

# **Report to the City of Chicago on Conflicts with Ring-billed Gulls and the 2011 Integrated Ring-billed Gull Damage Management Project**



**Prepared for  
Chicago Department of Environment**

**By**

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## EXECUTIVE SUMMARY

The large ring-billed gull (*Larus delawarensis*) population in Chicago has caused various conflicts including general nuisance, property damage, economic losses, and threats to human health and safety. Several studies have linked ring-billed gulls to increased levels of fecal indicator bacteria such as *Escherichia coli* (*E. coli*) in nearshore waters. Results of tests for *E. coli* have led to the issuance of swim advisories and swim bans for Chicago beaches.

The objectives of the 2011 Chicago Ring-billed Gull Damage Management Project were to (1) reduce the local production of ring-billed gulls, (2) reduce the severity of conflicts with gulls including the issuance of swim advisories and swim bans, (3) evaluate how limiting the production of gulls affects gull use of Chicago's beaches, and (4) educate the public regarding the link between gulls and swim advisories and swim bans. The Chicago Department of Environment, with support from the Chicago Park District, requested that USDA-APHIS-Wildlife Services (USDA-WS) provide assistance for the fifth consecutive year to implement this project.

During the pilot project in 2007, USDA-WS established that oiling eggs with food-grade corn oil was a successful method in reducing gull production. During the initial year, 52% of the nests were rendered inviable. From 2008 – 2010, oiling 80%, 81%, and 75% of the nests was found to make a significant additional reduction in the number of hatch-year gulls using Chicago beaches compared to 2007. The goal of treating 80% of the available nests was established again for the previously treated colonies in 2011. The incorporation of an aerial survey in 2011 furthered our ability to minimize the production of ring-billed gull young in Chicago by identifying locations of additional nesting colonies.

Fewer hatch year gulls used Chicago's beaches following egg oiling and there was a reduction of total gulls by 44% when compared to 2007. During the timeframe of these successful reductions of gull production, the number of conflicts caused by gulls (including the frequency of swim advisories and swim bans) were also decreasing. Water quality data were available from the Chicago Park District during our five treatment years and the prior year (pretreatment year) for 18 beaches. Canine harassment did not occur on 15 of the 18 beaches studies.

To further reduce the number of gulls using Chicago's beaches, an education program was implemented in 2011 to inform beachgoers on the importance of not littering and not feeding the birds. The objective of the program was to improve beach health by reducing the availability of anthropogenic food sources which are a major attractant to gulls. Over 4300 people were surveyed and deeply educated about beach health issues and 4,171 (96% of those surveyed) beachgoers agreed to pledge to keep Chicago beaches healthy by not littering and not feeding the birds. Thousands more were exposed to information about the connections between birds and water quality through the aggressive placement of posters at the beaches which discouraged hand-feeding of birds and littering.

## BACKGROUND

The ring-billed gull is a medium-sized gull with adult plumage consisting of a white head, neck, underside, and tail contrasting with its grey wings. Adults measure 45 cm from bill to tail, having a 50 cm wingspan and weighing about 0.7 kg (Godfrey 1966). Wing-tips of primaries are black with white spots and the legs and feet are yellow-green. The bird's name originates from a distinctive black ring around the tip of the

bill. The ring-billed gull is an adaptable and opportunistic bird often found nesting in colonies on break walls, bare soil, piers, structures, and rocks (Schreiber and Schreiber 1975).

Ring-billed gulls are gregarious nesters requiring only a small territory, and their colonies often contain thousands of pairs. Herring gulls, Canada geese, common terns, and Caspian terns are often seen sharing colonies with ring-billed gulls in the Great Lakes Region. Ring-billed gulls are faithful to their nesting regions. Gabrey (1996) reported that 41% of sub-adults and 63% of adults return to their natal colonies. Banding data revealed little immigration or emigration in or out of the Great Lakes Region deeming it a closed system (Weseloh 1984, Gabrey 1996). Over 75% of breeding adults and 55% of chicks banded at a colony were recovered <39 km from the colony in subsequent breeding years (Gabrey 1996).

Ring-billed gulls are long lived birds with few factors contributing to mortality. USGS records indicate the oldest band record for a ring-billed gull is 27 years, 3 months but the average ring-billed gull lifespan is 10 to 15 years (Ryder 1993). Gulls generally nest in isolated areas over water and therefore have few natural predators. Ring-billed gulls were drastically reduced by hunting in the late nineteenth century due to an increased demand for white feathers in the fashion industry (Graham 1975). However, the Migratory Bird Treaty between Canada and the United States, in 1916, afforded protection that allowed, in part, the population to increase (Canadian Wildlife Service 1975).

### ***Gull foraging behavior***

Gulls are adaptable, opportunistic feeders that readily switch food types based on availability and accessibility (Veermer 1970). The diet of ring-billed gulls is highly variable (Darling 1965). Gulls feed on dead fish and garbage, are known to seek out earthworms following rain events, feed on insects and rodents when available in high numbers, and are often seen accepting food from members of the public. Gulls spend their nights at a common roost, usually on a lake, a river, or a structure where they are safe from mammalian predators and from human disturbance (Costello 1971). Prior to sunset and again at sunrise they can be seen commuting between their daytime feeding and loafing sites and their night-time roosts. Adult ring-billed gulls at Great Lakes nesting colonies have been known to travel an average of 25 km to utilize anthropogenic food sources (Belant et al. 1998).

### ***Gull breeding biology***

Ring-billed gulls attain sexual maturity in 2 to 3 years (Ludwig 1974). Gulls begin to arrive on the breeding colonies in the Great Lakes Region in late February to early March. Upon arrival, gulls spend nearly a month establishing territories, engaging in courtship rituals, and building nests. Egg laying begins in April in the Great Lakes Region with an average clutch consisting of 2.82 +/- 0.45 eggs (Mousseau 1984). Eggs are green to brown with dark spots. Adult pairs take turns incubating the eggs for approximately 25 to 27 days. The average hatching success ranges from 75% to 94% with an average fledge rate ranging from 0.80 to 1.9 young per nest (Mousseau 1984, Brown and Morris 1994, Brown and Morris 1996).

### ***Gull populations***

Data on ring-billed gull populations in Illinois are limited. Information on gull populations in Illinois is provided for informational purposes. Data from the USGS Breeding Bird Survey (Sauer et al. 2011) for the period of 1966-2009 indicated that the ring-billed gull populations have increased in Illinois (Figure1).

The Colonial Waterbird Survey was conducted in 1999 and covered the shoreline and islands of the Great Lakes and some inland colonies near the shore of the Great Lakes. Survey data indicated that there were 7,381 nesting pairs of ring-billed gulls on the Illinois portion of the Lake Michigan coast, an additional 31,161 pairs of ring-billed gulls along the Indiana portion of the Lake Michigan coast, and 29,166 pairs of ring-billed gulls at 21 sites along the southern half of the Wisconsin portion of the Lake Michigan coast (Cuthbert et al. 2003). This survey was not a complete count of gulls nesting in the states and did not include any birds that might have been nesting on inland lakes and rivers, nor was it a complete census of rooftops and other nesting sites.

### ***Conflicts with ring-billed gulls***

The large population of gulls in the Chicago region causes a range of problems for people and the environment. These problems include causing a nuisance in public open spaces, contributing to property damage and economic losses to structures (e.g., flat roofs and stonework), adverse aesthetic impacts, foul odors near nesting sites, potential health and safety risks caused by accumulations of fecal material on buildings, near outdoor dining areas and at recreational sites; and potentially reducing recreational enjoyment of beaches by contributing bacteria that result in the issuance of swim advisories and swim bans.

In Chicago, the two major nesting colonies are near marinas and it is thought that adult gulls and their offspring from both colonies are partially responsible for excessive amounts of bird droppings on boats and docks in marinas. Gulls from the Dime Pier colony frequent a popular tourist attraction, Navy Pier, and create negative interactions with large numbers of people. Also, representatives from the Chicago Police Department-Marine and Helicopter Unit and the U.S. Army Corps of Engineers indicate that gulls create nuisances at their facilities (Pers. Comm, 1<sup>st</sup> District Commander Christopher Kennedy, Chicago Police Dept. and Gregory Vejvoda, Facility Manager, U.S. Army Corps of Engineers).

Recent research has documented a cause and effect relationship between gull use of habitats and increased bacterial contamination. Whitman and Nevers (2003) noted that the number of birds on a beach may relate to the bacterial contamination of recreational waters. Edge and Hill (2007) showed that bird droppings served as primary sources of *E. coli* contamination. Levesque et al. (2000) documented that the bacterial content of ring-billed gull droppings can contribute to microbiological contamination of recreational waters and Nugent et al. (2008) described how ring-billed and other gulls contributed to increased fecal coliform levels in a municipal drinking water source. Gull numbers at beaches appeared to be significantly correlated with water and foreshore sand concentrations of *E. coli* taken 24 hours later (Whitman et al. 2004). DNA fingerprinting of *Salmonella* isolates from sand and water at 63rd St Beach were a reasonably good match to gull feces isolates, but other birds could also have been *Salmonella* vectors. Hansen et al. (2011) concluded that waterfowl, including Canada geese, ring-billed gulls, and Mallard ducks were the primary source of *E. coli* contamination at beaches, while also cautioning that total bird counts were not a reliable predictor of the main contributor of *E. coli*.

Further evidence was provided immediately to the north of Chicago, where the Lake County Illinois Health Department used DNA ribotyping to genetically analyze *E. coli* samples from four beaches and “found that gull feces were the predominant source of the bacterial counts” (Lake County Board 2004, Soucie and Pfister 2003, RTI International 2011). Further public health concerns were noted at beaches heavily used by gulls when additional studies conducted by the Lake County Illinois Health Department identified the pathogens *Salmonella* spp. and *Proteus mirabilis* in fresh gull feces at Lake County beaches (M. Adam, Lake County Health Dept., personal comm., July 29, 2009). It has also been demonstrated that in Racine, Wisconsin gull feces is capable of carrying human pathogens (Kinzelman et al. 2008) and that gulls are a significant non-point source of fecal contamination on beaches (Kinzelman et al. 2004).

The high concentration of gulls, and their accompanying fecal matter, on Chicago’s beaches may be a contributing factor to swim bans, which result in a devaluation of Chicago’s beaches and a loss of revenue. A University of Chicago study estimated that swim bans can result in a 45% decline in attendance on beaches, and that swim bans can lead to \$17.3 million in lost economic value and an additional \$2.1 million lost expenditure value in a single year (Shaikh 2006). Furthermore, USDA-WS evaluated the economic impact of loss attendance at seven beaches which experienced a significant reduction in the number of swim advisories or swim bans between 2006 (pretreatment year when gull damage management was not conducted in Chicago) and 2009 (after 3 years of gull damage management). During this period, the alleviation of 54 swim advisories or swim bans potentially averted \$888,000 to \$15.2 million in losses to the Chicago economy (USDA 2010).

The increased ring-billed gull population has also impacted aviation safety. Nationally, gulls are the species group most frequently involved in collisions with civil aircraft in the USA. From 1990-2009, 7,894 gulls were reported struck nationally (Dolbeer et al. 2011). Bird strikes into the windshield or engine of an airplane have the potential to cause substantial damage. For example, during takeoff from a Great Lakes airport an aircraft ingested gulls into two engines which subsequently caused an uncontained engine failure in one of the engines. Both engines were damaged beyond repair. Airport operations recovered 14 gull carcasses from

the engine and runway, with estimated repair costs of \$1 million for repairs and \$0.5 million in lost revenue (Wright 2010). According to Federal Aviation Administration records, gulls have been involved in collisions with aircrafts at Chicago Midway International Airport 82 times and Chicago O'Hare International Airport 86 times between January 1, 1990 and October 1, 2011 (FAA Birdstrike Database). Since it is estimated that only 20% to 25% of all bird strikes are reported (Conover et al. 1995, Dolbeer et al. 1995, Linnell et al. 1996, Linnell et al. 1999), the number of collisions with gulls in Chicago is likely much higher than FAA records indicate.

Lastly, evidence also suggests that other bird species may be negatively impacted by the increase in the ring-billed gull population. Researchers have implicated ring-billed gulls as negatively influencing nesting success of piping plovers and common terns (Maxson and Haws 2000, Morris et al. 1980).

### ***Previous efforts addressing gull damage and conflicts at Chicago's beaches***

The Chicago Park District (CPD) has taken additional steps to improve sand and water quality on Chicago's beaches. Since 2007, Wildlife Services personnel have observed a reduction of uncontained refuse available to wildlife. The placement of additional lidded trash receptacles at all beaches, placement of solar powered compactors in high use areas, and daily beach grooming efforts have been employed to reduce the litter and the number of gulls foraging on Chicago's beaches. The use of canine harassment has also been explored as a management technique at select locations. Beaches with historically high numbers of swim days exceeding the recommended water bacteria levels and high gull use have benefitted from canine harassment (Hartmann et al, 2010).

### ***Managing nests to prevent reproduction***

Oiling eggs with 100% food grade corn oil has been shown to be effective at reducing the hatch rate of gulls (Pochop et al. 1998, Blackwell et al. 2000). After multiple years of minimizing the production of fledglings through egg oiling, a reduction in the number of nesting attempts may be detectable at the gull colonies (Olijnyk and Brown (1999). It is also possible that gull nesting colonies may relocate as a result of the physical destruction of nests (Ickes et al. 1998), thus creating even more conflicts if relocated nesting colonies move closer to airports or on rooftops where significant damage could be sustained. However, egg oiling is a less intrusive method of preventing production than physical nest destruction and in USDA-WS experience is less likely to result in the relocation of a nesting colony (J. Cummings, USDA-WS, pers. comm.). In addition, egg oiling performed early in the nesting cycle is considered humane (Hadidian et al. 1997).

## **OBJECTIVES**

The objectives of the Chicago Ring-billed Gull Damage Management Project were to (1) reduce the local production of ring-billed gulls, (2) reduce the severity of conflicts with gulls including the issuance of swim advisories and swim bans, (3) evaluate how limiting the production of gulls affects gull use of Chicago's beaches, and (4) educate the public regarding the link between gulls and swim advisories and swim bans. We hypothesized that oiling the majority of ring-billed gull eggs will continue to reduce the number of hatch-year ring-billed gulls produced in Chicago, and that the decrease in the number of hatch-year ring-billed gulls will therefore reduce severity of conflicts with gulls, including swim advisories and swim bans on Chicago's beaches.

## **METHODS**

### ***Colony assessment and egg oiling at Dime Pier and Lake Calumet***

Prior to egg oiling, colony assessment visits to Dime Pier, DuSable Harbor Breakwall, and Lake Calumet began on April 7, 2011. Subsequent visits took place weekly to assess the colony size and nesting stage at the three sites. In order to facilitate the application of oil early in incubation, nesting chronology was estimated via egg flotation as described by Nol and Blokpoel (1983).

Once incubation began, eggs were treated with food grade corn oil that was applied using a pressurized four-gallon backpack tank and hand-held spray wand. The spray wand was equipped with a tip that produced a

fan pattern. Sprayers were pressurized and delivered oil at rates between 3 to 6 ml/sec. The sprayer tips were held about 15 to 20 centimeters (6 to 8 inches) above each egg and approximately 3 ml of corn oil were applied to each egg. The oiling treatment consisted of two USDA-WS staff walking transects through the colony with backpack sprayers to apply corn oil to all eggs in each selected nest. All nests at Dime Pier were treated and counted. Nests at DuSable Harbor Breakwall were counted to determine a total colony count. The number of nests to be treated in order to reach 80% of the colony was calculated and then those nests were treated.

Eggs at Dime Pier and DuSable Harbor Breakwall were first oiled on April 29, 2011. Additional retreatments took place on May 16 and May 31. Through egg floatation, it was determined that egg incubation at Lake Calumet began after Dime Pier and DuSable Harbor Breakwall. Therefore, oiling at Lake Calumet did not take place until May 4. Additional retreatments took place on May 18 and May 31. Due to the close proximity of Dime Pier and DuSable Harbor Breakwall, the nesting activity at these locations was considered to be one nesting colony and in the remainder of this report will be referred to as the Dime Pier colony.

Data related to changes in total nest numbers and percentage of nests treated at each colony was compared between the five treatment years (2007 through 2011). The reported total number of nests that were treated at Dime Pier and Lake Calumet were based on the largest number of nests counted during a single oiling. Nests that were not oiled were only counted once during the first treatment before chicks were present. Locations where nests were not oiled were marked with flagging tape. During the retreatment visits, areas that were flagged during the first treatment were avoided to minimize disturbance that might affect chick mortality rate (Fetterolf 1983).

### ***Increase understanding of regional populations***

An aerial survey was completed on April 20, 2011 to further our understanding of the number of gulls nesting in Chicago and to aid in locating new nesting sites. A crew of three which included the pilot and two observers flew out of and landed back at the Lewis University Airport. Official surveys began in the southeast corner of Chicago. Five transects approximately 1.6 km apart were completed parallel to Lake Michigan. The first two transects were completed along the entire Chicago shoreline. The subsequent three transects surveyed the area between the Chicago Loop and Lake Calumet. Additional areas surveyed included the North Branch of the Chicago River and the Chicago Sanitary and Ship Canal. The survey was conducted at approximately 80 km/hr and at a minimum altitude of 152 m. Approximately 362 km<sup>2</sup> (140 mi<sup>2</sup>) were surveyed for gull colonies.

Global Positioning System (GPS) coordinates were recorded for locations where gulls were identified. Staff then conducted a visit to each location to determine if the observation of the nest colony identified from the air contained nests and if the colony may cause conflicts which would warrant management of gull production.

### ***Gull observation surveys***

To evaluate the efficacy of the program and accurately assess the number of gulls contributing to the deposition of fecal matter at beaches, observational surveys of gull presence were conducted at 20 locations along Chicago's shoreline (Figure 2). Observational surveys of gulls were conducted at beaches, harbors, and other historic gull use sites. Survey routes normally started from the northern or southern most end of the city. Each survey location was traversed on foot and the number of hatch-year (HY) and after hatch-year (AHY) gulls observed on and within 75 meters of the beach, (including nearby parks, parking lots, and shoreline) were counted and recorded. Additional data recorded during observational surveys included: time, weather conditions, and species of other shorebirds observed at each location. Table 1 illustrates the number of surveys conducted each week in each of the five years when egg oiling was conducted.

On three separate dates during the swim season, a secondary observer conducted an independent gull count simultaneously with the primary observer to assess accuracy of the primary gull observer's estimate of gull use of survey locations. The numbers of gulls (HY, AHY, and total gulls) observed were compared after all observations were completed for the day to evaluate the similarity of the data.

Complete data sets were available to analyze gull use for 10 of the 15 beaches surveyed. Analysis was conducted for weeks 5-10 of the observation periods. For each of the 10 beaches, we compared the number of gulls observed during the surveys in each of the six one-week observation blocks across 2007, 2008, 2009,

2010, and 2011 using a two-factor factorial analysis of variance. *A priori* linear contrasts were applied to the week-by-year interaction term to identify at what week of the six weeks analyzed (if any) the five years differed in the mean number of gulls observed. Separate analyses were conducted for HY, AHY, and total gulls, with the realization that analyses of the total gull numbers are descriptive ventures since total gull numbers are not independent from the two components, HY and AHY numbers. Since surveys collected by the primary and secondary observer were comparable, only the observations completed by the primary observer were analyzed.

Information was collected at all 15 beaches during the entire 2011 swim season. Although statistical analyses either were not possible or were inappropriate for 63<sup>rd</sup> Street, 57<sup>th</sup> Street, Foster, Oakwood, and South Shore beaches, a descriptive evaluation between the mean number of HY, AHY, and total gulls is important to communicate.

Gull use totals at 63<sup>rd</sup> Street, 57<sup>th</sup> Street, and Foster Avenue beaches were altered because of gull harassment during multiple years of our study period. For trial purposes, dispersal of gulls via canine harassment was conducted at Foster Avenue beach in 2006 and 2007 and at 63<sup>rd</sup> Street beach in 2007. A full time harassment program was then conducted at 57<sup>th</sup> and 63<sup>rd</sup> Street beaches during the entire 2008 swim season from dawn to dusk. In 2009, canine harassment did not take place at Foster Avenue, 57<sup>th</sup> Street, or 63<sup>rd</sup> Street beaches. During 2010 and 2011 a full time canine harassment program was employed at 63<sup>rd</sup> Street beach with periodic visits taking place at 57<sup>th</sup> Street beach. Observations of 63<sup>rd</sup> and 57<sup>th</sup> Street beaches were conducted either before canine harassment was implemented or during gull harassment periods during 2011. We examined the differences in gull use at 63<sup>rd</sup> and 57<sup>th</sup> Street beaches including nearby breakwalls before and during harassment periods. To minimize potential effects canine dispersal of gulls may have had on gull use of beaches and the associated observational data, Foster, 57<sup>th</sup> Street, and 63<sup>rd</sup> Street beaches were excluded from statistical analysis.

Observations occurred at Oakwood and South Shore beaches during 2010 and 2011. Surveys were not conducted during the first three years of the study period and therefore unavailable for comparisons.

The nesting colonies at Dime Pier and Lake Calumet were also observed periodically during the survey period to assess colony fledge date, HY development, and gull movement patterns.

### ***Swim advisories and swim bans on Chicago's beaches***

The CPD regularly examines near-shore water quality at swimming beaches in Chicago. According to the U.S. Environmental Protection Agency recommended threshold, swim advisories are implemented in Chicago when the geometric mean of two *E. coli* sample readings exceeds the threshold of 235 most probable number (mpn) per 100 mL of sampled beach water. If the mean of two samples is  $\geq 1000$  mpn/100 mL, a swim ban will be in effect for the beach the day following sample collection. Together, swim advisories and swim bans are termed "exceedances." The CPD's methodology used to monitor beach water quality and to issue exceedances has remained unchanged throughout the period covered in this report. Thus, in addition to examining exceedance trends across the five years of egg oiling, we were able to use the 2006 data as a pretreatment baseline for comparisons in proportion of tests exceeding 235 mpn/100 mL.

The proportion of water quality tests exceeding 235 mpn/100 mL at 15 beaches were compared for 2006 through 2011 swim seasons (Table 2). This approach avoids conflict in inferences relative to the number of days during the week that a water quality exceedance was in place. The proportion of water quality tests at each beach  $\geq 235$  mpn were compared between years using chi-square contingency table tests. Of most interest were comparisons for each beach between the pretreatment year, 2006, and the final year of treatment in this study, 2011. In addition to the 15 beaches, comparisons were made for the three beaches influenced during our study period by canine harassment activities (Foster, 57<sup>th</sup> Street, and 63<sup>rd</sup> Street). The extent of canine involvement is illustrated in Table 2.

### ***Reduce food sources on beaches and educate beachgoers***

An education program was implemented in conjunction with the Chicago Department of Environment and the Chicago Park District to increase beachgoers' knowledge of water quality issues and provide guidance to patrons on what they can do to improve beach health. Outreach included installation of signs and posters at targeted beaches (Figure 3), art work at Oak Street beach, and personal communication from four Beach

Ambassadors. To further promote the project's message and determine if public outreach was effective, public surveys were completed at 12 beaches with high attendance rates and history of water quality exceedances.

Public surveys were administered by Beach Ambassadors who received training on: beach health challenges and solutions; beneficial ways to interact with wildlife; general CPD beach information; and how to interact with the public in a positive way. The surveys were designed to measure the efficacy of education efforts by tracking beachgoers knowledge of beach health issues through the beginning, middle, and final thirds of the swim season.

As a part of the survey, the Beach Ambassadors asked three primary questions: 1) Did you know that the Chicago Park District sometimes issues swim bans or swim advisories due to water quality issues? 2) Did you know that gull droppings contribute to the water contamination causing the bans or advisories? 3) Have you noticed educational signs and posters discouraging the feeding of gulls?

Surveys collected from seven of the beaches were suitable for assessing time trends among beachgoers for a particular beach. The number of beachgoers available to survey varied greatly from beach to beach due to attendance fluctuations. Therefore, it should be noted that the sum of surveys analyzed differed at each beach during the three assessment periods.

The proportion of positive responses for each question at each beach was analyzed during the beginning, middle, and end of the swim season. This approach avoids conflict in inferences relative to the number of samples administered during each period.

In addition to assessing beachgoers knowledge about beach related issues, ambassadors asked participants: How often do you visit this beach during a season? Do you live in Chicago? Will you pledge to keep our beaches healthy by not feeding the birds and not littering? Additional demographic information was also collected but not analyzed.

## RESULTS

### *Egg oiling and nesting chronology at Dime Pier and Lake Calumet*

In 2011, USDA-WS conducted three egg oiling applications at Dime Pier and Lake Calumet. Approximately 83% of the nests were treated at Dime Pier (3,566 nests containing 8,837 eggs; Figure 4; Table 3) and Lake Calumet (2,933 nests containing 6,663 eggs; Figure 4; Table 3). In 2011, the colony size at Dime Pier decreased by 153 nests (-3%) in comparison to 2010. Gulls, after abandoning Lake Calumet in 2010, returned in 2011, although only in small numbers compared to the first three years of the project (Table 3).

Gull chicks were first observed during the second retreatment on May 16 at Dime Pier and on May 18 at Lake Calumet. The first observation of a fledged HY gull occurred during a survey on June 22. The number of HY gulls observed on beaches continued to increase through observation periods 5-9. Based on increased HY gull beach use during observation block 7 and site visits to the Dime Pier colony, USDA-WS estimated a mean fledge date of July 11 for HY gulls from the managed colonies in Chicago.

### *Minimizing conflicts from newly located nesting populations*

Three sites were identified by the aerial survey to have nesting ring-billed gulls and herring gulls (*Larus argentatus*) (Figure 2). All three sites were rooftop colonies that posed a potential threat to property as well as human health or safety. USDA-WS determined that nesting should be discouraged at the three sites and therefore 100% of the nests were treated or removed.

Nests at rooftop colony #1 (Jardine Water Purification Plant) were treated on May 4, May 18, and May 31. The greatest number of nests rendered inviable occurred on May 18, when a total of 1,754 ring-billed and 139 herring gull nests were treated. USDA-WS returned to the rooftop on June 9 to remove the previously oiled eggs and remaining nesting material.

Rooftops #2 and #3 were located on warehouses in close proximity to Midway International Airport. USDA-WS removed the nests rather than oiling the eggs to promote early abandonment of the sites. During four visits to rooftop #2, one ring-billed gull nest and 94 herring gull nests were removed. The greatest number of nests removed during a single visit occurred on May 16 when one ring-billed gull nest and 33 herring gull nests were removed.

Eight visits were made to rooftop #3 where 4,335 ring-billed gull nests and 203 herring gull nests were removed over a 56 day period. During the initial three days of removal (May 4-6) 2,379 ring-billed gull nests were removed before gulls had an opportunity to establish new nests. An additional 1,731 ring-billed gull nests were picked-up on May 10 and May 11 to complete the first round of nest removal. During nest removal activities, we observed a yellow patagial tagged gull that was tagged during the 2007 nesting season at Lake Calumet.

A total of 6,090 ring-billed gull nests and 436 herring gull nests were removed from the three rooftop colonies. During nest removal, gulls were observed establishing new nests after their initial nests were destroyed. Therefore, it is highly likely that the number of nests removed is greater than the actual colony size. We estimate that approximately 4,134 to 5,865 ring-billed gull nests and 261 herring gull nests were prevented from successfully nesting on rooftops during 2011 (Table 4).

### ***Observations of gull use of Chicago habitats***

During the first two weeks of surveys, USDA-WS observed a 97% and 72% increase in AHY gull use compared to 2010 at the 13 beaches surveyed that were not influenced by canine harassment. On the contrary, during the following 13 weeks of observations, a 9% reduction in the mean number of AHY gulls was observed.

Hatch-year gulls were first observed on beaches on June 22. Hatch year gull use of beaches increased during the next five week blocks of the swim season. After this period, HY gull use of beaches remained stable for the remaining weeks of the swim season (Figure 5).

In 2011, all 13 beaches surveyed that were not affected by canine harassment were noted to have a reduction in HY gull use in comparison to 2010. Additionally, the number of HY gulls observed on the 10 analyzed beaches declined by 91% from 2007 to 2011 (Table 5) and exhibited a statistically detectable week by year interaction ( $P \leq 0.08$ ) (Table 6). As expected, declines in AHY gull use of beaches was not as striking as was observed for HY gulls. Compared to the initial year of observations in 2007, we observed a reduction in the number of AHY gulls at eight of the 10 beaches and a total reduction of 10% (Figure 6, Table 5).

Although the total number of gulls observed is the sum of the HY and AHY and therefore not independent of its components, it still is important to examine changes since the ultimate success of this project depends on whether or not limiting recruitment can eventually affect an already existing gull population. Nine of ten beaches surveyed exhibited a reduction in total gull use, while the mean number of total gulls observed per weekly observation block declined 44% during 2011 compared to 2007 (Figure 7, Table 5).

The effects of increasing our ability to minimize HY production and not observing a significant change in AHY gull use resulted in HY gulls accounting for 7% of the gulls on the beach during 2011. During 2007, the initial study period, HY gulls represented 43% of the total gulls observed on beaches during weeks 5-10. During 2008, 2009, and 2010, the proportion of HY gulls to AHY gulls was 15%, 10%, and 14% respectively.

Canine harassment was performed from dawn to dusk at 63<sup>rd</sup> Street beach during 2011. Observations of gull use of the beach were conducted before and during canine harassment periods. Observations that were made shortly before canine deployment showed that gulls gathered on the beach and foraged on refuse in the parking lot before dogs were deployed to disperse the birds. During 15 visits, a mean of 214 gulls were observed at the site. Surveys during canine harassment periods confirmed that gulls were continually dispersed off the beach. While dogs were deployed, gulls were observed loafing throughout Jackson Park and Jackson Harbor including nearby 59<sup>th</sup> Street Pier and Casino Pier. Table 7 illustrates the mean number of gulls that utilized the beach and breakwalls at 63<sup>rd</sup> Street beach during observations.

Three quality control gull observational surveys were completed by a secondary observer during the swim season. During each of these surveys, estimates of the number of gulls using the locations were within 10 % of each other for the number of HY, AHY, and total gulls observed. Total gull use recorded by the secondary observer were -0.2%, -6.6%, and -1.2% away from the primary observers' totals.

### ***Frequency of swim advisories and swim bans on Chicago's beaches***

In comparing swim exceedance data from egg oiling years with those from the year before initiating egg oiling (2006), the proportion of water quality tests requiring issuance of a swim advisory or ban declined at a majority of the beaches. During 2011, 12 of 15 beaches had a lower proportion of tests in exceedance of water

quality standards compared to 2006 (Table 2). Of those 15 beaches, one had a statistically detectable reduction at  $P \leq 0.1$  (Table 2).

In addition to the 15 monitoring locations, a considerable reduction in exceedances was observed at 63<sup>rd</sup> Street beach. During the 2008, 2010, and 2011 swim seasons, a full-time canine harassment program was employed to disperse gulls, at which time swim advisories and bans decreased considerably compared to non-harassment years (Table 2).

### ***Reduce food sources on beaches and educate beachgoers***

Public surveys were collected from 4,368 beachgoers at 12 beaches. Of those surveyed, 4,337 people fully completed the surveys that were administered by the Beach Ambassadors. Incomplete surveys were discarded to avoid possible responses from inattentive individuals.

Of the 4,337 beachgoers surveys, 35% responded that they had knowledge that the Chicago Park District sometimes issues swim bans or swim advisories due to water quality issues, 23% responded that they knew that gull droppings contribute to the water contamination which causes swim bans or advisories, while 28% responded that they had noticed educational signs and posters discouraging the feeding of gulls. Table 8 shows the number of positive and negative responses for each examined question of the survey.

Although questions were asked independently of each other, it was apparent that if the surveyed beachgoer noticed the signs or posters, they were more likely to respond positively to the other questions asked by the Beach Ambassadors. Of the 28% of beachgoers that noticed the signs or posters, 64% responded they knew the Chicago Park District sometimes issues swim bans or swim advisories due to water quality issues and 53% knew that gull droppings contribute to the water contamination causing the bans or advisors. Conversely, if the beachgoer did not notice the signs or posters only 24% and 12% responded positively to the questions on beach health (Table 9).

A statistical analysis was able to be completed on survey responses collected from seven of the 12 beaches. When comparing results from 3,428 surveys that were completed during the three survey periods, we did not find a significant change over the summer in the beachgoers awareness of swim bans or in the relationship between gulls on the beach and poor water quality at any of the seven beaches analyzed. Therefore, there was no evidence that beachgoers knowledge of beach health improved during the study period. To the contrary, positive responses to the three primary questions decreased during the second or third period for a majority of the beaches (Table 10). However, since many beach visitors may only visit the beach once or twice a season (based on survey data and anecdotal evidence), we should not expect to see an increase in positive responses over the season.

Out of the 3,428 surveys analyzed, 3,256 responded to the question: How often do you visit this beach during a season? Of the 3,256 beachgoers surveyed, 42% answered that they visit the beach once a month or less during the swim season. Beachgoers that replied that they visit the beach more than one time per month were more likely to answer “Yes” to the three primary questions. Specifically, 48% of beachgoers who visit the beach more frequently (more than once a month) responded that they knew the Chicago Park District sometimes issues swim bans or swim advisories due to water quality issues. Conversely, only 29% of beachgoers who visit the beach once a month or less responded “yes” to the same question (Table 11).

A total of 4,171 beachgoers agreed to sign our pledge. Regardless of their knowledge of beach health issues at the time of the survey, 96% of beach patrons surveyed pledged to keep Chicago beaches healthy by not littering and not feeding the birds.

## **DISCUSSION**

During 2011, USDA-WS found that hindering HY gull recruitment at newly identified nesting sites while also continuing to treat approximately 80% of the nests at the two known colonies continued to significantly reduce the number of HY gulls on the beaches as compared to the initial treatment year (2007).

Gulls returned to Lake Calumet in 2011 in limited numbers. During observations of the colony during this nesting season, it was evident that only a small section of Lake Calumet was suitable for nesting due to the growth of dense vegetation. Gulls were only observed at the west end of the dike and on Gull Island where

vegetation was minimal. The return of the Lake Calumet nest colony along with locating previously unknown nests on rooftops aided us in preventing an additional 9,185 nests from producing young in Chicago during 2011 compared to 2010. It is possible that some of the gulls that previously nested at Lake Calumet are now nesting on rooftops. During nest destruction activities in 2011, we observed a patagial tagged gull that nested at Lake Calumet during 2007 now nesting on a rooftop.

Locating new nesting sites provided an opportunity to further our understanding of the local ring-billed gull population and increase the project's effectiveness in limiting future recruitment of HY gulls into the adult population. An unplanned benefit of the aerial survey was to potentially improve human health and safety for the residents of Chicago. Ring-billed gulls were found to be nesting on the rooftop of the Jardine Water Purification Plant. Plant managers were concerned with the large number of gulls and the accumulation of fecal material that was being deposited on the building's air intake vents. Additionally, two of the nesting sites were found within the critical flight path of Midway International Airport. Gulls are involved in wildlife collisions with aircraft and annually cause at least \$1.8 million in damages to commercial aircraft (Dolbeer et al. 2011). Therefore, we encouraged early nest abandonment to reduce the potential for bird – aircraft collisions near the nesting sites.

During weeks 1 and 2, an astoundingly high number of AHY gulls were observed on Chicago beaches compared to previous years. Nest removal activities that encouraged colony abandonment at rooftop colonies may have contributed to this increase early in the swim season. Through aerial imagery (Google Earth) and anecdotal evidence, it was confirmed that gulls nested successfully in 2010 at the three rooftop sites. The effects of removing nests from rooftop locations and the subsequent abandonment of the colony in 2011 may have contributed to an increase in AHY gull use of beaches early in the swim season when gull pairs would have normally spent their time at the nesting site. Conversely, while nest destruction pushed adult birds away from their colonies earlier than customary, prohibiting egg development likely contributed to fewer HY gulls on Chicago beaches during 2011.

We expected egg oiling to reduce the numbers of HY gulls in 2011. Since initiating egg oiling as a management tool in 2007, HY gull use of beaches has declined by 91% and all ten of the analyzed beaches have seen a significant reduction in HY gull use. In 2011, when the fewest number of known nests were left viable to produce young, HY gulls represented less than 7% of the total gulls observed on beaches. During the 2010 swim season, the year before nests on rooftops were located and removed, HY gull use of Chicago's beaches represented 14% of the total number of gulls observed during our surveys (Table 5).

As would be expected for a long-lived species, a reduction in the number of AHY gulls using Chicago beaches was not detected. However, continuing to reduce HY gull production has overshadowed the effects of not changing AHY gull use. Total gull use at nine of ten beaches surveyed exhibited a reduction in total gull use in 2011 compared to 2007.

Shortly before sunrise and before canine harassment was executed, it was evident that gulls were attracted to 63<sup>rd</sup> Street beach and the adjoining parking lot. During multiple visits, refuse left by beach patrons the night before provided generous foraging opportunities for gulls at the location. Once canine activities were initiated and morning cleanup crews removed the refuse, the gull numbers at these two locations declined considerably. During canine harassment periods, gulls were routinely observed staging at 59<sup>th</sup> Street pier (Table 7).

The CPD continues to evaluate how sand and water quality can improve at their beaches. The relationship between water quality exceedances and gull numbers, gull excrement, beach grooming practices, and weather conditions is complex and not fully understood. It appears that reducing factors that contribute to increase levels of fecal indicators, such as gull use of beaches, has reduced the number of exceedances issued.

The effects gulls have on water quality test results are most evident at 63<sup>rd</sup> Street beach. During 2008, 2010, and 2011 observations, it was clear that if dogs were present and deployed on beaches, virtually no gulls were observed using the beach. During those three years in which canine harassment was implemented, a noticeably lower exceedance rate was evident at 63<sup>rd</sup> Street beach. In 2011, a statistically detectable reduction of  $P \leq 0.1$  was observed compared to 2007.

Less than half of beachgoers surveyed responded positively about having knowledge of swim bans and recognizing the relationship between gull droppings and water quality. The low response totals were not

anticipated. At the beginning of the project, we had a belief that beachgoers had an understanding that swim bans were issued due to poor water quality test results but that the patrons may be uninformed as to the connection between water quality and gulls. Based on a low number of positive responses recorded on the survey, it is apparent that education is needed and that beachgoers continue to lack knowledge on beach health issues.

While a fairly low percentage of people noticed the educational posters (28% of those surveyed), this is still a large number of people being educated. If we extrapolate 28% surveyed, based on 10-20 million visitor to beaches all year, we can estimate that 280,000 – 560,000 people were exposed to information about beach health issues. Furthermore, once the permanent signs are installed next year, we should expect this number to increase.

It was encouraging to note that if a beachgoer noticed the signs or posters, they were more likely to have responded “Yes” to knowing about swim bans and the relationship between gulls and water contamination.

The underlying goals of the education program were to inform beachgoers of beach health issues and provide information that would encourage them not to litter or feed birds. A total of 4,368 beachgoers were surveyed and informed of the project and 4,171 beachgoers signed our pledge and agreed to do their part in keeping Chicago beaches healthy.

## **CONCLUSION AND NEXT STEPS**

Since the beginning of the Integrated Ring-billed Gull Damage Management Project all surveyed beaches have shown a reduction in the number of HY gulls with an overall 91% reduction in the mean number of gulls observed. Increased knowledge of nesting locations in 2011 improved our ability to manage HY gull production in Chicago. Continued efforts to limit production of ring-billed gulls and locate unknown colonies should eventually produce observable downward trends in beach usage by AHY birds as the adult population declines through natural attrition and due to minimal recruitment due to the egg oiling project.

Limiting HY production is only part of the integrated approach used to reduce conflicts caused by gulls in Chicago. Surveys conducted during the 2011 swim season showed that a majority of beachgoers are not educated on beach health issues. Since birds are currently well conditioned to use Chicago beaches as foraging locations, it continues to be important to educate the public on the importance of not littering or feeding the birds. We are hopeful that reducing the availability of anthropogenic food sources on Chicago beaches may eventually reduce the number of gulls seeking food sources at the beaches.

Ultimately the goal of the Integrated Ring-billed Gull Damage Management Project is to reduce the number of conflicts caused by gulls in Chicago. Results collected from this project support the claim that conflicts were reduced. Twelve of the 15 Chicago beach monitoring sites that did not use canine harassment exhibited a reduction in the proportion of days requiring an issuance of a water quality exceedance compared to 2006. Locating three rooftop colonies likely aided in the success of this project by minimizing the recruitment of gulls and promoting early abandonment of rooftop nesting sites. In addition to reducing HY gull numbers at area beaches we lessened human health and safety concerns at Midway International Airport and at the Jardine Water Purification Plant.

Moving forward, we are hopeful that continuing to allocate resources towards public education would eventually make Chicago a less attractive location for gulls to forage. We also found value in conducting aerial surveys to identify gull nest colonies and recommend additional aerial surveys take place in the future. Additionally, due to the human health and safety concerns attributed to the newly found rooftop colonies, it is recommended that efforts be made in 2012 to discourage the development of nests at these locations. However, it is probable that gulls from these rooftop colonies will be displaced and attempt to reneest in new locations.

## LITERATURE CITED

- Belant, J. L., S. K. Ickes, and T. W. Seamans. 1998. Importance of landfills to urban nesting herring and ring-billed gulls. *Landscape and Urban Planning* 43: 11 – 19.
- Blackwell, B. F., T. W. Seamans, D. A. Helon, and R. A. Dolbeer. 2000. Early loss of herring gull clutches after egg-oiling. *Wildlife Society Bulletin* 28: 70 – 75.
- Brown, K. M. and R. D. Morris. 1994. The influence of investigator disturbance on the breeding success of Ring-billed Gulls (*Larus delawarensis*). *Colonial Waterbirds* 17: 7 – 17.
- Brown, K. M. and R. D. Morris. 1996. From tragedy to triumph: Renesting in Ring-billed-gulls. *Auk* 113: 23 – 31.
- Canadian Wildlife Service. 1975. Gull seminar proceedings. Canadian Wildlife Service, Sackville, New Brunswick.
- Conover, M. R., W. C. Pitt, K. K. Kessler, T. J. Dubow, and W. A. Sanborn. 1995. Review of human injuries, illnesses and economic-based losses caused by wildlife in the United States. *Wildlife Society Bulletin* 23:407 – 414.
- Costello, D. F. 1971. *The world of the gull*. Lippincott Co., Philadelphia and New York.
- Cutbert, F. J., J. McKearnan, L. R. Wires, and A. Joshi. 2003. Distribution and abundance of colonial waterbirds in the U.S. Great Lakes: 1997-1999. Draft 16. Report to the U.S. Fish and Wildlife Service.
- Darling, L. 1965. *The gull's way*. William Morrow and Co., New York.
- Dolbeer, R. A., S. E. Wright, and E. C. Cleary. 1995. Bird and other wildlife strikes to civilian aircraft in the U. S., 1994 Interim report DTFA01-91-Z-02004. USDA for FAA, FAA Technical Center, Atlantic City, New Jersey. P8. Federal Aviation Administration Wildlife Strike Database. 2007.  
<http://wildlife.pr.erau.edu/public/>
- Dolbeer, R. A., S. E. Wright, J. Weller, and M. J. Begier. 2011. Wildlife strikes to civilian aircraft in the U. S. 1990-2009. Federal Aviation Administration National Wildlife Strike Database Serial Report Number 16. Report of the Associate Administrator of Airports. Washington, DC.
- Edge, T. A. and S. Hill. 2007. Multiple lines of evidence to identify the sources of fecal pollution at a freshwater beach in Hamilton Harbour, Lake Ontario. *Water Research* 41: 3585 – 3594.
- Fetterolf, P. M. 1983. Effects of investigator activity on ring-billed gull behavior and reproductive performance. *Wilson Bulletin* 95:23 – 41.
- Gabrey, S. W. 1996. Migration and dispersal in Great Lakes Ring-billed and Herring Gulls. *Journal of Field Ornithology* 67:327 – 339.
- Godfrey, W. E. 1966. *Birds of Canada*. National Museums of Canada, Ottawa.
- Graham, F., Jr. 1975. *Gulls. A social history*. Random House, New York.

- Hadidian, J., G. R. Hodge, and J. W. Grandy. 1997. *Wild Neighbors: the humane approach to living with wildlife*. Fulcrum Publishing, Golden, Colorado.
- Hansen, D. L., S. Ishii, M. J. Sadowsky, R. E. Hicks. 2011. Waterfowl abundance does not predict the dominant avian source. *Journal of Environmental Quality* 40:1924 – 1931.
- Hartmann, J. W., S. F. Beckerman, T. W. Seamans, R. M. Engeman, S. Abu-Absi. 2010. Report to the city of Chicago on conflicts with ring-billed gulls and the 2009 integrated ring-billed gull damage management project (Prepared for Chicago Department of Environment) Springfield, IL: USDA/APHIS/Wildlife Services.
- Ickes, S. K., J. L. Belant, and R. A. Dolbeer. 1998. Nest disturbance techniques to control nesting by gulls. *Wildlife Society Bulletin* 26:269 – 273.
- Illinois Department of Public Health. (2010) Beach Monitoring Web Site. Retrieved from <http://app.idph.state.il.us/envhealth/ilbeaches/public/>
- Lake County Board. (2004) Lake County Regional Framework Plan. Lake County, Illinois. Retrieved from [www.co.lake.il.us/health](http://www.co.lake.il.us/health)
- Kinzelman, J., S. L. McLellan, A. Amick, J. Preedit, C. O. Scopel, O. Olapade, S. Gradus, A. Singh, and G. Sedmak. 2008. Identification of human enteric pathogens in gull feces at Southwestern Lake Michigan bathing beaches. *Canadian Journal of Microbiology* 54:1006 - 1015.
- Kinzelman, J., S. L. McLellan, A. Daniels, S. Cashin, A. Singh, S. Gradus, and R. Bagley. 2004. Non-point Source Pollution: Determination of Replication versus Persistence of *Escherichia coli* in Surface Water and Sediments with Correlation of Levels to Readily Measurable Environmental Parameters. *Journal of Water Health* 2:103 – 114.
- Linnell, M. A., M. R. Conover, and T. J. Ohashi. 1996. Analysis of bird strikes at a tropical airport. *Journal of Wildlife Management* 60:935 – 945.
- Linnell, M.A., M. R. Conover, and T. J. Ohashi. 1999. Biases in bird strike statistics based on pilot reports. *Journal of Wildlife Management* 63:997 – 1003.
- Levesque, B.; P. Brousseau, F. Bernier, E. Dewailly, and J. Joly. 2000. Study of the bacterial content of ring-billed gull droppings in relation to recreational water quality. *Water Research* 34:1089 – 1096.
- Ludwig, J. P. 1974. Recent changes in the ring-billed gull population and biology in the Laurentian Great Lakes. *Auk* 91:575 – 594.
- Maxson, S. J., and K. V. Haws. 2000. Population Studies of Piping Plovers at Lake of the Woods, Minnesota: 19 Year History of a Declining Population. *Waterbirds*: 23:475 – 481.
- Morris, R. D., I. R. Kirkham, and J. W. Chardine. 1980. Management of a declining Common Tern colony. *Journal of Wildlife Management* 44:241 – 245.
- Mousseau, P. 1984. A comparison of two methods to assess the breeding success of Ring-billed Gulls. *Journal of Field Ornithology* 55: 151 – 159.
- Nol, E., and H. Blokpoel. 1983. Incubation period of ring-billed gulls and the egg immersion technique. *Wilson Bulletin* 95: 283 – 286.

- Nugent, B., K. Gagne, and M. J. Dillingham. 2008. Managing gulls to reduce fecal coliform bacteria in a municipal drinking water source. *Proceedings of the Vertebrate Pest Conference* 23: 26 – 30.
- Olijnyk, C. G., and K. M. Brown. 1999. Results of a seven year effort to reduce nesting by herring and great black-backed gulls. *Waterbirds* 22: 285 – 289.
- Pochop, P A., J. L. Cummings, C. A. Yoder, and J. E. Steuber. 1998. Comparison of white mineral oil and corn oil to reduce hatchability in ring-billed gull eggs. *Proceedings of the Vertebrate Pest Conference* 18: 411 – 413.
- RTI International. 2011. Bacteria TDMLs for Illinois' Lake Michigan Beaches Options Summary report. Task Order 2010-25, Report to the U.S. Environmental Protection Agency.
- Ryder, J. P. 1993. Ring-billed gull. In *The birds of North America*, No. 33 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 – 2009. Version 3.23.2011. USGS Patuxent Wildlife Research Center, Laurel, MD.
- Schreiber, E., and R. W. Schreiber. 1975. *Wonders of sea gulls*. Dood Mead and Co., New York.
- Shaikh, S. L. 2006. "Fact Sheet: The Value of Chicago Beaches". Unpublished report. University of Chicago. Chicago, IL. February 20, 2006. 10 pp.
- Souciw W.T., and M. A. Pfister. 2003. E. coli source identification on Lake Michigan Beaches in Lake County, Illinois. Great Lakes Beach Association Annual Meeting.
- USDA. Animal and Plant Health Inspection Service. Wildlife Services. National Wildlife Research Center. 2010. Unpublished report. *Economic Effects of Wildlife Services Gull Damage Management on Chicago Swim Bans*. Fort Collins, CO: APHIS, 2 pages
- Vermeer, K. 1970. Breeding biology of California and Ring-billed Gulls: a study of ecological adaptations to the inland habitat. Report Series Number 12. Environment Canada, Canadian Wildlife Service, Ottawa.
- Weseloh, D. V. 1984. The origins of banded Herring Gulls recovered in the Great Lakes region. *Journal of Field Ornithology* 55:190 – 195.
- Whitman, R. L., and M. B. Nevers. 2003. Foreshore sand as a source of *Escherichia coli* in nearshore water of a Lake Michigan beach. *Applied and Environmental Microbiology* 69:5555 – 5562.
- Whitman, R. L., M. B. Nevers, G. C. Korinek, and M. N. Byappanahalli. 2004. Solar and temporal effects on *E. coli* concentration at a Lake Michigan swimming beach. *Applied and Environmental Microbiology* 70: 4276 – 4285.
- Wright, S. 2010. Some Significant Wildlife Strikes to Civil Aircraft in the United States (1990 - April 2010). US Department of Agriculture/Animal and Plant Health Inspection Service/Wildlife Services. Sandusky, OH. May 5, 2010.

**Table 1. Number of ring-billed gull observation surveys within week blocks in 2007 through 2011 field seasons in Chicago, Illinois.**

Block	Dates	Number of Observations				
		2007	2008	2009	2010	2011
1	5/27-6/2	3	0	3	3	3
2	6/3-6/9	3	0	3	3	3
3	6/10-6/16	2	1	3	3	3
4	6/17-6/23	3	7	3	3	3
5 <sup>a</sup>	6/24-6/30	3	6	3	3	3
6 <sup>a</sup>	7/1-7/7	2	4	3	3	3
7 <sup>a</sup>	7/8-7/14	2	5	3	3	3
8 <sup>a</sup>	7/15-7/21	3	4	3	3	3
9 <sup>a</sup>	7/22-7/28	2	4	3	3	3
10 <sup>a</sup>	7/29-8/4	1	3	3	3	3
11	8/5-8/11	0	3	3	3	3
12	8/12-8/18	0	3	3	3	3
13	8/19-8/25	0	3	3	3	3
14	8/26-9/1	0	2	3	3	3
15	9/2-9/9	0	1	3	3	3

<sup>a</sup>Hatch-year and after hatch-year gull analysis conducted on observation blocks 5-10

**Table 2. The proportion of water samples on Chicago’s beaches from 2006 – 2011 that exceeded established water quality standards<sup>1</sup>, where 2006 represents a pre-egg oiling treatment baseline year.**

Beach	Proportion of tests resulting in swim advisories or bans						2006 vs. 2011
	2006	2007	2008	2009	2010	2011	p-values
Juneway	0.09	0.10	0.14	0.03	0.04	0.06	0.38
Rogers	0.08	0.07	0.12	0.03	0.04	0.06	0.54
Howard	0.08	0.08	0.13	0.03	0.09	0.07	0.75
Jarvis/Fargo	0.08	0.11	0.11	0.01	0.10	0.06	0.57
Leone/Loyola	0.13	0.08	0.07	0.08	0.07	0.07	0.19
Hollywood/Osterman	0.18	0.16	0.10	0.12	0.19	0.11	0.25
Montrose	0.24	0.28	0.25	0.23	0.21	0.23	0.81
North Avenue	0.11	0.20	0.00	0.06	0.03	0.08	0.56
Oak Street	0.09	0.21	0.04	0.03	0.11	0.05	0.36
Ohio Street	0.13	0.18	0.09	0.11	0.07	0.14	0.77
12th Street	0.22	0.10	0.07	0.15	0.13	0.15	0.25
31st Street	0.27	0.41	0.17	0.13	0.21	0.17	0.14
South Shore	0.21	0.26	0.15	0.16	0.31	0.22	0.96
Rainbow	0.22	0.41	0.19	0.27	0.24	0.24	0.7
Calumet	0.28	0.41	0.17	0.23	0.22	0.16	0.0833

Beach	Proportion of tests resulting in swim advisories or bans at canine harassment locations						2006 vs. 2011
	2006	2007	2008	2009	2010	2011	p-values
Foster	0.19 <sup>2</sup>	0.21 <sup>2</sup>	0.14	0.08	0.10	0.04	0.006
57th Street	0.23	0.26	0.00 <sup>3</sup>	0.33	0.13 <sup>2</sup>	0.14 <sup>2</sup>	0.16
63rd Street	0.50	0.57 <sup>2</sup>	0.06 <sup>3</sup>	0.57	0.21 <sup>3</sup>	0.11 <sup>3</sup>	<.0001

1. Swim advisories and bans from Illinois Department of Public Health Database

<http://app.idph.state.il.us/envhealth/ilbeaches/public/>

2. Intermittent canine harassment.

3. Full-time canine harassment.

**Table 3. Estimated number of ring-billed gull nests and eggs oiled at Dime Pier/DuSable Harbor Breakwall and Lake Calumet, Chicago, Illinois, in 2007 through 2011.**

	Total Number of Ring-billed Gull Nests					Number of Nests Removed or Oiled					Number of Eggs Removed or Oiled					Untreated Nests				
	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
Dime Pier/ DuSable Harbor Breakwall	3,797	4,727	4,668	5,292	5,139	3,470	3,773	3,750	3,954	4,223	8,764	9,554	8,889	10,285	10,398	327	954	918	1,338	916
Lake Calumet	31,395 <sup>1</sup>	22,918	21,355	0	3,454	15,000	18,363	17,391	0	2,933	41,753	48,036	41,244	0	6,663	16,395	4,555	3,964	0	521
Total	35,192	27,645	26,023	5,292	8,593	18,470 (52) <sup>2</sup>	22,136 (80)	21,141 (81)	3,954 (75)	7,156 (83)	50,517	57,590	50,133	10,285	17,061	16,722	5,509	4,882	1,338	1,437

<sup>1</sup> 2007 nests totals were estimated for Lake Calumet.

<sup>2</sup> Estimated percentage of nests oiled.

**Table 4. Number of ring-billed gull and herring gull nests and eggs oiled or removed at the three rooftop colonies during 2011.**

2011	Rooftop #1								Rooftop #2				Rooftop #3			
	Ring-billed Gulls				Herring Gulls				Ring-billed Gulls		Herring Gulls		Ring-billed Gulls		Herring Gulls	
	Nests Oiled	New Nests	Eggs Oiled	New Eggs	Nests Oiled	New Nests	Eggs Oiled	New Eggs	Nests Removed	Eggs Removed	Nests Removed	Eggs Removed	Nests Removed	Eggs Removed	Nests Removed	Eggs Removed
4/29											24	67				
5/4	893	893	1,916	1,916	115	115	307	307					377	903		
5/5													1,741	4,293		
5/6													261	685		
5/10													1,400	3,463	69	195
5/11													331	482	20	54
5/16									1	3	33	69				
5/18	1,754	861	4,613	2,697	139	24	375	68								
5/20													107	208	7	13
5/31	1,487	0	3,856	0	114	0	141	0								
6/2													71	139	65	159
6/3													19	45	1	2
6/8											30	78				
6/28													28	41	41	81
7/1											7	15				
Reportable Sum		1,754		4,613		139		375	1	3	94 <sup>1</sup>	229 <sup>1</sup>	4,335 <sup>1</sup>	10,259 <sup>1</sup>	203 <sup>1</sup>	504 <sup>1</sup>

<sup>1</sup> Nests and eggs reported at rooftop #2 and #3 are greater than the actual colony size due to gulls re-nesting during the removal period.

**Table 5. Mean number of hatch-year, after hatch-year, and total ring-billed gulls observed on beaches without canine harassment per observational survey in Chicago, Illinois during weeks 5-10 of the observation period in 2007, 2008, 2009, and 2010. Percentage change for 2008, 2009, 2010, and 2011 in comparison to 2007 are shown in parentheses.**

Beach	Year	Hatch-Year	After Hatch-Year	Total
Leone/Loyola Beach	2007	41.7	79.2	120.9
	2008	16.1(-62)	71.1(-10)	87.1(-28)
	2009	8.8(-79)	114.4(44)	123.2(2)
	2010	11.9(-72)	58.3(-26)	70.2(-42)
	2011	5.1(-88)	68.8(-13)	73.9(-39)
Hollywood/Osterman Beach	2007	114.1	204.4	318.5
	2008	22.2(-81)	216.0(06)	238.2(-25)
	2009	6.8(-94)	161.8(-21)	168.6(-47)
	2010	11.4(-90)	121.7(-40)	133.1(-58)
	2011	5.1(-96)	98.3(-52)	103.4(-68)
Montrose Beach	2007	205.5	314.8	520.3
	2008	46.6(-77)	313.3(0)	360.0(-31)
	2009	20.0(-90)	222.7(-29)	242.7(-53)
	2010	36.0(-82)	302.7(-4)	338.7(-35)
	2011	19.8(-90)	350.1(11)	369.9(-29)
North Avenue Beach	2007	83	155.7	238.7
	2008	12.2(-85)	130.2(-16)	142.5(-40)
	2009	9.7(-88)	145.0(-07)	154.7(-35)
	2010	15.6(-81)	161.5(4)	177.1(-26)
	2011	9.5(-89)	173.4(11)	182.9(-23)
Oak Street Beach	2007	4.1	13.2	17.3
	2008	0.4(-91)	7.2(-45)	7.6(-56)
	2009	0.6(-85)	15.8(20)	16.4(-5)
	2010	1.2(-71)	7.8(-41)	9.0(-48)
	2011	0.7(-83)	8.9(-33)	9.6(-45)
Ohio Street Beach	2007	0.4	5.9	6.3
	2008	0.3(-26)	4.3(-26)	4.6(-26)
	2009	0.1(-87)	4.4(-25)	4.4(-29)
	2010	0.3(-20)	7.2(23)	7.6(20)
	2011	0.2(-50)	7.1(20)	7.3(16)
12th Street Beach	2007	28.9	57.8	86.8
	2008	16.3(-44)	82.3(42)	98.6(14)
	2009	9.8(-66)	41.8(-28)	51.6(-41)
	2010	7.9(-73)	37.6(-35)	45.4(-48)
	2011	4.8(-83)	47.1(-19)	51.9(-40)
31st Street Beach	2007	86.3	93.3	179.5
	2008	28.1(-67)	129.9(39)	158.0(-12)
	2009	17.3(-80)	139.7(50)	156.9(-13)
	2010	16.1(-81)	47.3(-49)	63.4(-65)
	2011	12.1(-86)	89.3(-4)	101.4(-44)
Rainbow Beach	2007	137.9	183.2	321.1
	2008	39.4(-71)	263.4(44)	302.9(-6)
	2009	28.7(-79)	186.1(2)	214.8(-33)
	2010	33.9(-75)	190.4(4)	224.4(-30)
	2011	13.3(-90)	153.3(-16)	166.6(-48)
Calumet Beach	2007	180.1	84.8	264.9
	2008	38.3(-79)	56.3(-34)	94.6(-64)
	2009	17.4(-79)	63.6(-25)	80.9(-69)
	2010	27.8(-85)	60.7(-28)	88.4(-67)
	2011	10.2(-94)	74.3(-12)	84.6(-68)

Beach	Year	Hatch-Year	After Hatch-Year	Total
Total	2007	882	1192.2	2074.2
	2008	219.9(-75)	1274.1(7)	1494.1(-28)
	2009	119.1(-86)	1095.2(-8)	1214.3(-41)
	2010	162.1(-82)	995.2(-17)	1157.3(-44)
	2011	75.8(-91)	1070.8(-10)	1151.6(-44)

**Table 6. P value of year by week interaction between 2007, 2008, 2009, 2010, and 2011 hatch year, after hatch-year, and total ring-billed gull use of beaches without canine harassment during weeks 5-10.**

Beach	Hatch-Year			After Hatch-Year			Total		
	year	week	yr*wk	year	week	yr*wk	year	week	yr*wk
Loyola	<.0001	<.0001	.0749	.0004	.88	.45	.0009	.13	.72
Kathy Osterman	<.0001	<.0001	<.0001	<.0001	.0055	.74	<.0001	<.0001	.51
Montrose	<.0001	<.0001	<.0001	.0215	.15	.23	<.0001	.0008	.0547
North Avenue	<.0001	<.0001	.0013	.30	.0001	.0473	.0184	<.0001	.14
Oak Street	<.0001	<.0001	<.0001	.0539	.0018	.0195	.0256	<.0001	.0059
Ohio Street	.51	.0828	.0717	.43	.30	.0383	.43	.24	.0252
12 <sup>th</sup> Street	<.0001	.0002	.0332	.0367	.18	.74	.0158	.84	.80
31 <sup>st</sup> Street	<.0001	<.0001	<.0001	.0009	.60	.96	.0002	.31	.78
Rainbow	<.0001	<.0001	<.0001	.0158	.0993	.34	.0005	.63	.0555
Calumet	<.0001	<.0001	<.0001	.72	.0214	.50	<.0001	<.0001	.0007

**Table 7. Mean number of total ring-billed gulls observed at 63<sup>rd</sup> Street beach with and without canine harassment in Chicago, Illinois during 2011.**

Gulls Observed at 63rd Street Beach		
Location	Non-Harassment Periods	Harassment Periods
Near Shore <sup>1</sup>	0.2 (n=15)	11.1 (n=30)
Park <sup>1</sup>	54.7 (n=15)	5.3 (n=30)
Beach <sup>2</sup>	159.5 (n=15)	6.2 (n=30)
Casino Pier <sup>2</sup>	31.0 (n=15)	9.3 (n=22)
59th Street Pier <sup>2</sup>	30.9 (n=15)	96.5 (n=22)

<sup>1</sup> Canines did not have access to this area.

<sup>2</sup> Canines had access to this area.

**Table 8. The number and percentage of responses from fully completed surveys from beachgoers during the 2011 swim season in Chicago, Illinois.**

Beachgoers Response	Swim Ban Knowledge	Connection Between Droppings and Bans	Noticed Signs or Posters	Pledge	Live In Chicago
"Yes"	1527	1018	1216	4171	3075
"No"	2810	3319	3121	166	1262
% "Yes"	35%	23%	28%	96%	71%

**Table 9. The number and percentage of responses from beachgoers regarding educational signage from fully completed surveys during the 2011 swim season in Chicago, Illinois.**

Beachgoers Response	Noticed Signs or Posters		Did Not Notice Signs or Posters	
	Swim Ban Knowledge	Connection Between Droppings and Bans	Swim Ban Knowledge	Connection b/w Droppings and Bans
"Yes"	775	643	752	375
"No"	441	573	2369	2746
% "Yes"	64%	53%	24%	12%

**Table 10. The proportion of positive responses from beachgoers surveyed during three assessment periods at the seven analyzed beaches in Chicago, Illinois during 2011.**

Did you know that the Chicago Park District sometimes issues swim bans or swim advisories due to water quality issues?				
Beach	Period 1	Period 2	Period 3	p-value
12 <sup>th</sup> Street	51.0 (n=98)	5.4(n=314)	43.6(n=445)	<.0001
63 <sup>rd</sup> Street	44.8(n=183)	45.3(n=95)	*	.94
Calumet	15.2(n=105)	43.3(n=164)	25.0(n=4)	<.0001
Foster Avenue	62.2(n=317)	11.4(n=35)	46.2(n=212)	<.0001
Montrose	35.9(n=357)	26.4(n=53)	29.7(n=101)	.26
North Avenue	18.0(n=267)	15.2(n=66)	11.6(n=95)	.34
Rainbow	*	73.0(n=285)	45.3(n=232)	<.0001

Did you know that gull droppings contribute to the water contamination causing the bans or advisories?				
Beach	Period 1	Period 2	Period 3	p-value
12 <sup>th</sup> Street	52.0	6.1	22.5	<.0001
63 <sup>rd</sup> Street	32.8	26.3	*	.27
Calumet	17.1	27.4	25.0	.15
Foster Avenue	33.4	14.3	33.0	.0659
Montrose	25.8	9.4	25.7	.0313
North Avenue	17.2	9.1	10.5	.11
Rainbow	*	30.2	27.2	.45

Have you noticed educational signs and posters discouraging the feeding of gulls?				
Beach	Period 1	Period 2	Period 3	p-value
12 <sup>th</sup> Street	27.6	7.0	26.1	<.0001
63 <sup>rd</sup> Street	34.4	31.6	*	.63
Calumet	19.1	42.7	25.0	.0003
Foster Avenue	29.0	8.6	45.3	<.0001
Montrose	35.6	28.3	31.7	.50
North Avenue	21.0	15.2	20	.57
Rainbow	*	26.3	30.2	.33

\* Surveys were not collected during all three assessment periods at 63<sup>rd</sup> Street and Rainbow beaches.

**Table 10. The number and percentage of responses from beachgoers that visit beaches once a month or less and from beachgoers that visit beaches more than once a month during the 2011 swim season in Chicago, Illinois.**

Beachgoers Response	Visit once a month or less			Visit more than once a month		
	Swim Ban Knowledge	Connection Between Droppings and Bans	Noticed Signs or Posters	Swim Ban Knowledge	Connection Between Droppings and Bans	Noticed Signs or Posters
"Yes"	388	274	354	919	543	574
"No"	969	1083	1003	980	1356	1325
% "Yes"	29%	20%	26%	48%	29%	30%

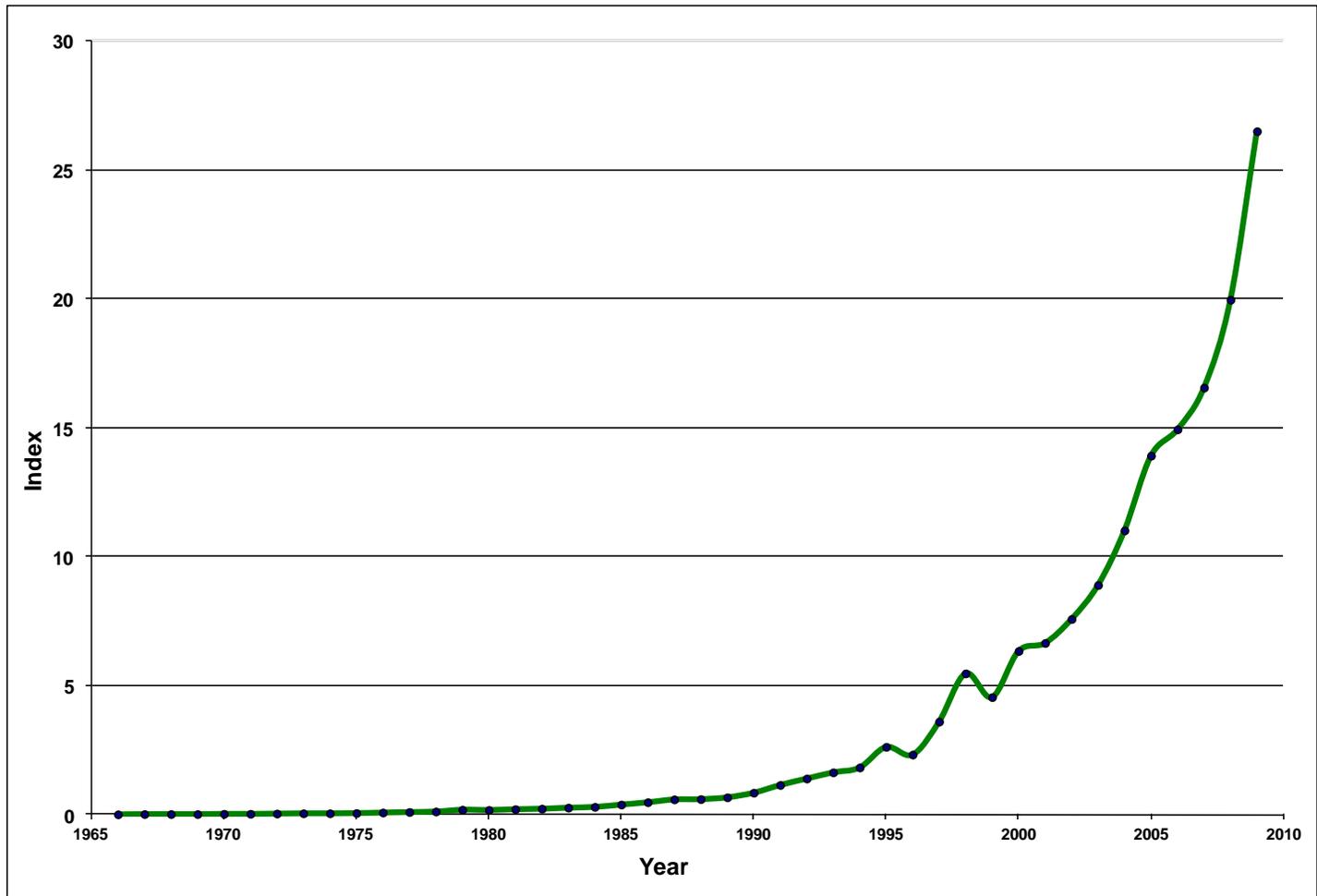


Figure 1. Breeding Bird Survey annual population indices for ring-billed gulls in Illinois from 1966-2009 from Sauer et al. (2011).

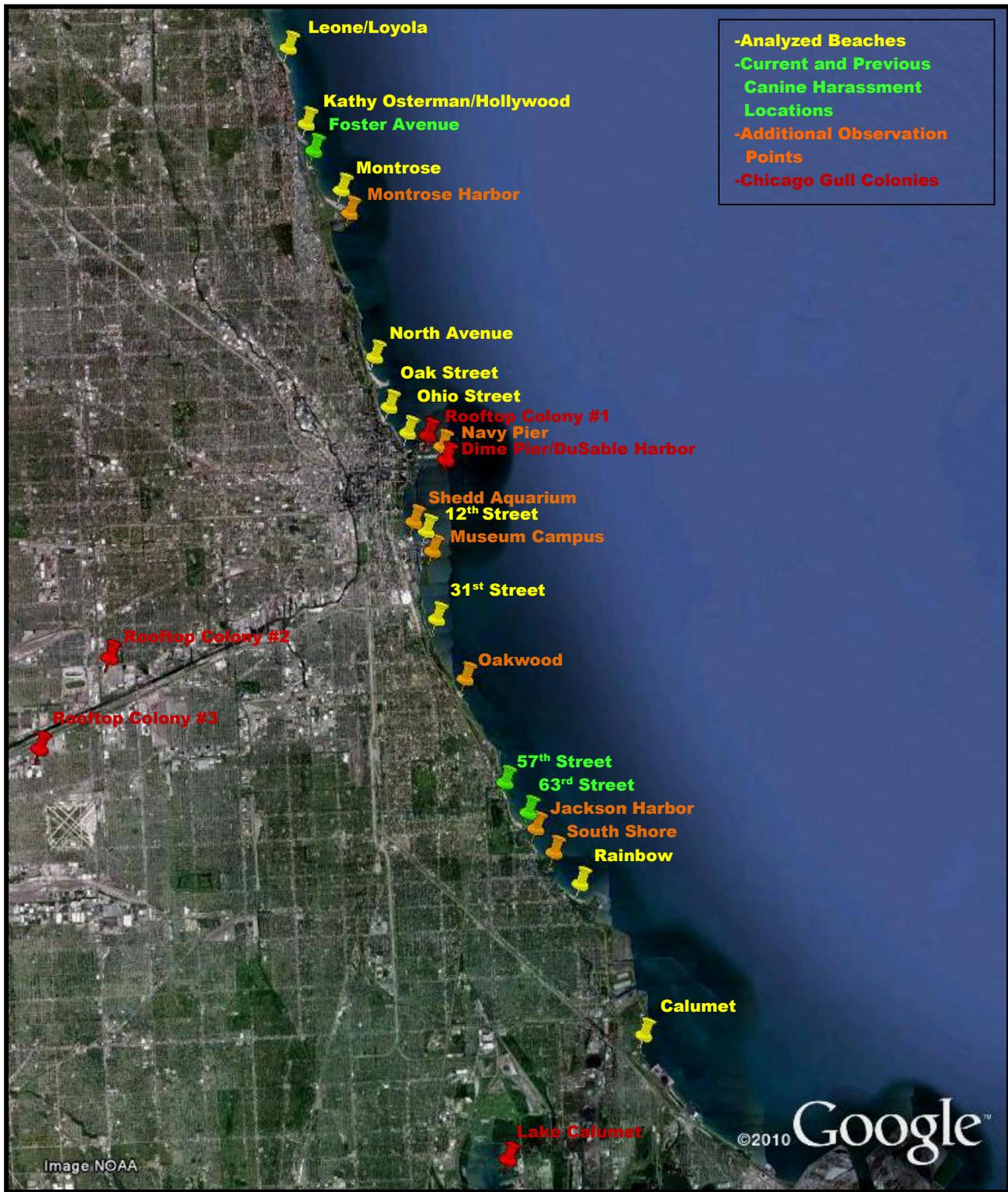


Figure 2. Observation points in Chicago, Illinois and ring-billed gull colony locations (Map courtesy of Google Earth).

# HELP PREVENT SWIM BANS!

## HELP KEEP OUR BEACHES HEALTHY AND PREVENT SWIM BANS

- Don't Feed the Birds
- Don't litter. Garbage, especially leftover food, can attract gulls and other wildlife to beaches, resulting in water contamination.
- Bird waste contaminates the sand and water, which can result in swim bans and advisories and may even make people sick.
- Feeding birds people food is not good for the birds! If you would like to view or help birds in Chicago, try setting up a bird feeder in your yard, volunteer to rescue birds injured by collisions with buildings, or join a local bird club.
- Feeding birds on Chicago's beaches is illegal and carries a fine of up to \$500.

### Other Things You Can Do:

- Put small children in waterproof diapers and change diapers frequently.
- Keep dogs in designated areas and please pick up after your dog.
- Don't swim if you are feeling sick.



Birds eat.



Birds poop.



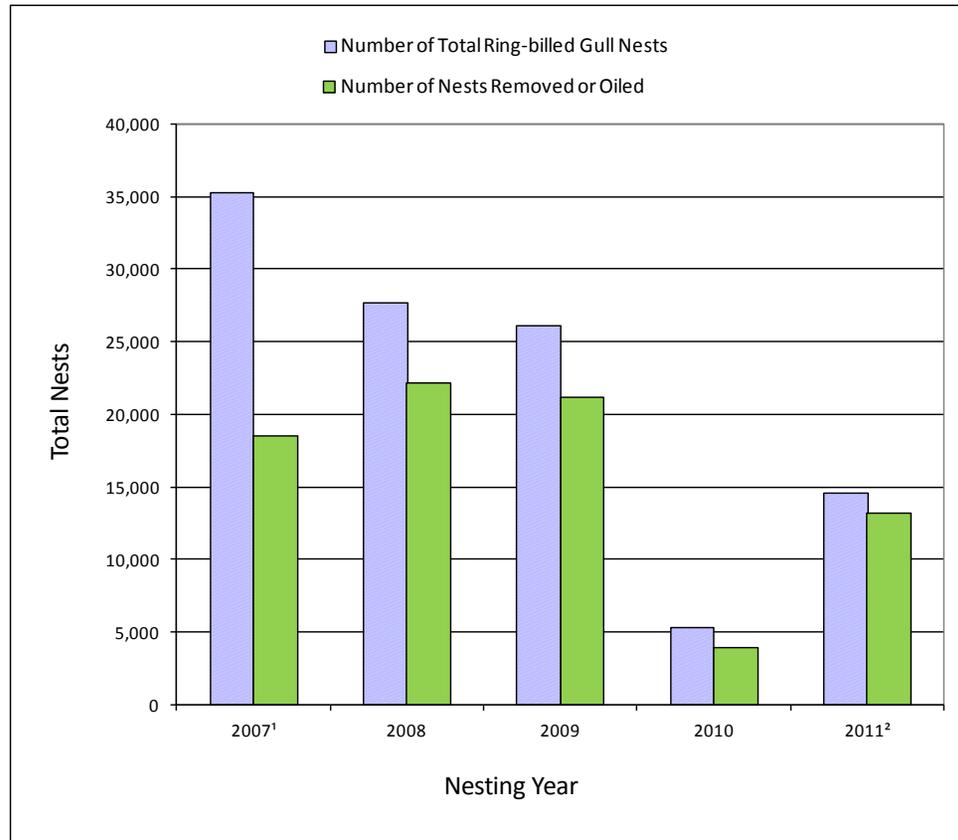
Swim bans happen.

## PLEASE DON'T FEED THE BIRDS. PLEASE DON'T LITTER.

For more information about beaches, visit [www.chicagoparkdistrict.com/resources/beaches](http://www.chicagoparkdistrict.com/resources/beaches).  
For more information about birds in Chicago, visit [www.cityofchicago.org/Environment](http://www.cityofchicago.org/Environment).



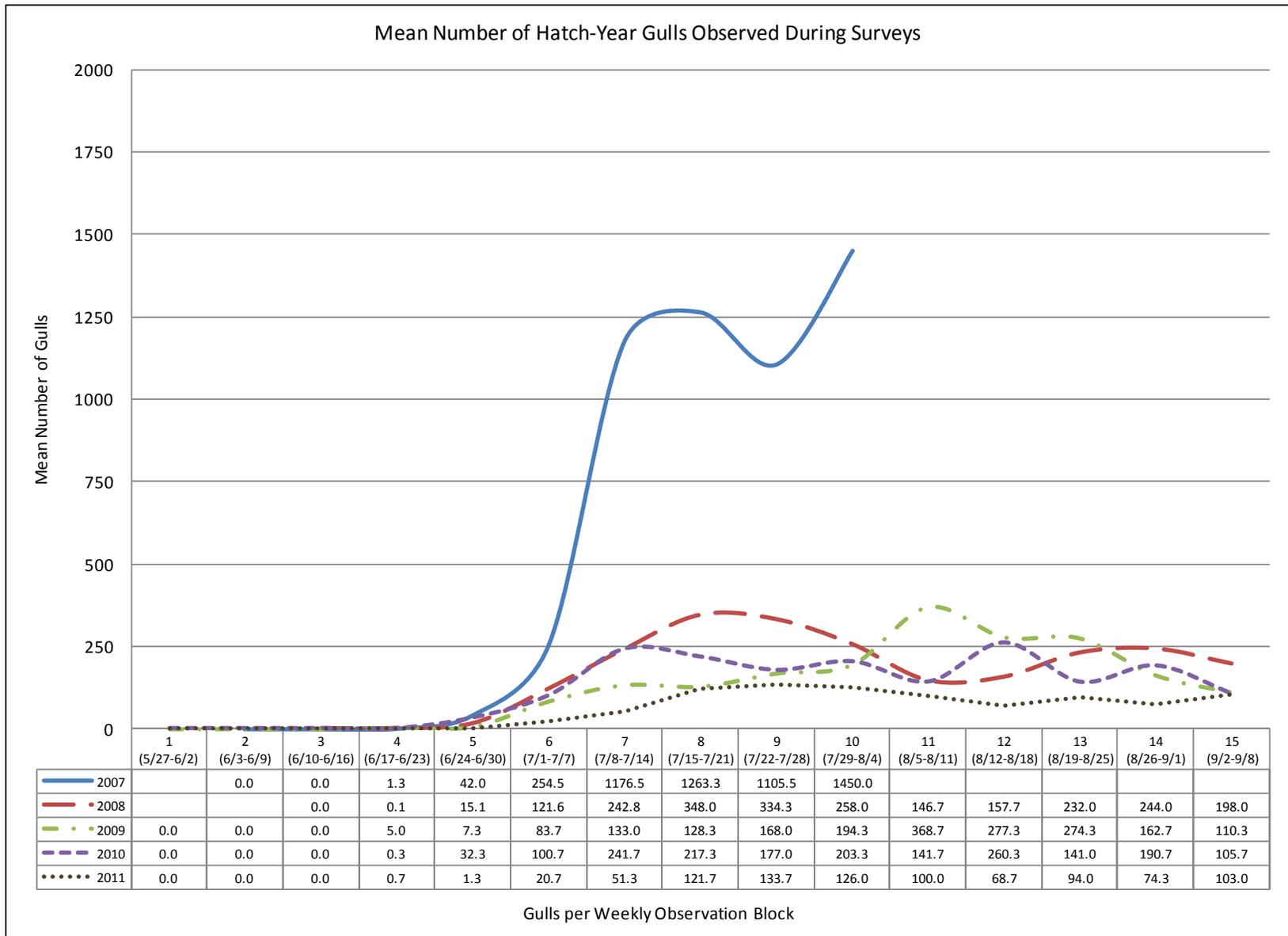
Figure 3. Chicago Park District poster used to increase beachgoers knowledge of water quality issues and provide guidance to patrons on what they can do to improve beach health.



<sup>1</sup> 52 percent of the total nests in 2007 were estimated. In 2008, 2009, 2010, and 2011 all nests were physically counted.

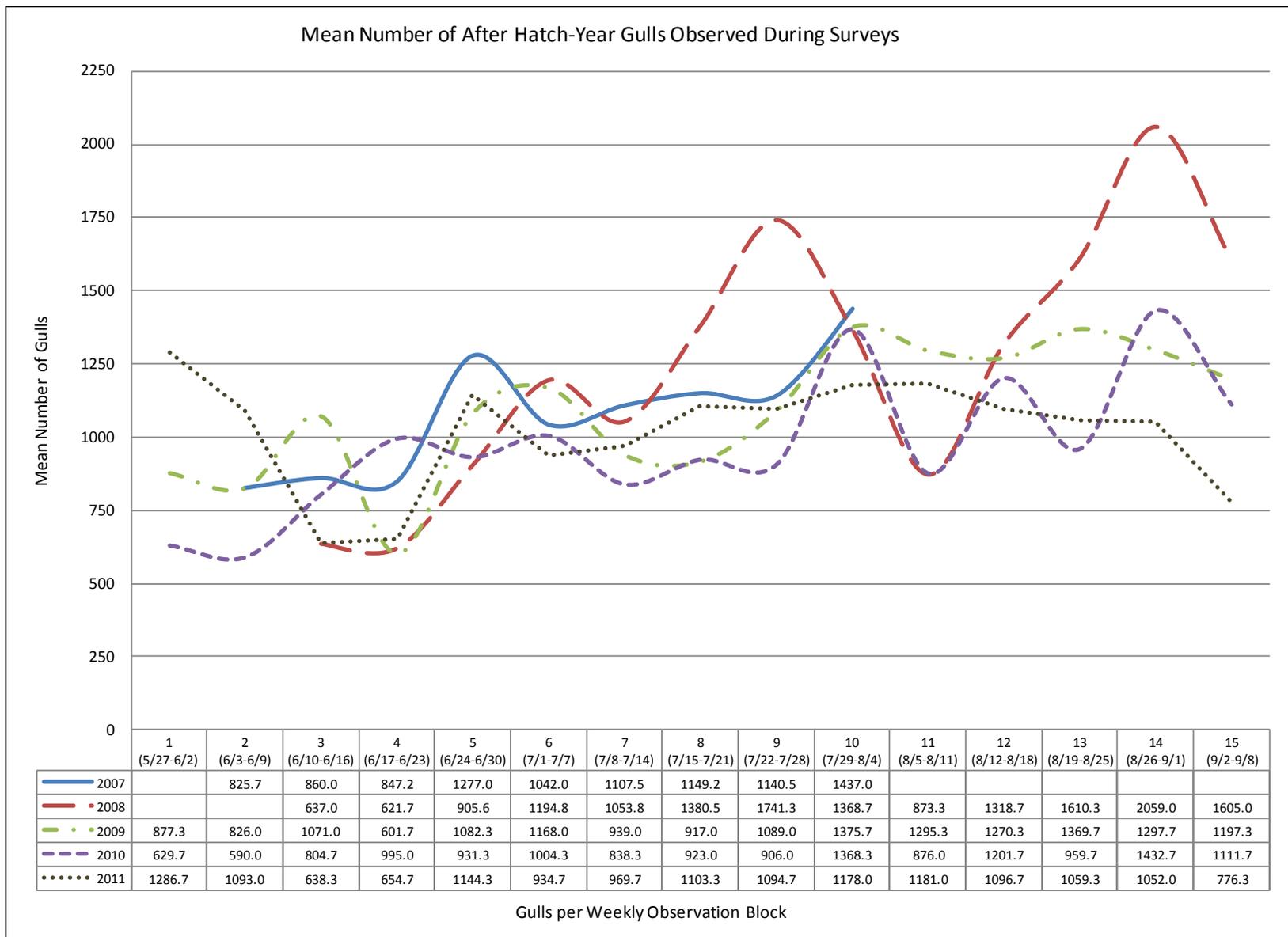
<sup>2</sup> The "Number of Total Ring-billed Gull Nests" and "Number of Nests Removed or Oiled" in 2011 is likely greater than the actual colony size due to gulls renesting during the removal period.

**Figure 4. Total number of nests and eggs oiled or removed in Chicago between 2007 and 2011.**



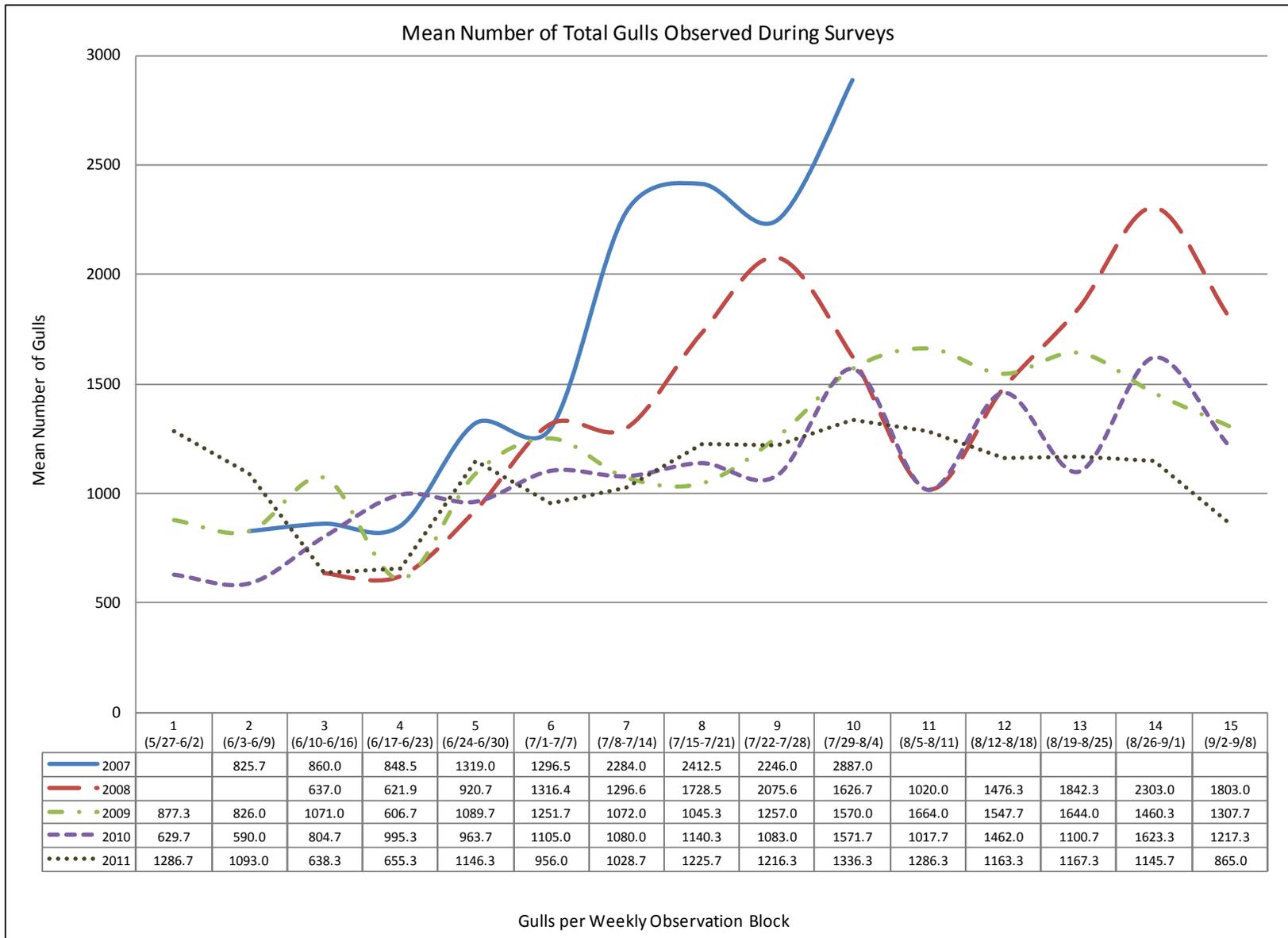
Please note: Observations were not conducted for the entire swim season in 2007 and 2008.

**Figure 5. Mean number of hatch-year ring-billed gulls observed at ten Chicago beaches per weekly observation block during 2007-2011.**



Please note: Observations were not conducted for the entire swim season in 2007 and 2008.

**Figure 6. Mean number of after hatch-year ring-billed gulls observed at ten Chicago beaches per weekly observation block during 2007-2011.**



Please note: Observations were not conducted for the entire swim season in 2007 and 2008.

**Figure 7. Mean number of total ring-billed gulls observed at ten Chicago beaches per weekly observation block during 2007-2011.**