park Lake anglers target common carp, the largest number of comments received regarded the desire to stock largemouth bass. DEC will perform a fisheries survey in 2017 to assess the status of the population to determine if low angler catch rates reflect its current state. Results of the survey will be used to develop management strategies to improve the fishery.
3. Work with CPC to improve fishing access at Central Park Lake if consistent with CPC's objectives and concerns.
4. Overgrowth of aquatic plants and harmful algal blooms negatively affect fishing. Efforts to ameliorate blooms should be explored and implemented, if possible.

5. With a high catch rate of fish the Harlem Meer should be recommended as a location to bring beginning anglers and to hold public fishing events.
6. Since CPC is effective at reaching anglers within Central Park, DEC Fisheries should work with that agency if fishing-related information needs to be communicated to anglers.
7. DEC should work with CPC to promote the high largemouth bass catch rate at the Harlem Meer and publicize the most current fishery information. This information should also be made available through the public DEC website. The Meer should be surveyed every three to five years to provide the most accurate information to anglers.
8. Similar to Prospect Park Lake's angler demographics, the large majority of anglers at both Central Park Lake and the Harlem Meer were male. Fishing promotion should target females where possible.

Acknowledgements

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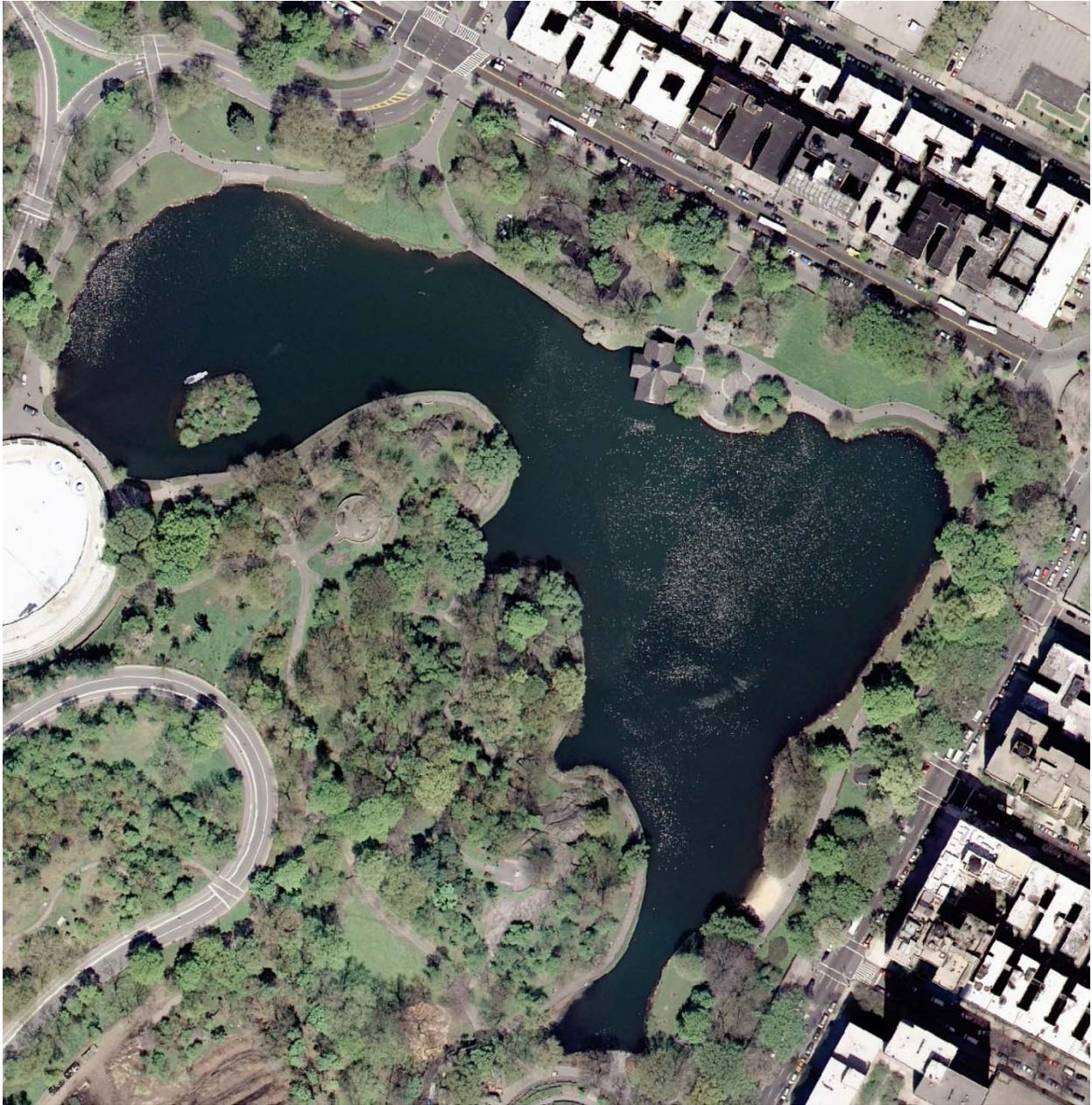

Figure 1a. Central Park Lake

Figure 1b. The Harlem Meer

SANDWICH SCHEDULE: (4 Counts, 4 Interviews/Day)				
DURATION	AM	PM	LAKE (CYCLE A)	LAKE (CYCLE B)
:30	7:00	11:00	Meer Count	Lake Count
1:00	7:30	11:30	Meer Interview	Lake Interview
	8:00	12:00		
:30	8:30	12:30	Travel	Travel
:30	9:00	1:00	Lake Count	Meer Count
1:00	9:30	1:30	Lake Interview	Meer Interview
	10:00	2:00		
1:00	10:30	2:30	Lunch	Lunch
	11:00	3:00		
:30	11:30	3:30	Lake Count	Meer Count
1:00	12:00	4:00	Lake Interview	Meer Interview
	12:30	4:30		
:30	1:00	5:00	Travel	Travel
:30	1:30	5:30	Meer Count	Lake Count
1:00	2:00	6:00	Meer Interview	Lake Interview
	2:30	6:30		
	3:00	7:00	END	END

OPEN SANDWICH SCHEDULE: (4 Counts, 4 Interviews/Day)				
DURATION	AM	PM	LAKE (CYCLE C)	LAKE (CYCLE D)
1:00	7:00	11:00	Meer Interview	Lake Interview
	7:30	11:30		
:30	8:00	12:00	Meer Count	Lake Count
:30	8:30	12:30	Travel	Travel
1:00	9:00	1:00	Lake Interview	Meer Interview
	9:30	1:30		
:30	10:00	2:00	Lake Count	Meer Count
1:00	10:30	2:30	Lunch	Lunch
	11:00	3:00		
1:00	11:30	3:30	Lake Interview	Meer Interview
	12:00	4:00		
:30	12:30	4:30	Lake Count	Meer Count
:30	1:00	5:00	Travel	Travel
1:00	1:30	5:30	Meer Interview	Lake Interview
	2:00	6:00		
:30	2:30	6:30	Meer Count	Lake Count
	3:00	7:00	END	END

Figure 2. Survey schedules followed by creel agent
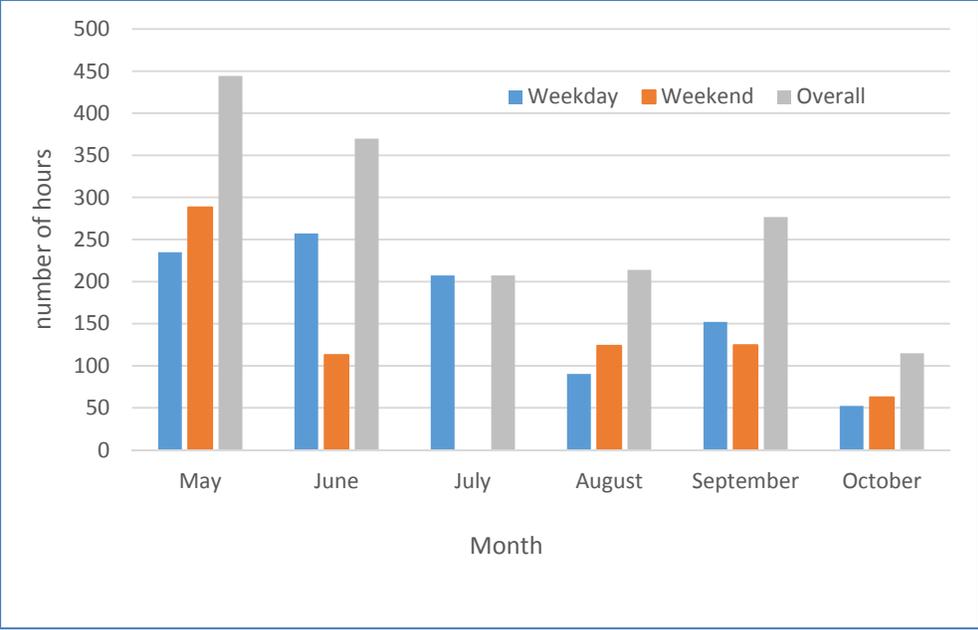
Figure 3a. Estimated monthly angling effort at Central Park Lake
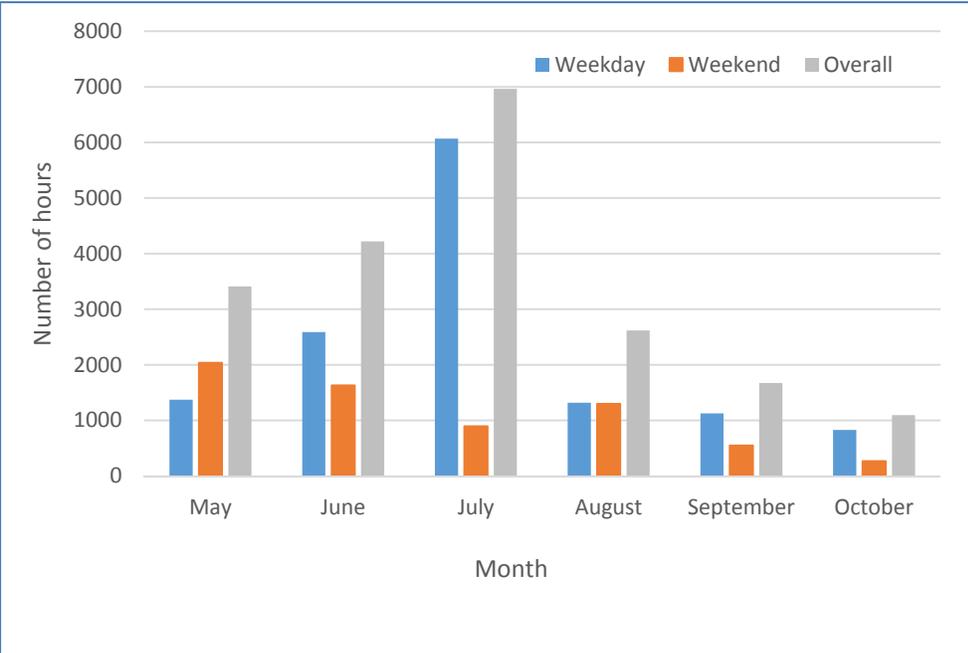
Figure 3b. Estimated monthly angling effort at the Harlem Meer
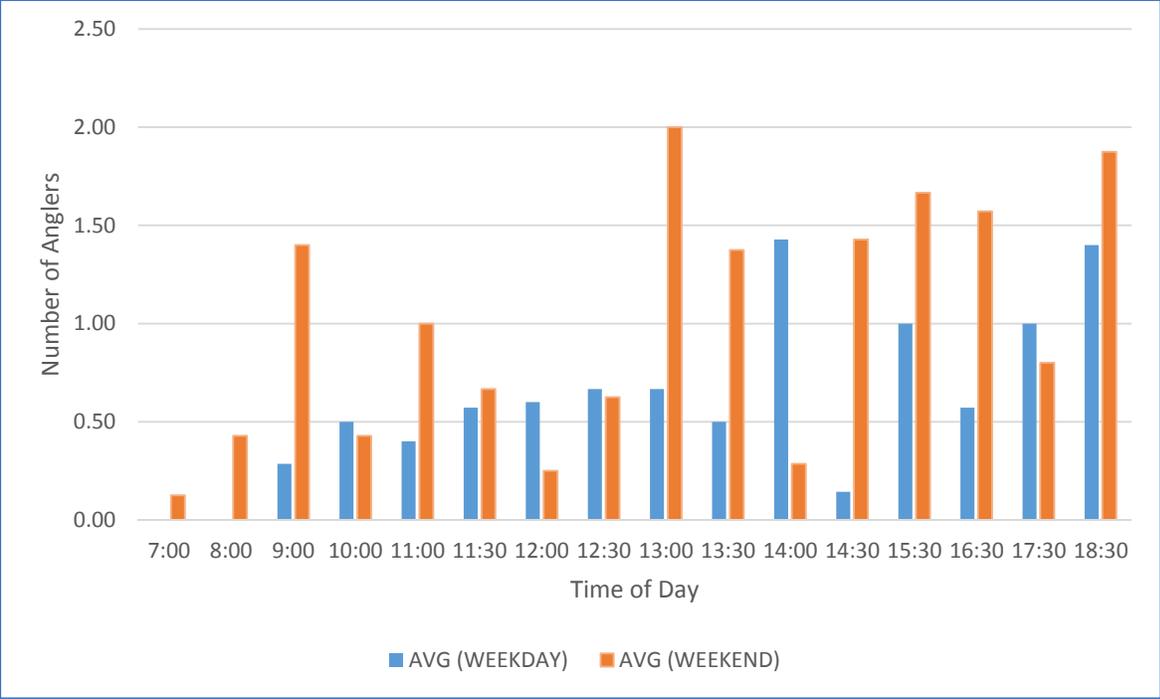
Figure 4a. Central Park Lake Instantaneous Counts
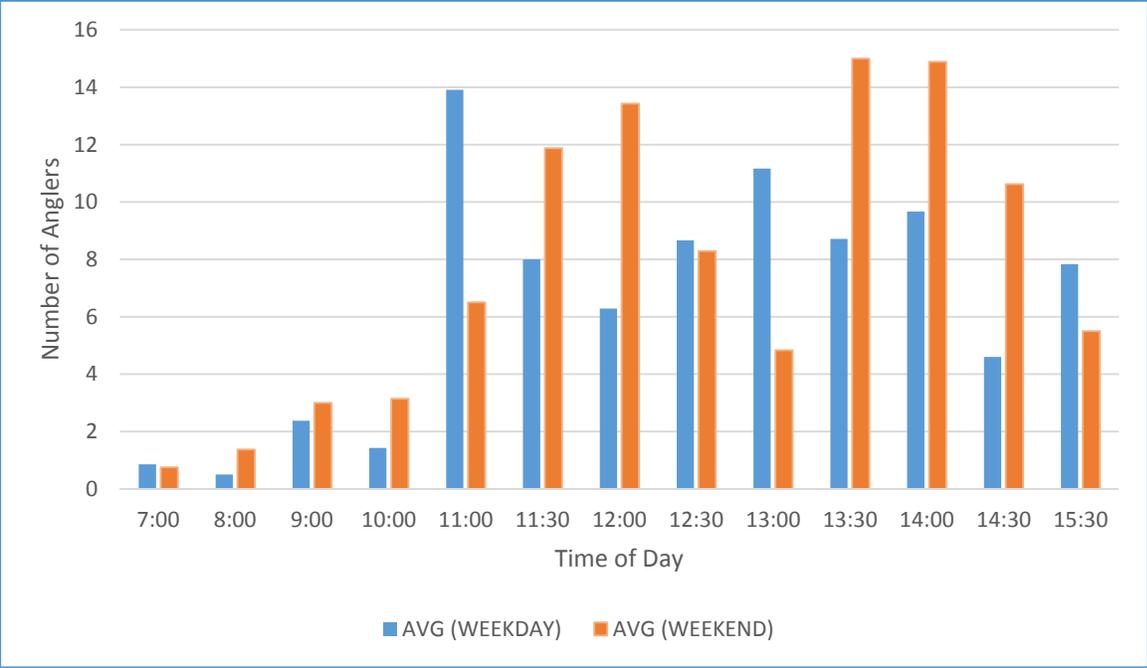
Figure 4b. Harlem Meer Instantaneous Counts
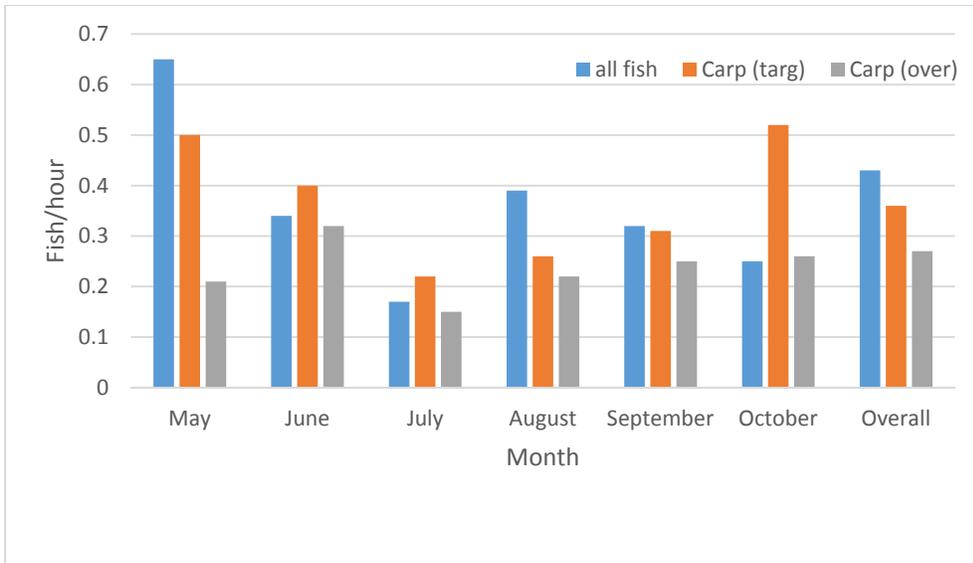
Figure 5. Catch rates for all fish species and carp (as targeted by carp anglers) at Central Park Lake. Anglers interviewed: 5/5/2015 – 10/31/2015.
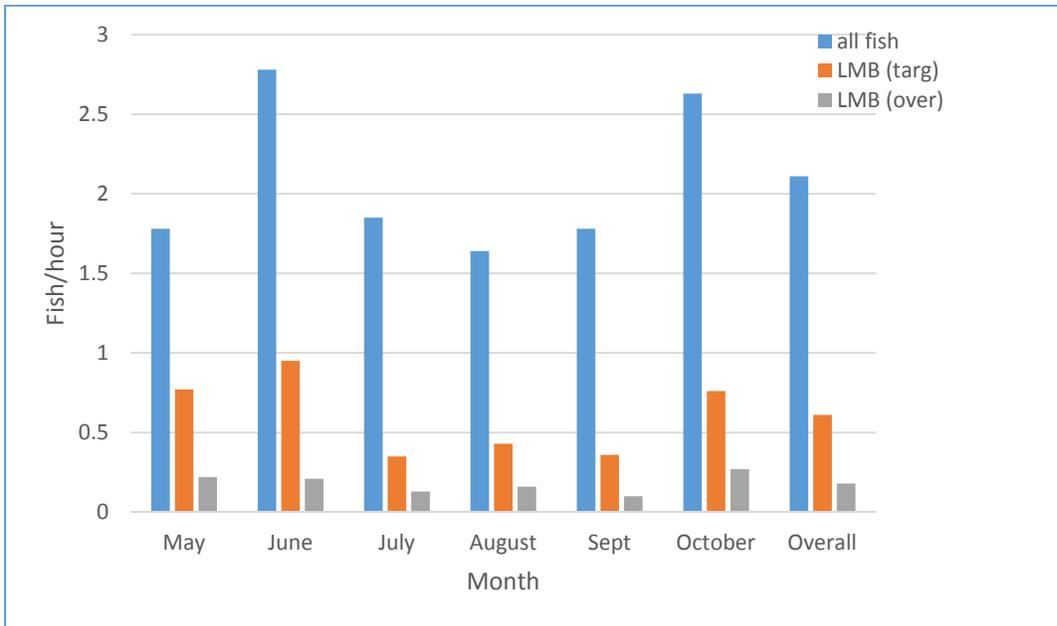
Figure 6. Catch rates for all fish species and largemouth bass (targeted and overall) at the Harlem Meer. Anglers interviewed: 5/5/2015 - 10/31/2015.
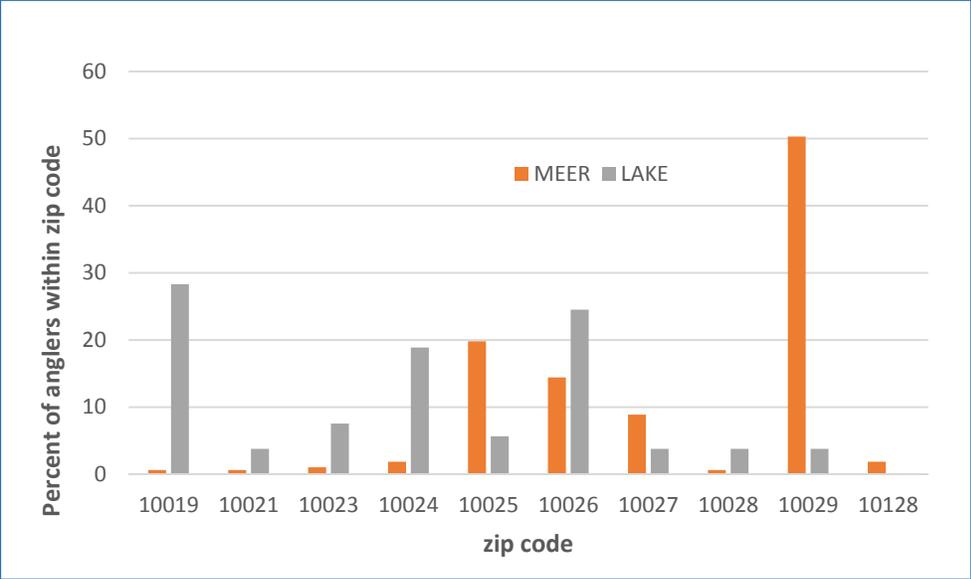
Figure 7. Manhattan-based anglers by zip code. Percentages are of anglers per water body

Figure 8. Zip code distribution around Central Park

Tables

Table 1a. Monthly estimated angler effort (hours) at Central Park Lake in 2015. Standard errors in parentheses.

Month	Weekday	Weekend	Overall
May	234.81 (3.03)	288.10 (7.59)	444.34 (4.37)
June	257.18 (3.98)	112.73 (5.58)	369.91 (3.27)
July	207.32 (4.22)	0.0	207.32 (2.74)
August	90.23 (1.81)	123.75 (3.94)	213.98 (2.47)
September	152.17 (2.42)	124.50 (4.08)	276.67 (2.48)
October	52.33 (1.34)	62.44 (1.39)	114.77 (1.05)
Average	165.67 (33.5)	118.59 (39.2)	271.16 (26)
Total	994.04 (1.3)	711.51 (2.1)	1626.98 (1.2)

Table 1b. Monthly estimated angler effort (hours) at the Harlem Meer in 2015. Standard errors in parentheses.

Month	Weekday	Weekend	Overall
May	1372.75 (11.98)	1481.13 (31.40)	3409.30 (88.13)
June	2590.17 (28.75)	1630.76 (21.79)	4220.93 (20.79)
July	6068.81 (47.52)	894.83 (35.08)	6963.64 (36.69)
August	1317.42 (10.75)	1299.38 (17.50)	2616.80 (13.30)
September	1126.03 (7.68)	547.80 (13.46)	1673.83 (7.59)
October	827.57 (9.69)	268.48 (8.05)	1096.05 (6.26)
Average	2217.12 (808.7)	1020.39 (273)	3330.09 (440)
Total	13302.75 (14.6)	6677.79 (12.2)	19980.54 (9.6)

Table 2. Anglers' fish targeting preferences at the Lake and Meer during 2015.

Fish Species	Number of anglers targeting a fish species at the Lake (%)	Number of anglers targeting a fish species at the Meer (%)
Any	21 (18)	468 (64)
Bluegill	2 (1.7)	41 (6)
Carp	87 (73)	5 (0.68)
Catfish	18 (15)	8 (1.1)
Largemouth bass	34 (28)	262 (36)
Other	2 (1.7)	2 (0.27)
Pumpkinseed	0	23 (3)
Yellow perch	0	1 (0.14)
TOTAL	164 (137)*	810 (111.2)*

*Percentages add up to greater than100 due to anglers targeting more than one species

Table 3a. Monthly estimated angling effort at the Lake for carp.

Month	Weekday	Weekend	Overall
May	171.41	210.31	381.72
June	187.74	82.29	270.03
July	151.34	0.0	151.34
August	65.87	90.34	156.21
September	111.08	90.89	201.97
October	38.20	45.58	83.78
Average	120.94	86.57	207.51
Total	725.64	519.41	1245.05

Table 3b. Monthly estimated angling effort at the Meer for largemouth bass.

Month	Weekday	Weekend	Overall
May	494.19	533.21	1,027.4
June	932.46	587.07	1,519.53
July	2,184.77	322.14	2,506.91
August	474.27	467.78	942.05
September	405.37	197.21	602.58
October	297.93	96.65	394.58
Average	798.16	367.34	1,165.51
Total	4,788.99	2204.05	6993.05

Table 4. All fish catch rate summary, with standard errors, of interviewed anglers at Central Park Lake and the Harlem Meer between 5/5/2015-10/31/2015 using the mean of ratios method to determine catch rates (fish/hour).

Month	Mean of ratios (fish/hr) CP Lake	SE, CP Lake	Mean of ratios (fish/hr) Harlem Meer	SE, Harlem Meer
May	0.65	0.23	1.78	0.29
June	0.34	0.10	2.78	0.80
July	0.17	0.10	1.85	0.45
August	0.39	0.17	1.64	0.26
September	0.32	0.09	1.78	0.30
October	0.25	0.14	2.63	0.64
Overall	**0.43**	0.09	**2.11**	0.14

Table 5. Carp catch rates for Central Park Lake anglers targeting carp and largemouth bass catch rates for Harlem Meer anglers targeting largemouth bass, 5/5/2015-10/31/2015; mean of ratios method used to calculate fish/hour. Standard errors in parentheses.

Month	Targeted Carp/hr CP Lake	Overall Carp/hr CP Lake	Largemouth bass/hr Harlem Meer	Overall Largemouth bass/hr Meer
May	0.50 (0.21)	0.21 (0.09)	0.77 (0.34)	0.22 (0.06)
June	0.40 (0.13)	0.32 (0.11)	0.95 (0.44)	0.21 (0.09)
July	0.22 (0.10)	0.15 (0.07)	0.35 (0.10)	0.13 (0.04)
August	0.26 (0.26)	0.22 (0.11)	0.43 (0.16)	0.16 (0.04)
September	0.31 (0.31)	0.25 (0.11)	0.36 (0.19)	0.10 (0.03)
October	0.52 (0.52)	0.26 (0.29)	0.76 (0.44)	0.27 (0.12)
Overall	**0.36 (0.07)**	**0.27 (0.05)**	**0.61 (.20)**	**0.18 (0.03)**

Table 6a. Total effort and total catch estimates for weekday and weekend strata and overall for all fish species at Central Park Lake. Anglers interviewed during 5/5/2015 – 10/31/2015.

Stratum	Variable	Estimate
Weekdays	Effort	994.04 hours
	Catch	288.27 fish
Weekend days	Effort	711.51 hours
	Catch	298.83 fish
Overall	Effort	1,626.98 hours
	Catch	699.60 fish

Table 6b. Total effort and total catch estimates for weekday and weekend strata and overall for all fish species at the Harlem Meer. Anglers interviewed during 5/5/2015 - 10/31/2015.

Stratum	Variable	Estimate
Weekdays	Effort	13,302.75 hours
	Catch	30,862.4 fish
Weekend days	Effort	6,677.79 hours
	Catch	4,011.39 fish
Overall	Effort	19,980.54 hours
	Catch	42,159 fish

Table 7a. Total effort and total catch estimates for weekday and weekend strata and overall for carp at Central Park Lake. Carp anglers interviewed 5/5/2015 – 10/31/2015.

Stratum	Variable	Estimate
Weekdays	Effort	725.64 hours
	Catch	384.59 fish
Weekend days	Effort	519.41 hours
	Catch	155.82 fish
Overall	Effort	1,245.05 hours
	Catch	460.67 fish

Table 7b. Total effort and total catch estimates for weekday and weekend strata and overall for largemouth bass at the Harlem Meer. Largemouth bass anglers interviewed 5/5/2015 – 10/31/2015.

Stratum	Variable	Estimate
Weekdays	Effort	4,788.99 hours
	Catch	2,969.17 fish
Weekend days	Effort	1,879.17 hours
	Catch	1,146.29 fish
Overall	Effort	6,668.16 hours
	Catch	4,601.03 fish

Table 8a. Estimated number of all fish and carp caught per month from Central Park Lake between 5/5/2015-10/31/2015 calculated from catch rates and estimated monthly fishing effort.

Month	Estimated # all fish caught	Estimated # carp caught
May	288.82	190.86
June	125.77	108.01
July	35.24	33.30
August	83.45	40.61
September	88.53	62.61
October	28.69	43.57
Overall	699.60	448.22

Table 8b. Estimated number of all fish and largemouth bass caught per month from the Harlem Meer between 5/5/2015-10/31/2015 calculated from catch rates and estimated monthly fishing effort.

Month	Estimated # all fish caught	Estimated # largemouth bass caught
May	6,068.55	791.094
June	11,734.17	1,443.56
July	12,882.73	877.42
August	4,291.55	405.08
September	2,979.42	216.93
October	2,882.61	299.88
Overall	42,158.94	4,265.76

Table 9. Age structure for Central Park Lake and Harlem Meer anglers, 5/5/2015-10/31/2015.

Age	% Central Park Lake Anglers	% Harlem Meer Anglers
0 – 18	25.5	34.1
19 – 29	29.9	9.9
30 – 39	12.4	17.6
40 – 49	10.9	13.9
50 – 59	13.1	14.1
60 – 69	6.6	9.6
70 - 79	0.7	0.5
80 +	0.7	0.2

Table 10. Ethnicities of Central Lark Lake and Harlem Meer anglers, 5/5/2015-10/31/2015.

Ethnicity	% Central Park Lake anglers	% Harlem Meer anglers
African American	19	47.5
Asian	17.5	6.3
Caucasian	49.6	23.2
Latino	11.7	20.4
Middle Eastern	2.2	1.6
Other	0.0	0.6
N/A	0.0	0.6

Table 11. Reel types and number of rods used by Central Park Lake and Harlem Meer anglers, 5/5/2015-10/31/2015

Reel type	% Lake anglers	% Meer anglers	Number of rods used	% Lake anglers	% Meer anglers
Spinning	79.8	61.5	1	78.1	86.7
Spincasting	3	4.5	2	20.4	10.8
Baitcasting	7.7	9.7	3	1.5	1.8
Fly	16	5	4	0	0.4
Bamboo/line	0	15.1	5	0	0.3
Hook & line	0	4.1			

Table 12. Bait types used by anglers at Central Park Lake and the Harlem Meer, 5/5/2015-10/31/2015.

Bait type	Central Park Lake (%)	Harlem Meer (%)
Artificial	**27.7**	**44.4**
Natural (types & compositions below)	**72.3**	**55.6**
Worms (all types)	5.31	15.38
Corn	15.04	25.35
Bread/dough	74.34	16.61
Meat (different types eaten by humans)	2.65	38.11
Fish	0	0.35
Clam	0	2.45
Other**	2.65	1.75

** "other" bait consisted of frogs, carp bait and cheese

Table 13. Anglers' knowledge of various NYS and NYC fishing-related policies and practices at Central Park Lake and the Harlem Meer. Numbers are percentages.

Policy/practice	Lake Yes	Lake No	Meer Yes	Meer No
Awareness CPC actively encourages safe disposal of fishing line and tackle to minimize harm to wildlife	86.11	13.89	69.39	30.61
Any use of biodegradable fishing lures	31.94	68.06	19.95	20.05
Knowledge of DEC fisheries surveys	47.22	52.78	30.16	69.84
Willingness to use Smartphone-based app for communication of fish catch info to DEC	72.22	23.61 4.2,maybe	75.11	23.3 1.6,maybe
Knowledge of DEC free fishing clinics	29.17	70.83	17.65	82.35
Knowledge of CPC free fishing at the Meer	76.39	23.61	88.24	11.76
Participated in DEC free fishing clinic	1.4	98.6	1.8	98.2
Participated in CPC free fishing clinic	25	75	53.74	46.26
Knowledge of fishing license requirement	69.44	30.56	57.69	42.31
Knowledge of catch & release fishing regulation	100	0	98.4	1.6
Fished outside of New York City	93.3	6.7	72.2	27.8

Table 14a. Central Park Lake angler comments received.

Angler comment	Percent anglers
Stock fish	32.5
Improve access	19.8
Improve water quality/decrease algae	13.5
Manipulate fish habitat	8.7
Remove trash/increase number of line disposal receptacles	7.1
Eliminate row boats	7.1
Increase enforcement of regulations	5.6
Increase signage	4.0

Table 14b. Harlem Meer angler comments received.

Angler comment	Percent anglers
Improve water quality/decrease algae	33.5
Stock fish	23
Specific to CPC/most related to free fishing program	9.2
Improve fishing access	8.9
Manipulate fish habitat	7.6
Remove trash/increase number of line disposal receptacles	6.8
Increase enforcement of regulations	3.7
Allow watercraft	3.7
Increase signage	3.7

Table 15. Percentage of anglers' level of satisfaction on an increasing satisfaction scale of 1 to 5. Only new interviews included.

Satisfaction level	Percentage of Lake anglers	Percentage of Meer anglers
5	33.3	46.6
4	25.0	28.5
3	23.6	17.4
2	11.1	5.0
1	6.9	2.5

Table 16. Comparisons of catch rates of fish caught for NYC waters creel-surveyed.

Waterbody	Fish/hr (all fish)	Fish/hr (largemouth bass, targeted)	Estimated number of fish caught
Prospect Park Lake	0.94	0.57	15,589
Central Park Lake	0.43	0.004	700
Harlem Meer	2.11	0.61	42,159