Beneficial Use Impairment Removal Project

Niagara River Area of Concern
Heron and Osprey Nesting Success and Productivity Monitoring
Year 4 (2017) Survey Report

Final - January 12, 2018

Beneficial Use Impairment Removal Project

Niagara River Area of Concern
Heron and Osprey Nesting Success and Productivity Monitoring

Year 4 (2017) Survey Report

January 12, 2018

Prepared for:
United States Fish and Wildlife Service (USFWS)
New York Field Office (NYFO)
3817 Luker Road
Cortland, NY 13045

New York State Department of Environmental Conservation (NYSDEC)
270 Michigan Avenue
Buffalo, NY 14203

Prepared by:
NewEarth Ecological Consulting, LLC
169 Watson Mill Road
Saco, ME 04072
207.286.3259

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF GRAPHS

1.0 INTRODUCTION

1.1 BACKGROUND

In 1987 the governments of the United States (U.S.) and Canada identified several areas within the Great Lakes region where environmental degradation had occurred due to historic pollution and habitat degradation. The areas were identified and designated for remediation and restoration and referred to as Areas of Concern (AOC). Remedial Action Plans (RAPs) were developed for each AOC and each RAP identified beneficial use impairments (BUI) (i.e., negatively affected chemical, physical and/or biological properties associated with the AOC) that required restoration or remediation to remove the impairment from the list of BUIs associated with AOCs. The 37-mile long Niagara River waterway flows from Lake Erie to Lake Ontario and was identified as one of the forty-three AOCs for the Great Lakes region. The Niagara River AOC (NR AOC) is divided into two portions which are managed separately; the New York portion located on the U.S. side of the river and the Ontario portion located on the Canadian side of the river. On the U.S. side, the NR AOC extends from Smokes Creek in Buffalo Harbor north to the Niagara River's mouth at Lake Ontario (Figure 1).

The New York State Department of Environmental Conservation (NYSDEC) is currently funded by the U.S. Environmental Protection Agency (USEPA) to coordinate the Niagara River RAP. Because the Niagara River AOC is a binational AOC the NYSDEC is coordinating technical assessments and regulatory efforts with the Canadian Niagara River RAP managers. A RAP was developed for the New York portion of the NR AOC (NYSDEC 1994) and identifies and provides the rationale and subsequent remediation plans for several BUIs. A 2012 addendum to the RAP (NR AOC Stage 2 Addendum) describes updated BUI-specific delisting criteria. Included in the delisting criteria for the "Degradation of Fish and Wildlife Populations" BUI are assessments of 5-year trends in populations of sentinel native species representing the range of trophic levels within aquatic ecosystems (Filipski 2012). In 2012 the U.S. Fish and Wildlife Service (USFWS) New York Field Office (NYFO) was contacted by the USEPA Great Lakes National Program Office (GLNPO) to conduct assessments to evaluate trends of nesting success and productivity of NR AOC herons and Osprey (*Pandion haliaetus*), American Ornithological Society (AOS) alphanumeric code OSPR (AOS 2017), to support a determination of the status of the "Degradation of Fish and Wildlife Populations" BUI. These species are identified as sentinel native species and represent the top of the aquatic food chain within the Niagara River aquatic ecosystem.

In February 2014, the NYFO and NYSDEC issued a Scope of Work for performance of NR AOC Heron and Osprey Nesting Success and Productivity Monitoring (USFWS 2014). In April 2014, a plan was developed following the criteria outlined in the Scope of Work. The plan identified the survey protocols to be used over a 5-year period (2014-2018) for assessing the "Degradation of Fish and Wildlife Populations" BUI within the NR AOC and is hereafter referred to as the "Work Plan" (NewEarth 2015a). The Work Plan specifically identifies methods used for monitoring nesting success and productivity of OSPR and several heron species of interest and known to occur in the NR AOS, and includes: Great Egret (*Ardea alba*), AOS code GREG; Great Blue Heron

(*Ardea herodias*), AOS code GBHE; and, Black-crowned Night-heron (*Nycticorax nycticorax*), AOS code BCNH (AOS 2017).

This report provides a summary of the Year-4 (2017) sampling effort conducted in support of the 2014-2018 NR AOC Heron and Osprey Nesting Success and Productivity Monitoring Project (Project). Section 2.0 of this report provides a summary of the methods used, Section 3.0 provides survey results and a discussion is provided in Section 4.0. Appendices include photographs (Appendix A), completed 2017 nest monitoring data forms from heron (Appendix B) and OSPR (Appendix C) survey efforts.

1.2 STUDY AREA

This study focused on the New York portion of the NR AOC located on the U.S. side of the Niagara River and extending from Tifft Nature Preserve near Buffalo Harbor north to the mouth of the Niagara River at Lake Ontario (Figure 1).

2.0 METHODS

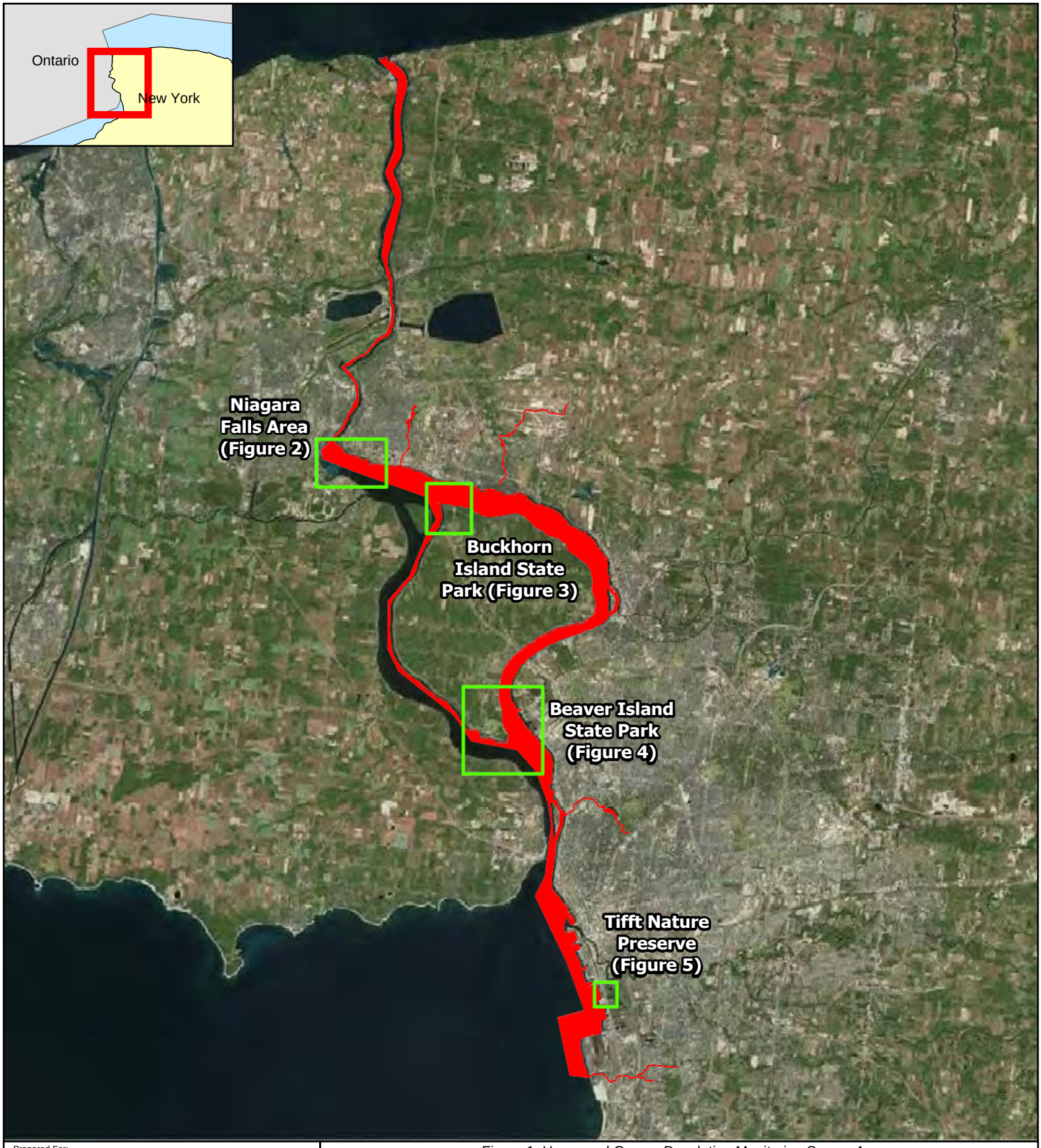
Heron and OSPR surveys were conducted in accordance with the approved Beneficial Use Impairment Removal Project, Niagara River Area of Concern Heron and OSPR Population Monitoring Work Plan (Work Plan) 2014-2018 (NewEarth 2015a). The Work Plan was adapted from several sources that are intensively involved in heron and raptor nest monitoring efforts applicable to the Niagara River area, including Moul et al. 2001, Steenhof and Newton 2007, Vennesland 2000, Vennesland and Butler 2004, and Vennesland and Norman 2006.

Survey efforts conducted in support of this Project were performed by biologists skilled in the identification of OSPR, heron, and due to the potential threat from this species to heron rookery nesting success, Double-crested Cormorant (*Phalacrocorax auritus*), AOS alpha code DCCO (AOS 2017). Each biologist was well-versed on the life histories of each species as presented in Hatch and Weseloh 1999, Hothem, et al. 2010, Mccrimmon et al. 2011, Poole et al. 2002, and Vennesland and Butler 2011, and experienced in the survey of avian species. Survey locations, field methodologies and field efforts were closely coordinated with, and based upon recommendations from, USFWS representative Amy Roe and NYSDEC representatives Connie Adams, Jennifer Dunn and Mark Filipski. The Work Plan should be referenced for additional details regarding the survey methodology used in this study.

2.1 HERON SURVEYS

2.1.1 Survey Locations

Per USFWS requirements (USFWS 2014) heron survey efforts specifically targeted three heron species; GREG, GBHE and BCNH. Through a review of Google Earth™ imagery, coordination with NYSDEC and USFWS, and following a broad reconnaissance level survey of the NR AOC initially conducted on March 25-26, 2014 and repeated each survey season to identify new locations (Figure 1), three potential nest site (e.g., rookery) locations have been identified in the general AOC for these species.



Prepared For:
US Fish and Wildlife Service
NY Department of Environmental Conservation

Prepared By:
NewEarth
ECOLOGICAL CONSULTING, LLC

Source: NewEarth Ecological Consulting, 2015; Esri, DigitalGlobe, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Date: 12/5/2016

Figure 1. Heron and Osprey Population Monitoring Survey Areas

Niagara River Area of Concern
2014 - 2018
Marsh Anuran and Avian Population Monitoring
Niagara and Erie Counties, NY

Legend

Study Area

Potential Heron and Osprey Nesting Areas

N

0 1 2 4 Miles

Heron survey locations included: Buckhorn Weir, a manmade diversion weir located to the northwest of Buckhorn Island State Park (north end of Grand Island, NY); Motor Island, also known as Pirate's Island located 1,300 feet to the east of Beaver Island State Park (south end of Grand Island, NY); and, Strawberry Island located 3,500 feet to the southeast of Motor Island. (Table 1, and Figures 3 and 4). A fourth location along the Canadian border was identified as a potential rookery site, but was determined to be outside of the survey area and was excluded from all survey efforts (Figure 2). Each of the three sites are monitored during the annual survey for evidence of breeding activity. However, as was the case in all previous years of survey, nest monitoring data was only collected at the Motor Island site in 2017 due to lack of heron activity at other sites.

Table 1. Location of Sites Monitored for Heron Nesting Activities-2017.

Site Name	Site ID	Nearest Town	Latitude	Longitude
Motor Island (aka Pirate's Island)	H-1	Grand Island	42° 57' 51.24"N	78° 56' 03.83"W
Buckhorn Weir	H-2	Grand Island	43° 04' 03.78"N	79° 00' 22.08"W
Strawberry Island	H-3	Grand Island	42° 57' 18.54"N	78° 55' 27.38"W

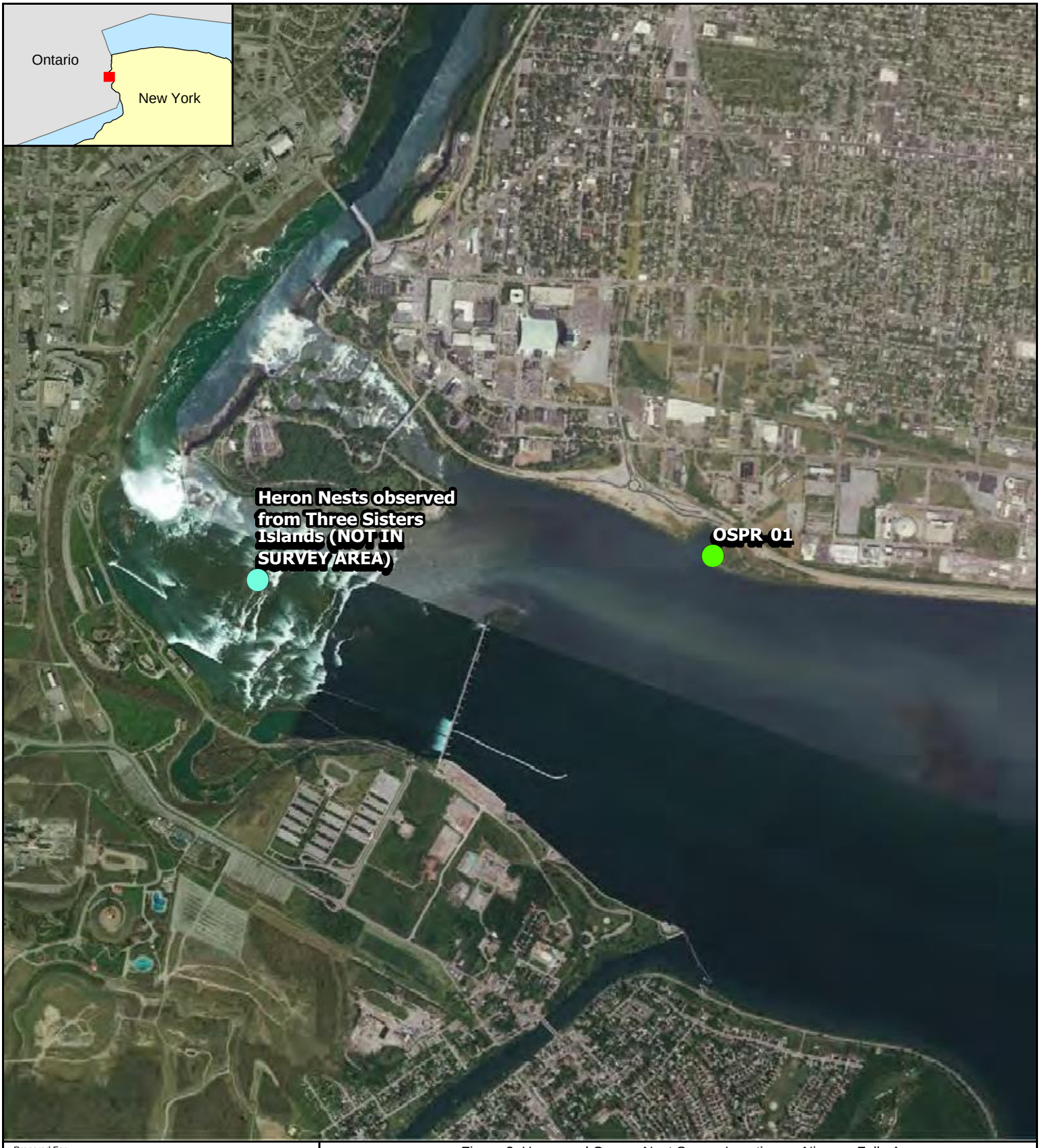
Biologists also established remote observation sites that offered views of potential rookery sites while minimizing disturbance to the birds: 1) Observation Point #1, located on a boat dock along the southeast shoreline of Grand Island (Figure 4); 2) Observation Point #2, located along the southeastern shoreline of Motor Island (Figure 4); and, Observation Point #3, located on a spit of land extending toward Buckhorn Weir (Figure 3).

2.1.2 Survey Periods

The primary goal of the heron nest monitoring effort was to collect information on target heron species to facilitate efforts to establish population estimates and to evaluate trends in the number of breeding adults for each species within the U.S. side of the NR AOC. Per approved survey guidelines identified in the Work Plan (NewEarth 2015a), and consistent with previous efforts (NewEarth 2015b, 2016a, b), multiple surveys were completed in 2017 within the recommended survey windows and included a pre-survey site reconnaissance and five nest monitoring events as shown in Table 2. Optimal seasonal timing varies from year to year depending on weather conditions and breeding chronology of the target birds and was taken into consideration when planning events. Survey dates were also selected to capture the variation in breeding phenology among coexisting species with a goal of increasing the probability of conducting at least one of the surveys during the seasonal peak in vocalization among all target heron species.

Table 2. 2017 Heron Nest Monitoring Survey Dates.

Survey Event	Survey Dates
General Site Reconnaissance	April 17, 2017
1	April 18, 2017
2	May 12, 2017
3	June 1, 2017
4	June 21, 2017
5	July 10, 2017



Prepared For:
US Fish and Wildlife Service
NY Department of Environmental Conservation

Prepared By:
NewEarth
ECOLOGICAL CONSULTING, LLC

Source: NewEarth Ecological Consulting, 2015; Esri, DigitalGlobe, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Date: 12/5/2016

Figure 2. Heron and Osprey Nest Survey Locations – Niagara Falls Area

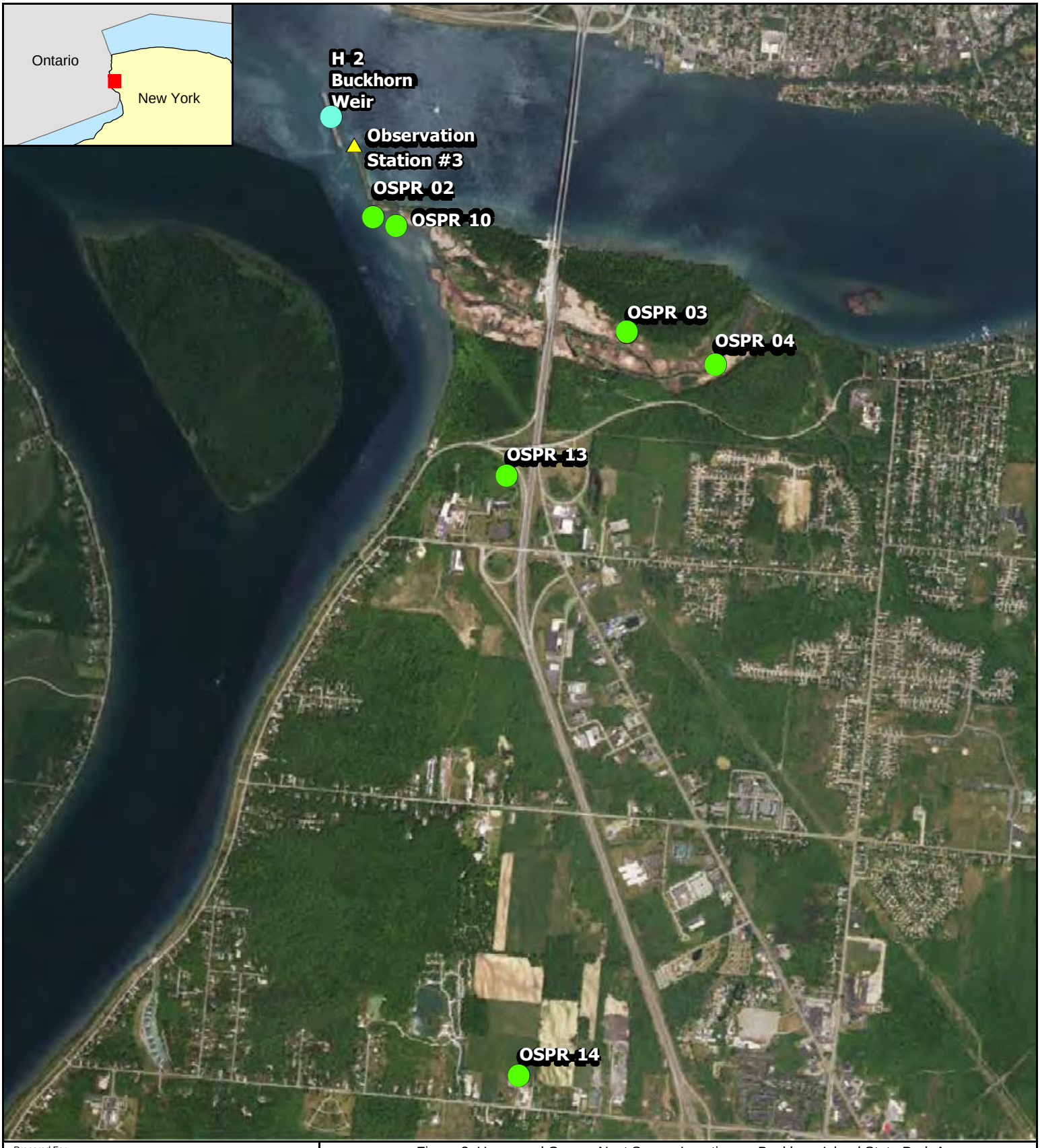
Niagara River Area of Concern
2014 - 2018
Marsh Anuran and Avian Population Monitoring
Niagara and Erie Counties, NY

Legend

Potential Osprey Nest Site

Potential Heron Nest Site

0 0.075 0.15 0.3 Miles



Prepared For:
US Fish and Wildlife Service
NY Department of Environmental Conservation

Prepared By:
NewEarth
ECOLOGICAL CONSULTING, LLC

Source: NewEarth Ecological Consulting, 2015; Esri, DigitalGlobe, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Date: 12/1/2017

Figure 3. Heron and Osprey Nest Survey Locations – Buckhorn Island State Park Area

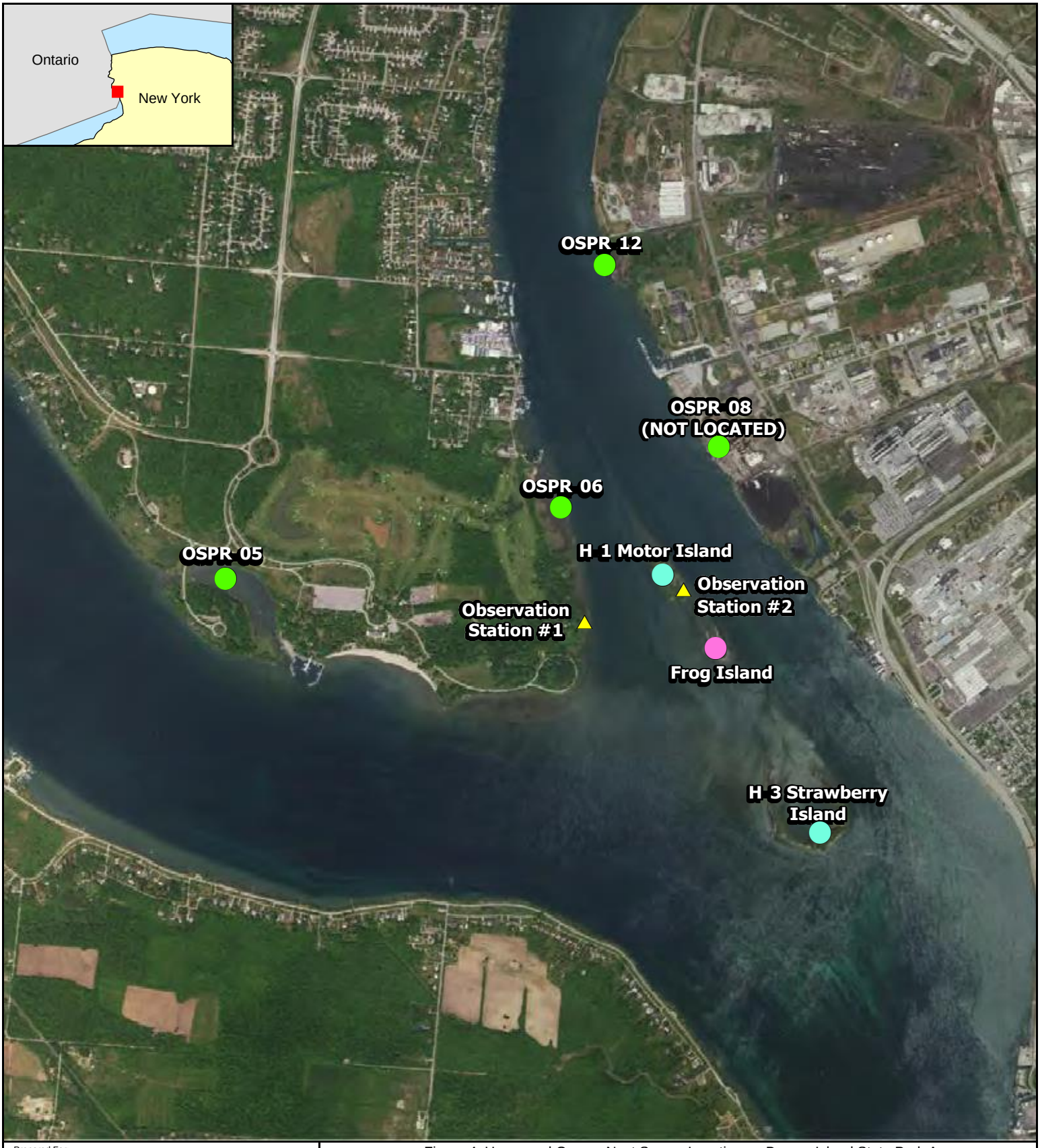
Niagara River Area of Concern
2014 - 2018
Marsh Anuran and Avian Population Monitoring
Niagara and Erie Counties, NY

Legend

- Potential Osprey Nest Site
- Potential Heron Nest Site
- Observation Station

N

0 0.1 0.2 0.4 Miles



Prepared For:
US Fish and Wildlife Service
NY Department of Environmental Conservation

Prepared By:
NewEarth
ECOLOGICAL CONSULTING, LLC

Source: NewEarth Ecological Consulting, 2015; Esri, DigitalGlobe, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Date: 12/5/2016

Figure 4. Heron and Osprey Nest Survey Locations – Beaver Island State Park Area

Niagara River Area of Concern
2014 - 2018
Marsh Anuran and Avian Population Monitoring
Niagara and Erie Counties, NY

Legend

- Potential Osprey Nest Site
- Potential Heron Nest Site
- Frog Island Restoration Site
- Observation Station

N

0 0.1 0.2 0.4 Miles

2.1.3 Productivity Monitoring

Nest monitoring efforts after the 2014 survey season followed a protocol that was modified slightly from the 2014 effort. The revised survey approach attempted to improve on nest detections and tracking throughout the monitoring effort by: 1) tracking productivity at a small subset of highly visible nests located along the eastern shoreline of the island; 2) conducting the count of overall nesting activity by species during each survey event, regardless of the nest location; and, 3) included monitoring/counts for DCCO in survey activities. In addition, per USFWS and NYSDEC approval, biologists accessed portions of the island perimeter on foot to get better visibility of nests. Movements within the island tended to cause some distress to the nesting birds and thus, biologists limited activities to locations along the perimeter of the island that did not cause disturbance to the herons.

Consistent with previous surveys, Motor Island was monitored five times during the breeding season (NewEarth 2015b, 2016a, b). The first visit in April was conducted after many adults had arrived on the rookery site and initiated courtship/breeding activities, but before many had begun incubation. For the second consecutive year, temperatures were unseasonably warm during early season survey efforts and no ice was present on the river. As a result, April surveys in 2016 and 2017 were conducted from all three remote observation stations as well as strategic locations on Motor Island and along its perimeter (Figure 4).

Surveys were scheduled to maximize the probability of determining nesting success for the highest number of nests, and in general took place approximately every three weeks during the incubation and nestling periods. Monitoring was performed during the afternoon when herons were most likely to be attending their nests, and on warm windless days. All data gathered during heron survey efforts were documented on the appropriate heron monitoring data forms (Appendix B).

Characterizing Nests

For each nest biologists made note of the species occupying the nest, even if the species was not one of the focal species (e.g. if a nest was being used by DCCO). If the nest was not occupied the nest was identified as “inactive”. Observers also made note of the nest status using the following notation scheme modified from Vennesland and Norman (2006):

AD Adult present at nest but not incubating
IN Incubating/Brooding
YN Young are visible in the nest
YB Young are present but have left nest
NV Not visible
FL Failed nest
IA Nest inactive (status unknown)

For nests that contained young the approximate age of the nestlings was recorded as follows (1 = 0-2 Weeks; 2 = 2-5 weeks; 3 = 5-8 weeks). Due to the sensitivity of colonies, observers spent the

minimum amount of time necessary to accurately assess the activity at the nest. Nests were only listed as "failed" if a breeding pair was confirmed to be using the nest site then visible evidence (e.g. the nest was destroyed, dislodged or only dead birds were seen in the nest) was observed to indicate that the nest was no longer in use.

Ageing Young

During survey activities observers noted the age of nestlings so that future visits could be timed to maximize the likelihood of determining success of each nest. As detailed in the Work Plan (NewEarth 2015a) at 0-2 weeks old GBHE nestlings are still covered in down and after a two-week period feathers begin to emerge. By five weeks of age nestlings can stand erect but primary feathers are still in pins. By six weeks of age primaries should have grown, but birds may still be flightless (Vennesland et al. 2011, Baicich and Harrison 1997). In GREGs and BCNHs the nestling period is slightly more advanced. Feathers start appearing after one week and by four weeks of age primaries have grown in (Hothem et al. 2010, Mccrimmon et al. 2011, Baicich and Harrison 1997).

Determining Nesting Success

Nests were considered to have been active if herons were seen attending the nest at least once during the breeding season. Nests were considered to have reached the incubating/brooding stage if at least one adult was present and sitting on the nest. Because of difficulty in determining nesting success once young leave the nest, young were considered to have fledged once they were seen on branches near the nest site or when they had reached fledging age (six weeks for GBHE and 4 weeks for GREG and BCNH). Nests were considered to have failed if incubating/brooding or nestlings were observed during at least one survey event but later were never determined to have fledged; or if failure could be determined after the season had ended (e.g. predated/abandoned eggs in the nest). Nests in which adults were observed attending to a nest, but met neither the "fledged" nor "fail" conditions were considered to have uncertain status as it could not be determined whether adults ever laid in the nest or not.

2.1.4 Photographic Documentation

Photographs were taken throughout the nest monitoring events to document the overall rookery setting, various stages of nesting activity and general features found on the island (Appendix A).

2.1.5 Unmanned Aircraft Systems (UAS) Monitoring

New to the 2017 heron rookery monitoring effort was the use of Unmanned Aircraft Systems (UAS) technology, also referred to as drones. UAS techniques were introduced into survey efforts to evaluate usefulness as an alternative, or supplement, to land-based visual surveys. UAS has the potential to be more economical, less obtrusive, safer, and a more efficient and versatile means to survey the Motor Island heron rookery. UAS missions were performed by a certified UAS Pilot and Drone Spotter from NewEarth, and were conducted under appropriate weather and safety conditions. Appropriate federal and state permits/approvals were acquired by NewEarth prior to flights. Missions followed Federal Aviation Administration regulations, provisions of the small

UAS Rule (Part 107), and local, state and federal permits/authorizations. Missions were immediately aborted if conditions became unsafe, or the UAS caused distress to the herons, or other wildlife species, more than that caused during typical survey efforts for the species.

2.2 OSPREY SURVEYS

2.2.1 Survey Locations

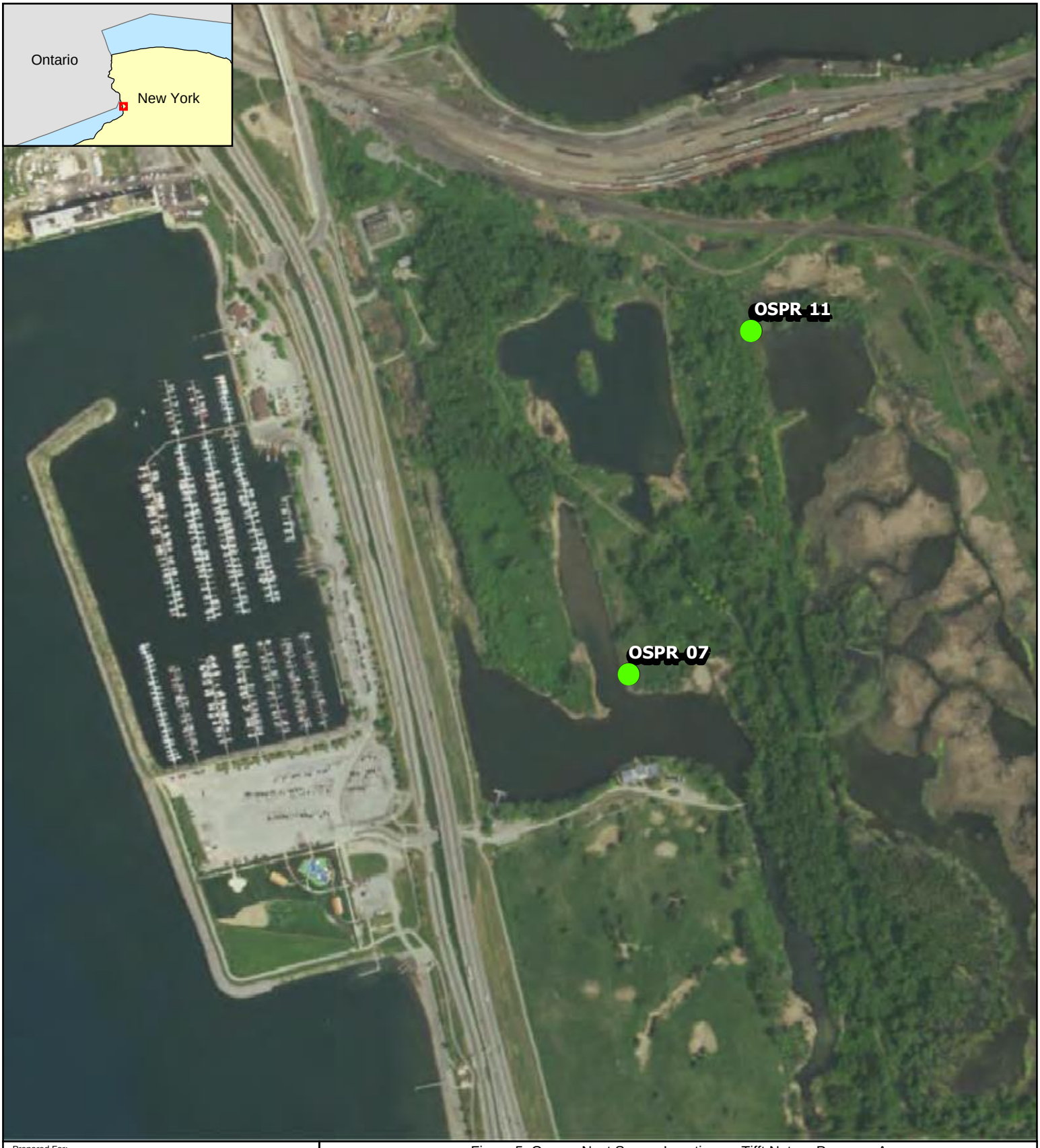
Based on input from NYSDEC biologists and annual site reconnaissance efforts, 12 potential OSPR nest locations have been targeted for observation during 2014-2017 surveys (Table 3) and are shown in Figures 2 through 5. These locations included all known man-made platforms whether active or not (OSPR-1, OSPR-2, OSPR-3, OSPR-4, OSPR-5, OSPR-6, OSPR-7, OSPR-11), natural active or formerly active nest sites away from dedicated platforms (OSPR-10, OSPR-12), and sites where sources had identified OSPR activity, but nests had yet to be located (OSPR-8, OSPR-9). All sites were monitored for activity during the 2017 survey effort regardless of whether OSPR were previously confirmed at the location.

Two additional potential nest sites were identified at the end of the 2017 monitoring season (OSPR-13 and OSPR-14). These sites were located during the final survey event, and as a result were only visited once in 2017.

To avoid disturbing OSPR during breeding/nesting activities biologists observed nest sites from remote locations that offered optimum views of the nest site rookery while minimizing disturbance to the birds. The locations were not fixed, and biologists were free to select vantage points as needed for optimal views throughout the survey effort. The latitude and longitude of each potential nest site was recorded using a handheld GPS receiver and are provided in Table 3.

Table 3. Location of Sites Monitored for Osprey Nesting Activities-2017.

Site ID	General Location	Latitude	Longitude
OSPR-1	Adams Slip, Niagara Falls	43° 04' 42.44"N	79° 02' 46.77"W
OSPR-2	Buckhorn State Park West, Grand Island	43° 03' 50.99"N	79° 00' 11.12"W
OSPR-3	Buckhorn State Park Central, Grand Island	43° 03' 34.50"N	78° 59' 06.78"W
OSPR-4	Buckhorn State Park East, Grand Island	43° 03' 30.93"N	78° 58' 44.83"W
OSPR-5	Beaver Island State Park, Grand Island	42° 57' 43.34"N	78° 57' 36.87"W
OSPR-6	East River Marsh, Grand Island	42° 58' 00.25"N	78° 56' 26.76"W
OSPR-7	Tifft Nature Preserve, Buffalo	42° 50' 53.68"N	78° 51' 27.78"W
OSPR-8	Niagara Power Plant, Kenmore	~42° 58' 12.80"N	~78° 55' 54.57"W
OSPR-9	Sewer Plant, Wheatfield	~43° 04' 29.68"N	~78° 56' 19.69"W
OSPR-10	Buckhorn State Park West-Relocation, Grand	43° 03' 49.73"N	79° 00' 05.24"W
OSPR-11	Tifft Nature Preserve, Buffalo	42° 51' 10.99"N	78° 51' 30.03"W
OSPR-12	Tonawanda Coke Plant, Kenmore	42° 58' 39.13"N	78° 56' 23.62"W
OSPR-13	South of East-West Park Rd, Grand Island	43° 3'7.01"N	78°59'31.45"W
OSPR-14	Whitehaven Road, Grand Island	43° 1'21.97"N	78°59'11.29"W



Prepared For:
US Fish and Wildlife Service
NY Department of Environmental Conservation

Prepared By:
NewEarth
ECOLOGICAL CONSULTING, LLC

Source: NewEarth Ecological Consulting, 2015; Esri, DigitalGlobe, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Date: 12/5/2016

Figure 5. Osprey Nest Survey Locations – Tifft Nature Preserve Area

Niagara River Area of Concern
2014 - 2018
Marsh Anuran and Avian Population Monitoring
Niagara and Erie Counties, NY

N

Legend

Potential Osprey Nest Site

0 0.0275 0.055 0.11
Miles

2.2.3 Survey Periods

The primary goal of the OSPR nest monitoring effort was to collect information on nesting activities to facilitate efforts to establish OSPR population estimates, and to evaluate trends in the number of breeding adults within the NR AOC. Per the Work Plan (NewEarth 2015a) and consistent with previous survey efforts, multiple surveys were completed in 2017 within the recommended survey windows and included a pre-breeding season site reconnaissance and four nest monitoring events as shown in Table 4 (NewEarth 2015b, 2016a, b). Optimal seasonal timing varies from year to year depending on weather conditions and breeding chronology of the target birds and was taken into consideration when timing survey events.

Table 4. 2017 Osprey Nest Monitoring Survey Dates.

Survey Event	Survey Dates
General Site Reconnaissance	April 17, 2017
1	April 18-19, 2017
2	May 12-14, 2017
3	May 31 - June 1, 2017
4	June 20-22, 2017
5	July 12-13, 2017

2.2.4 Productivity Monitoring

Nest sites were monitored five times during the breeding season. The first monitoring event was conducted after most adults had arrived at nest sites and initiated courtship/breeding activities, but before incubation had begun. Subsequent survey events were scheduled to maximize the probability of determination of nesting success for the highest number of nests and in general took place approximately every three weeks during the incubation and nestling periods. All data gathered during OSPR survey efforts were documented on the appropriate data forms (Appendix C). At no time were nest sites approached during the active breeding/nesting period.

Characterizing Nests

At each nest, biologists made note of the nest status using the following notation scheme modified from Vennesland and Norman (2006):

AD Adult present at nest but not incubating
IN Incubating/Brooding
YN Young are visible in the nest, or adult is seen carrying food to the nest site
NV Not visible
FL Failed nest
IA Nest inactive (status unknown)

In most cases biologists are able to determine the status of nests shortly after arriving at the observation site. However, when no adults or young were visible the observer waited up to one hour for adults to return to the nest; and if needed, returned to the nest site at a later time/date. If no adults were seen after an hour of observation and several visits to the site, the nest was listed as "inactive". Nests were only listed as "failed" if there was visible evidence that the nest is no longer in use (e.g. the nest was destroyed, and/or dead birds were observed at the nest site).

Ageing Young

Attempts were made to age nestlings to better determine timing of site visits and for evaluation of nesting success. For nests that contained young, the approximate age of the nestlings was recorded as follows (1 = 0-2 Weeks; 2 = 2-5 weeks; 3 = 5-8 weeks). Generally, nestlings between 0-2 week of age are covered in down and at two weeks will begin to appear feathered. By five weeks old young are nearly full grown (Poole et al. 2002).

Determining Nesting Success

Nests were considered to have been active if OSPRs were seen attending the site at least once during the breeding season. Nests were considered to have reached the incubating/brooding stage if at least one adult was observed sitting on the nest. Because of difficulty in determining nesting success once young leave the nest, young were considered to have fledged once they had reached five weeks of age which is typically when juveniles can leave the nest site. Nests were considered to have failed if incubating/brooding or nestlings were observed at some point in the survey period but were never determined to have fledged. Nests in which adults were observed attending to a nest but did not meet neither the "fledged" nor "fail" determination, were considered to have uncertain status as it could not be determined whether adults ever laid eggs in the nest or not.

2.2.5 Photographic Documentation

Biologists collected photographs of each nest site throughout the nest monitoring events to document the overall nest setting and various stages of nesting activity (Appendix A).

2.2.6 Unmanned Aircraft Systems (UAS) Monitoring

Unmanned Aircraft Systems (UAS) were also used in 2017 to evaluate usefulness as an alternative, or supplement, to land-based visual surveys of OSPR. As with heron monitoring, use of UAS has the potential to be more economical, less obtrusive, safer, and a more efficient and versatile means to survey OSPR nests. UAS missions were performed by a certified UAS Pilot and Drone Spotter from NewEarth, and were conducted under appropriate weather and safety conditions. Appropriate federal and state permits/approvals were acquired by NewEarth prior to flights. Missions followed Federal Aviation Administration regulations, provisions of the small UAS Rule (Part 107), and local, state and federal permits/authorizations. Missions were immediately aborted if conditions became unsafe, or the UAS caused distress to the OSPR, or other wildlife species, more than that caused during typical survey efforts for the species.

2.3 OTHER SPECIES/LOCATIONS

2.3.1 New Restoration Sites

Work is ongoing in the AOC by the NYSDEC, the New York Power Authority (NYPA), and others to restore or create fish and wildlife habitat (NYPA 2016). Although not specifically a component of the survey protocol, two of these sites are evaluated concurrent to heron and OSPR monitoring activities to determine use by target heron species. Frog Island, constructed in the fall of 2014, is an approximately 2.6-acre roughly oval-shaped fish habitat restoration site within the Niagara River and located approximately 800 feet to the southeast of Motor Island (Figure 1). The site is comprised of rock berms and vegetative plantings. Restoration efforts were completed in 2017 on a portion of Strawberry Island which was modified to create seven acres of diverse habitats for fish and birds, and to create a new approximately 0.7-acre island, 250 feet to the north of Strawberry Island (NYPA 2016).

3.0 RESULTS AND DISCUSSION

3.1 HERON

A site reconnaissance survey was performed on April 17th, 2017, followed by heron nest monitoring surveys on April 18, May 12th, June 1st, June 21st and July 10th, 2017 (Table 2). Graphs 1 through 4 provide summaries of the heron survey results, and Figures 2, 3, and 4, show the locations of potential heron survey sites. Appendix A provides photographs from the survey event and Appendix B provides the raw survey data and completed data forms.

3.1.1 Rookery Locations

The April reconnaissance targeted the NR AOC to assess the general condition at sites identified during previous efforts and to follow up on tips regarding potential new sites (Table 1 and Figure 2). Reconnaissance also included a re-visit to the gorge of the Niagara River downstream (north) of Niagara Falls in June by NewEarth biologists. As with previous efforts, many foraging heron and DCCO were observed throughout the AOC, particularly within the gorge north of Niagara Falls; however, no new heron rookery sites were identified.

Observers assessed Motor Island, Strawberry Island and Buckhorn Weir (Figures 3 and 4), as well as the general AOC, for heron nesting activity. Since the onset of the monitoring effort in 2014, heron nesting has only been confirmed at the Motor Island rookery site (identified as H-1 on Figure 4). Motor Island and nearby Strawberry Island, located 3,500 feet southeast of Motor Island, reportedly were used as rookery sites for target heron species since at least 2002 (Adams, Personal Communication 2015a, b; Weseloh Personal Communication 2016). Bald Eagles (*Haliaeetus leucocephalus*) were first sighted on Strawberry Island in 2011 and began nesting on the island in 2013. Soon after, heron and DCCO populations on Strawberry Island began to decrease and nesting on Motor Island began to increase significantly (Adams, Personal Communication 2015a, b). Heron nesting has not been document on Strawberry Island since 2013 (Adams and Walters 2014), although over the course of this study, numerous GBHE, GREG and BCNH have been observed along the shoreline and in perimeter vegetation on the island (Newearth 2015, 2016a, b).

As of the 2017 survey, the Bald Eagle nest remains active at Strawberry Island and although numerous target heron species have been observed in habitat along the edges of the island, none appear to be nesting there. Buckhorn Weir is not known to have previously supported nesting heron species, but was once home to thousands of nesting terns and is thought to provide suitable habitat for nesting heron (Adams and Walters 2015a). Consistent with previous years, the weir site is monitored annually, but continues to be dominated by nesting ring-billed gulls and several pairs of DCCOs. Many terns and DCCO continue to nest on the utility poles and platforms nearby (Adams and Walters 2014, 2015, 2016; NewEarth 2015b, 2016a, b).

Over the past several decades, DCCO numbers have been increasing in the Niagara AOC region (Adams 2017; Adams and Walters 2010, 2011, 2012, 2014, 2015, 2016). This is consistent with other findings in the northeast and more specifically, along the nearby St. Lawrence River, which found dramatic increases in DCCO numbers over a short 5-year period at three known nesting locations (RE Grant & Associates 2002). In response, culling has been used periodically as a management tool by NYSDEC in an effort to keep population numbers from increasing, and to reduce potential negative impacts from DCCOs on nesting herons in the Niagara region. Since 2014, over 1,000 DCCO have been removed from Motor Island. However, as a result of a 2016 court order all DCCO removal efforts in the region ceased prior to this 2017 survey; including removals within the Motor Island heron rookery (Adams 2017).

Although DCCO numbers appear to be increasing, which along with other pressures could lead to heron dispersals to a new rookery, no new heron rookery sites were identified in 2017. This survey likely represents a full census of all known heron breeding sites within the U.S. side of the NR AOC. No obvious opportunities exist to increase the sample size of rookeries for the target heron species in the current study area without the removal of predators and other direct threats, restoration of existing areas to make them more suitable, or the creation of new sites. Due to the limited availability of habitat for nesting herons, populations of these target species in the NR AOC are extremely vulnerable. Identifying and protecting known nest sites and efforts to create additional sites is key in conservation efforts for these species. The active Bald Eagle nest on Strawberry Island may continue to deter heron use of the island, and a second nest on Navy Island in Canada could be affecting heron expansion in the north Grand Island area, including Buckhorn State Park and Buckhorn Weir.

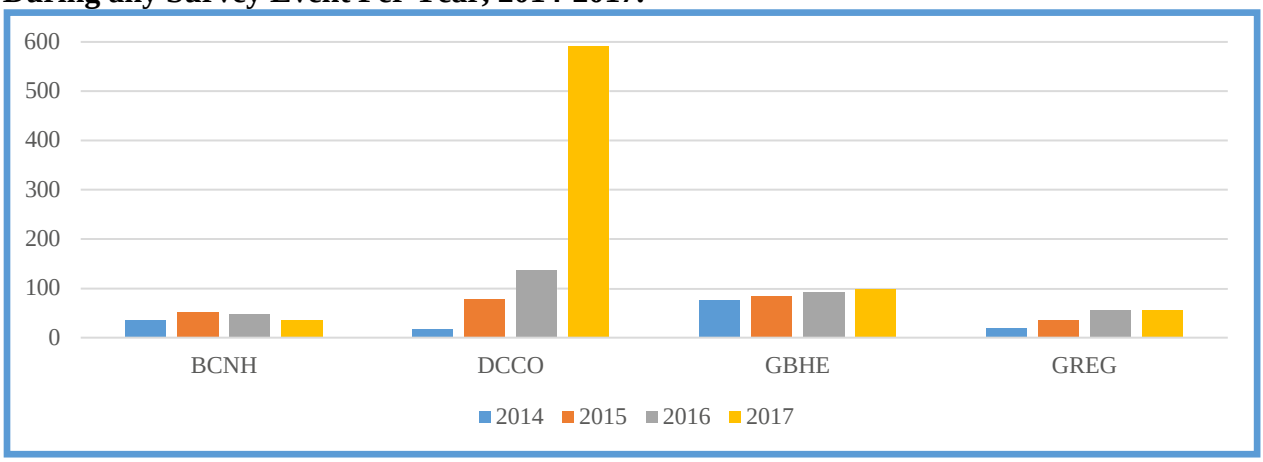
3.1.2 Motor Island Heron Monitoring

Productivity

The highest number of nests to reach at least the incubation stage (including nests with incubating adults and nests with chicks) during any one survey event in 2017, included 37 pairs of BCNHs, 98 pairs of GBHEs, 57 pairs of GREGs, and 591 pairs of DCCOs; an increase from all prior annual surveys for all species except BCNH, which have decreased slightly for two-consecutive years (Graph 1). Cormorant numbers have increased by a remarkable 331 percent (%) since 2016; an obvious reflection of the absence of DCCO culling efforts on Motor Island in 2017.

Despite this potentially significant increase in competition for nesting sites and resources on and near Motor Island, the number of GBHE and GREG to reach incubation stage have been similar since 2015.

Graph 1. Highest Number of Active Heron Nests to Reach Incubation Stage Reported During any Survey Event Per Year, 2014-2017.

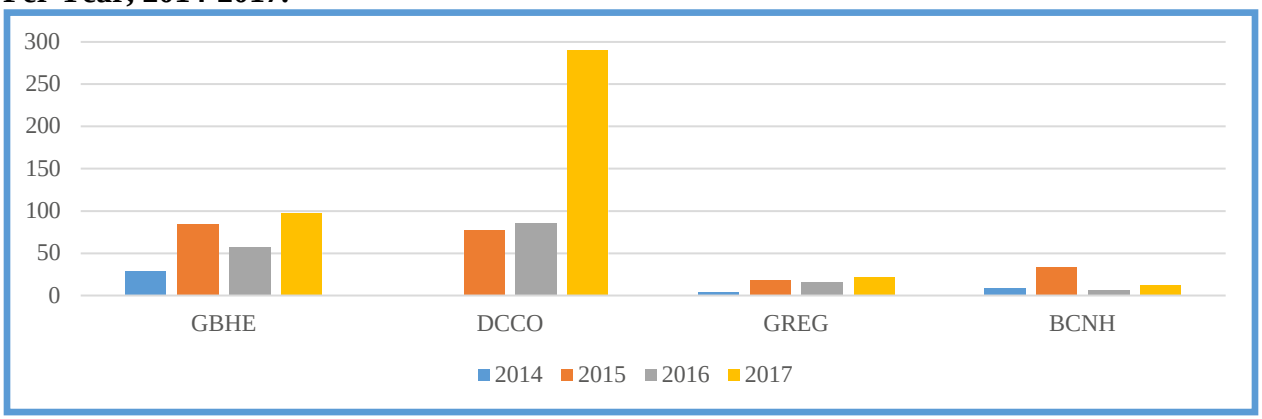


Sources: NewEarth Ecological 2015b, 2016a, 2016b.

During any one survey event, the highest number of nests with confirmed young in the nest included 12 BCNHs (32% of the maximum number nests documented as active for this species during any survey event), 291 DCCOs (46% of the nests believed to be active), 98 GBHEs (100% of the GBHE nests believed to be active), and 22 GREGs (39% of the nests believed to be active). The relatively low number of DCCO, GREG and BCNH nests with confirmed young when compared to those incubating is consistent with previous surveys (NewEarth 2015b, 2016a, b), and believed to be mostly attributed to the inability to see the young due to dense vegetation and the angle of visual line of site (i.e., from below nests), rather than low productivity or nest failure. Also consistent with previous surveys, young chicks could be heard in relatively large numbers within the dense vegetation, but many active nests were not visible despite attempts to utilize several different locations as vantage points. Appendix A provides images of the rookery taken during each survey event and shows how rapidly the visibility of nests diminishes; particularly for the species nesting in the sapling-shrub layer.

Initially it was thought that most heron nesting activities on the island would be complete by late-June. This is certainly the case with BCNH and GREG. However, although numbers are lower during the July event, many nests were still active. On July 10th, 46 nests were observed with fledgling GBHE, most of which were standing on or near nests and nearly ready flight (34 in 2016; 49 in 2015), 0 nests with BCNH chicks (2 in 2016; 4 in 2015), 0 nests with GREG chicks (6 in 2016; 10 in 2015), and 300 nests with DCCO chicks (92 in 2016; 71 in 2015). Dozens of fledged juvenile herons, representing all three of the target species, were also observed flying and foraging along the Niagara River and resting on newly created, Frog Island. Consistent with prior survey efforts, many pre-fledgling age DCCO chicks were observed in nests well into July; and some DCCO were still incubating or sitting on chicks too young to see during the July event (NewEarth 2015b, 2016a, b).

Graph 2. Highest Number of Heron Nests with Chicks Reported During any Survey Event Per Year, 2014-2017.

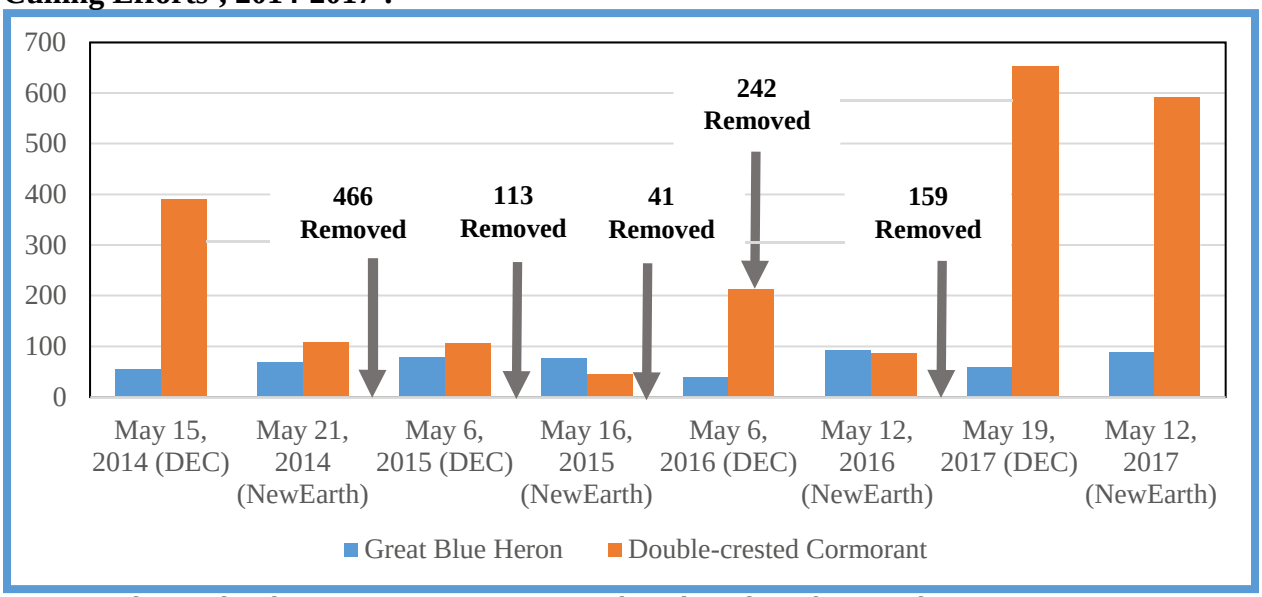


Sources: NewEarth Ecological 2015b, 2016a, 2016b.

Comparison with NYSDEC Surveys

With the exception of the 2014 survey event, NewEarth findings for number of active nests has been relatively consistent with surveys performed on Motor Island by NYSDEC (Graph 3) (NewEarth 2015b, 2016a, b). Surveys conducted by NYSDEC on May 17, 2017, documented 58 pair of GBHEs (40 in 2016; 78 in 2015), 48 pair of GREGs (50 in 2016; 66 in 2015), 52 BCNHs (20 in 2016; 41 in 2015), and also report a significant increase in DCCO with 652 active nest sites reported (212 in 2016; 107 in 2015) (Adams 2017; Adams and Walters 2014, 2015, 2016; Walters 2016;).

Graph 3. Number of Active Nests of Great Blue Heron and Double-crested Cormorant and Culling Efforts[1], 2014-2017[2].



Sources: Adams and Walters 2014, 2015, 2016; NewEarth Ecological 2015b, 2016a, b.

[1] DCCO culling efforts: 5/25 and 5/29, 2014 (466 individuals removed); 5/13 and 5/21, 2015 (154 removed); and, 5/6, 5/26 and 6/2 (401 removed).

[2] Survey performed by NewEarth or NYSDEC as indicated in parenthesis after dates.

Graph 3 also shows how GBHE and DCCO are affected by DCCO control efforts on Motor Island. Culling efforts between 2014 and 2017 show that the number of active DCCO nests decreases after removals, but generally rebound by the next nesting season; somewhat in proportion to the number removed (Adams and Walters 2014, 2015, 2016). When culling is eliminated, as was the case in 2017, the result is an almost immediate significant increase in reported active nests of DCCO throughout the following breeding season. The significant increase in DCCO in 2017 did not appear to have negatively affected the number of nesting heron, but will most certainly reduce habitat suitability for heron species which will likely negatively affect heron productivity over time as nest sites are lost (Graphs 1 and 2).

Nest Site Availability and Use

Collectively, the maximum number of active nests observed during any one survey was 748; identified during the early June event. Based on a fall leaf-off nest site survey of Motor Island in 2014 there were an estimated 779 existing nests available for use in the rookery (NewEarth 2015b). Annually, some nests are lost, and new nests are built. But, assuming the 779 nests are a good estimate of potentially available nest sites, after two consecutive years of relatively low nest use compared to that available (43% in 2016; 32% in 2015), nesting activity increased dramatically to 96% in 2017; unfortunately, 79% of the 748 active nests found in 2017 were occupied by DCCO. Although a detailed island-wide account of all nest sites has not been performed since 2014, it appears that many of the nests originally identified in 2014 are no longer present, and many new nests now exist; nearly all new nests were occupied by DCCO. Surveys that have included the evaluation of a sub-set of specific nests on Motor Island from year-year and a comparison of photographs of the rookery since 2014, provide evidence of the dynamics of available nest sites on the island (see Photographs in Appendix A).

Additionally, the location of nesting activities also appears to be changing. In 2016, biologists began noting higher numbers of active DCCO nests on the southern half of Motor Island than previously found. In 2017, higher numbers of DCCO nests were again noted on the southern end of the island, but also higher concentrations were found in the northern end where they previously were uncommon. Aerial imagery is not of sufficient resolution to identify specific nest locations, but a comparison of photographs taken between 2014 and 2017 appear to show this trend. Additionally, UAS video can capture aerial images at a much higher resolution and based on preliminary review of video from Motor Island, is able to capture many actual nest locations. Collected over time, UAS would likely be a useful tool in documenting changes in nest abundance and location.

Habitat Health

Typically, the condition of vegetation is believed to be similar from year-to-year and therefore the estimates, even if low, provide a barometer for trends in breeding activities at the rookery. However, it should be noted that although quantitative data has not been collected on vegetative health, over the course of this study biologist have noticed a decline in vegetative health, which

appears to be worsening particularly since DCCO culling efforts have ceased. This decline, although not quantifiable, first became obvious in 2016, when numerous downed large branches and wilted/dying leaf conditions were noted (NewEarth 2016a). In 2017, anecdotally these characteristics were more common and widespread, and there appears to be an increase in the number of active nests of GBHE and DCCO on the north end of the island, where they previously were uncommon.

As noted, the availability of heron nesting locations during any given nesting season is dynamic. Many nests are reused annually and become larger, heavier, and more burdensome on the branches they're attached to over time. Meantime, trees age and weaken over time resulting in loss of some potential nesting locations, but also the addition of new areas as trees grow. However, the dramatic increase in the number of DCCO utilizing the extremely limited habitat available on Motor Island is of concern for heron species. Although Niagara AOC survey efforts do not quantify this, obviously an increase in bird numbers will result in an increase in the amount of excrement deposited on the island. Photographs and UAS video show the extent of guano across the site, which will most likely eventually result in an accelerated decline in vegetative health island-wide than would occur under normal circumstances in a rookery ecosystem (see Photographs in Appendix A). Recent studies in forested colony sites in the southeastern United States found that increases in DCCO have been attributed to total or partial loss of forest cover and changes the soil chemistry at colony sites, which in turn affected normal plant growth and survival (Lafferty et. al., 2016). The long-term viability of the Motor Island heron rookery may be in jeopardy should vegetative conditions continue to deteriorate, particularly since no alternate nesting islands or isolated tree-dominated swamps (the preferred settings for rookeries) are known to occur in the AOC.

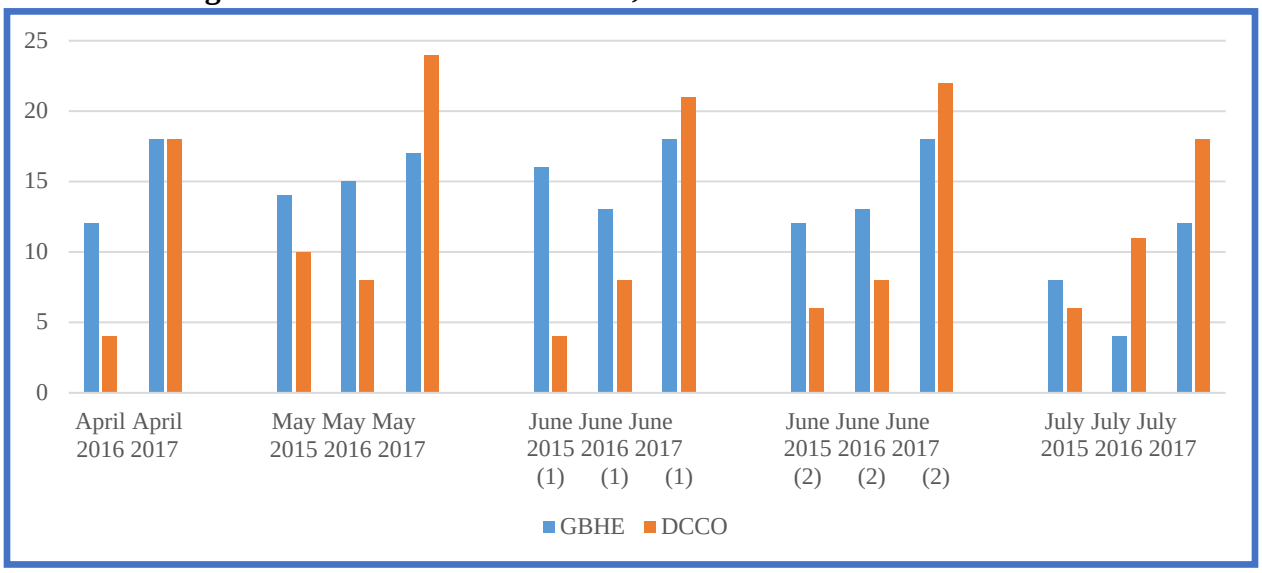
Beaver activity, the spread of grape vines and other invasive plant species, shoreline wave action, and natural succession each also pose threats to the vegetation that could significantly compromise nesting opportunities for the target species on Motor Island. Control/prevention measures are recommended, but should be done after all nesting has been completed. Vine and other invasive species removal should be evaluated and focused on specific areas/vegetation since some species are using the vine habitat. Shoreline erosion poses a less significant threat, but since nearly every tree is of value, stabilization efforts may be warranted to reduce vegetation loss. Given the significance of the Motor Island rookery site for heron nesting, tree/shrub health should be assessed regularly to identify threats, and to confirm that new growth is forming to replace vegetation that ages and dies off.

3.1.3 Subset Heron Nest Site Monitoring

Continuing with the sub-sampling approach first established in 2015, a subset of GBHE and DCCO nests were identified and tracked throughout the May to July period; allowing for a comparison to results observed in the larger colony site. GREG and BCNH nests were not tracked, since by May vegetation was too dense to observe from a distance and attempts to get closer agitated the birds and caused many to flush from their nests.

A total of 45 active nests were monitored in 2017; an increase of approximately 32% from 34 active nests in 2016. The evaluation included many of the 34 nests from the 2016 monitoring effort. However as with previous survey efforts and typical of the dynamics of a rookery, some of the original nests first documented in 2015 and 2016 were lost, others were rebuilt, new nests were added, and some nests present early in the season were again lost throughout the season (see photographs in Appendix A). New nests added after the April survey included, 13 DCCO added prior to the May survey, 2 DCCO and 1 GBHE added prior to the June 1st survey, and 1 DCCO added prior to the June 21st survey (see control tree photographs in Appendix A). As was the case for the larger colony site, the number of active DCCO nests in the control area increased significantly in 2017 in the absence of culling efforts; a 109% increase from the highest number reported in 2016 (11) and 140% higher than reported in 2015 (10) (Graph 4). Surprisingly, as was noted in the larger colony, this does not appear to have affected GBHE, which also saw an increase in number of active nests in 2017 where chicks were confirmed, to 18 nests; 20% higher than the highest number reported 2016 (15), and 12.5% higher than 2015 (16).

Graph 4. Number of Great Blue Heron and Double-crested Cormorant Nests to Reach Incubation Stage at Motor Island Control Site, 2015 and 2017[1,2].



Sources: NewEarth Ecological 2016.

[1] Control site not monitored as part of 2014 survey protocol.

[2] Unable to access the site in April 2015 due to ice on the Niagara River.

Higher numbers of active nests of course resulted in a higher number of chicks produced for both species. Eighteen GBHE nests produced 46 young (average of 2.6 chicks per nest) and 20 DCCO nests produced 45 young (average of 2.25 chicks per nest) compared to 12 GBHE nests producing 22 chicks and 6 DCCO producing 7 chicks in 2016. Three of the DCCO nests were in the incubation stage during the final survey in July, so the number of DCCO chicks is an underestimate of those likely produced. No nest failures were confirmed for either species, but DCCO did appear to take over one GBHE nest after the April survey event. As with attempts to monitor the larger rookery, some of the active nests visible at the onset of monitoring became concealed as the

monitoring progressed. Four nests, all occupied by DCCO, became obscured and although incubation was confirmed, presence of chicks could not be.

3.1.4 Incidental Observations

Since the 2014 survey efforts began, Bald Eagles, a state Threatened species, have been observed nesting on Strawberry Island, and more recently (2016) on nearby Navy Island in Canada. Eagles are a desirable species in the NR AOC, although their presence may be detrimental to the target heron species. Heron and DCCO reportedly nested on Strawberry Island prior to the arrival of bald eagles on the island in 2011, and their presence on the island is believed to be the reason behind large increases in the numbers of colonial waterbirds on Motor Island since 2013 (Adams and Walters 2014). Eagle nesting on Motor Island (the only known colony of GBHE, BCNH, and GREG in the NR AOC), could be catastrophic to the NR AOC heron population.

The state Threatened Common Tern (*Sterna hirundo*), and Caspian Tern (*Hydroprogne caspia,* formerly *Sterna caspia*) also continue to be observed flying, foraging, and roosting in and along the Niagara River and using the newly established Frog Island restoration site, as well as a newly established restoration area to the northwest of Strawberry Island. Many terns (as well as DCCO) are also nesting on utility line support structures adjacent to Buckhorn Weir; where tern nested until 1987 when ring-billed gulls took over the colony site (Adams, Personal Communication 2016a). Reports by NYSDEC indicate overall increases in sightings of terns throughout the NR AOC from 1,111 pair in 2004 to 2,398 in 2016 (Adams and Walters 2016).

3.1.5 Disturbances Noted During Survey Efforts

The primary disruption to nesting and roosting herons and other species that utilize the river and adjacent upland areas continues to be recreational boaters; particularly high-speed jet boats. Excessive noise, wakes, and boaters that encroached close to and/or onto nesting areas disturb species and threaten productivity. Additional signage and enforcement of speed limits and resource protection zones would likely help to reduce these types of disturbances and should focus on key areas such as Motor Island as well as key marsh bird nesting areas near Buckhorn State Park that are located within the river system.

Prior to 2017, DCCO control efforts on Motor Island most certainly also caused some disturbance to birds nesting on the island. However as 2017 surveys highlight, the lack of control efforts since the 2016 nesting season has resulted in a dramatic increase in the number of reproductively successful DCCO nesting on the island. Interesting though, while the number of nesting DCCO have increased, initial survey results seem to indicate that there was not a direct negative impact to other nesting heron species (i.e., the number of nest to reach incubation has not changed dramatically). It may be that negative effects will not be noticeable for several years, but results are consistent with initial results from a study in the Great Lakes region which found that despite regional increases in DCCO populations, BCNH or GBHE declines or nest abandonment did not result except under special circumstances (Cuthburt et. al., 2002).

3.1.6 UAS Use in Heron Rookery Monitoring

Initial findings of UAS use indicates drones can be an extremely beneficial tool for rookery monitoring, particularly over the long-term since it allows for a real-time aerial overview of rookery conditions and video documentation over time. First and foremost, however, is the safety of the species being evaluated. In this case, the use of UAS at Motor Island in 2017 did not cause any noticeable negative reaction or response from avian species on or near the island. It is likely that birds in the highly urbanized Niagara AOC have become desensitized to loud human activities and as a result less responsive to the UAS.

Second, although an in-depth analysis of the video data collected by the UAS was not a component of the scope of this survey effort, a preliminary review of the UAS video shows that individual nests, adult GREG, GBHE and DCCO, and in many cases even chicks and fledglings, are visible on video footage. Although vegetation will remain a factor to some extent, the UAS would likely provide an opportunity to improve on the accuracy of any future productivity monitoring. As an example, video collected on 6/21/2017 shows 37 active GREG nests as opposed to the 16 reported from ground-based observations (Appendix A, Photographs). However, these results were not included in the productivity information presented in this report since the results would skew the 2017 data when compared to previous survey efforts.

Results are less conclusive in video collected over areas of the island dominated by nesting DCCO and GBHE. This is believed to be primarily the result of survey design and other technological factors associated with coverage of a large area and longer flight times; which are less of an issue when evaluating discrete areas such as that used by nesting GREG or Osprey. Many GBHE and DCCO nests can clearly be seen in the video as the drone navigates across the island, but data was not collected in a manner that easily allowed for a count of active nests from the video. This is not to say that the video collected in 2017 cannot be used to improve the accuracy of rookery productivity monitoring, but the software and level of effort necessary to process the extremely large video files and distill the usable portions of video into manageable units for counting, far exceed the scope of this exploratory effort.

Finally, the resolution of UAS video should allow for year-to-year comparisons to help identify changes in vegetative health and locations of concentrations of nesting activities. Any future UAS monitoring should establish specific UAS survey goals and objectives, utilize methodology that is repeatable, and produce deliverables appropriate for the end-user.

4.0 OSPREY

Per survey recommendations, site reconnaissance surveys were performed on April 17th, and subsequent nest monitoring was performed on April 18th and 19th, May 12th through 14th; May 31st and June 1st; June 20th through 22nd; and July 12th and 13th, 2017 (Table 4). Graph 5 provides a summary of OSPR survey results and Figures 2 through 5 identify the locations of each survey site. Appendix A provides photographs from the survey event, and Appendix C provides the raw survey data and completed data forms from OSPR nest monitoring surveys.

4.1.1 Nest Site Locations and Type

Consistent with previous findings, only 10 of the original 12 potential sites identified (Table 3) had structures present that could be suitable for supporting nesting OSPR (Table 5) (NewEarth 2015b, 2016a, b). It is believed that sites OSPR-8 and OSPR-12 may be the same location, and despite reports of a nest near OSPR-9, no nest sites or OSPR activity have been located to date (Figure 4). In July 2017, based on a tip from NYS DEC, an additional potential nest was identified on a cell tower along Interstate 190 on north Grand Island and is identified as OSPR-13. No OSPR were observed on or near the site, but several twigs and branches were noted within the tower structure (Appendix A, Photographs). In the process of assessing OSPR-13, a second nest was found on a cell tower along Whitehaven Road on Grand Island and is identified as OSPR-14. When located, the nest was well-formed and occupied by an adult OSPR and two well-developed fledglings. Landowners adjacent to the property reported that the nest had two chicks and the pair have been actively producing between two and three chicks annually since 2014 (Dave Reilly 2017). Due to the late addition, nest OSPR-14 was not monitored with UAS.

Of the now 12 confirmed potential OSPR nest site locations, eight are man-made platforms specifically designed for nesting; the remaining four are on some type of man-made structure (Table 5). Five platforms (OSPR-1, OSPR-2, OSPR-5, OSPR-6, and OSPR-7) were installed between 2007 and 2010 as part of New York Power Authority (NYPA) Habitat Improvement Project (HIP) efforts, and two platforms (OSPR-3 and OSPR-4) were installed in the mid 1990's by NYSDEC and New York State Office of Parks, Recreation and Historic Preservation (OPRHP) (NYPA 2013). The remaining nest sites included a utility line pole (OSPR-10), an abandoned crane (OSPR-12) and two cell phone towers (OSPR-13 and OSPR-14). Due to interferences with power line activities, the nest at Site OSPR-10 was removed in 2007 and was relocated to a man-made nesting platform (OSPR-2) (Gerlach Personal Communication 2016). Osprey continued to attempt to rebuild the nest at OSPR-10 and NYPA removed it again in 2016. Table 5 shows the structure and type of nest platforms monitored during this effort and the identification code assigned to each platform by NYPA, whom conducted nest monitoring at seven locations (OSPR-1 through OSPR-7) from 2009 through 2012.

While a thorough assessment of potential natural sites (i.e., stable, large diameter trees near suitable foraging habitat) was not conducted as part of this survey, there appears to be a lack of suitable natural structures available in the NR AOC. Of the 12 OSPR nest sites monitored, none are natural features, and all nests that were active at some point in 2017 were either platforms installed specifically for OSPR nesting (OSPR-2, OSPR-5, OSPR-7) or natural nests that were built on man-made structures (OSPR-12, OSPR-13, OSPR-14) (i.e., abandoned crane and cell towers). This validates the usefulness of nest platform restoration efforts for this species in the NR AOC. However, numerous nest platforms, as well as many additional man-made features (utility poles, abandoned equipment and structures), are available within suitable habitat in the NR AOC and are not being utilized. This suggests that the density of suitable structures has likely been maximized for the number of OSPR currently using the AOC, or that the location or characteristics of the structure are, for unknown reasons, unsuitable for OSPR use.

Table 5. Osprey Nest Site Types and Corresponding New York Power Authority Identification Number.

Site ID	Location	Structure/Nest Site Type	Corresponding NYPA ID[1]
OSPR-1	Adams Slip, Niagara Falls	Untreated wood pole/ manmade metal nest platform	OP-6
OSPR-2	Buckhorn State Park West-Relocation, Grand Island	Untreated wood pole/ manmade metal nest platform	OP-1, originally relocated nest from OSPR-10
OSPR-3	Buckhorn State Park Central, Grand Island	Utility pole/ manmade wood nest platform	OP-3
OSPR-4	Buckhorn State Park East, Grand Island	Utility pole/ manmade wood nest platform	OP-2
OSPR-5	Beaver Island State Park, Grand Island	H-pile, steel, & untreated wood pole/ manmade metal nest platform	OP-7
OSPR-6	East River Marsh, Grand Island	H-pile, steel, & untreated wood pole/ manmade metal nest	OP-4
OSPR-7	Tifft Nature Preserve, Buffalo	Untreated wood pole/ manmade metal nest platform	OP-5
OSPR-8	Niagara Power Plant, Kenmore	**No structure or nest site located**	NA
OSPR-9	Sewer Plant, Wheatfield	**No structure or nest site located**	NA
OSPR-10	Buckhorn State Park West, Grand Island	Steel transmission line tower/natural nest	Nest relocated to OSPR-2 but Osprey periodically rebuilt it
OSPR-11	Tifft Nature Preserve, Buffalo	Utility pole/ manmade wood nest platform	NA
OSPR-12	Tonawanda Coke Plant, Kenmore	Steel abandoned crane/natural nest	NA
OSPR-13	South of East-West Park Rd and West of the Niagara Throughway (I-190), Grand Island	Metal cell phone tower	NA
OSPR-14	Approximately, 2489 Whitehaven Road, Grand Island and west of I-190, Grand Island	Metal cell phone tower	NA

The latter is becoming the more likely scenario since noted aggressive interactions between paired OSPR and lone individuals appears to be increasing. In 2017, aggressive interactions between the resident pair and a third bird were observed at four nest locations; OSPR-12, OSPR-7, OSPR-2,

and were also reported by the homeowner at OSPR-14 (Dave Reilly 2017). In 2016, such interactions were only noted at OSPR-2, and according to sources, had never been observed at the OSPR-14 site prior to 2017 (Dave Reilly 2017). A third OSPR was observed near OSPR-12 in 2016, near OSPR-10 and OSPR-2 in 2015, and near OSPR-7 in 2014, but no signs of aggression were noted. This suggest that numbers of returning OSPR in search of nest sites is increasing and may be at a point where returning unpaired birds may be physically attempting to take over preferred nest sites from the resident pairs. This may have been a significant factor in abandonment of OSPR-2 in 2016 and again in 2017 after incubation had begun.

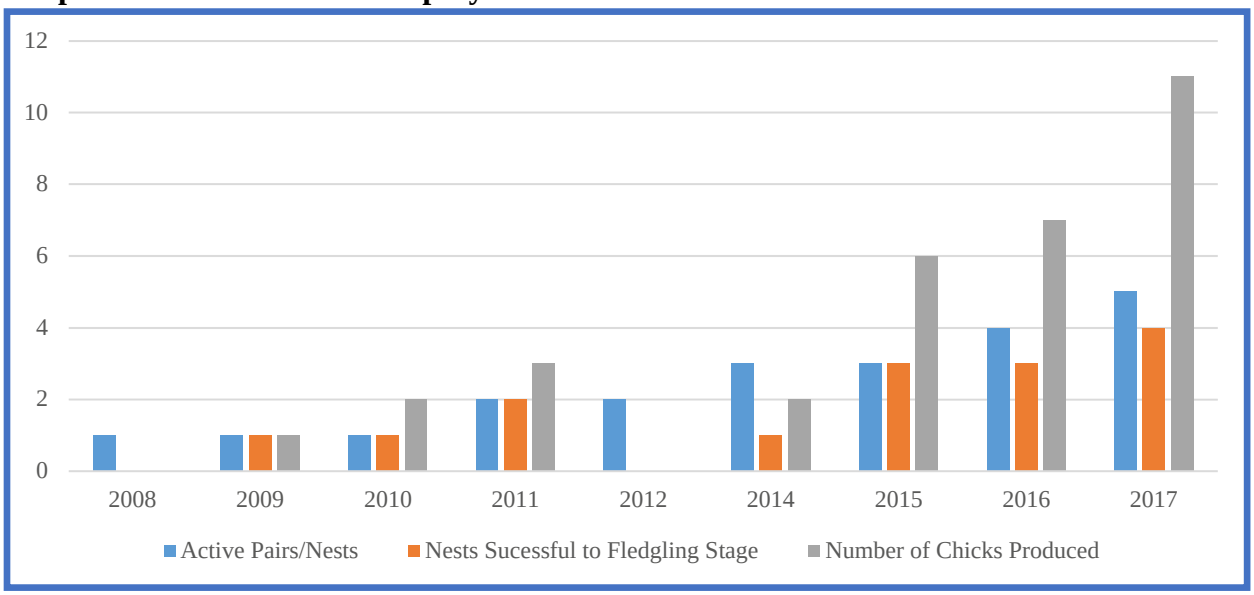
Many of the unused man-made OSPR nest platforms in the Niagara AOC are deteriorating, leaning, located too close to loud disturbances, and/or appear to be too short when compared to the height of most of the active nest platforms. Further, both of the sites identified in 2017 (1 active, 1 not) are on cell towers, and the OSPR-10 site is on utility line structures. These nest locations may pose a safety/maintenance issue for the utility company, and in the case of OSPR-10 requires periodic removal of a nest site that is known to be actively used by OSPR; which was removed in 2007 and again in 2016 (Gerlach, Personal Communication 2016). An evaluation of OSPR nesting platforms is recommended and a plan for replacement/relocation, etc. should be developed. Landowners adjacent to OSPR-14 have indicated that they are open to the installation of a platform on their property, should OSPR-14 need to be relocated (Dave Reilly 2017).

4.1.2 Productivity Monitoring

Incubation/brooding was confirmed at four of the now 12 potential nest sites located in the NR AOC during the 2017 effort (33%, up from 30% in 2016). Three nest sites have successfully fledged chicks for three consecutive years, and include a nest on a man-made nest platform in Tifft Nature Preserve (OSPR-7), a nest on an abandoned crane in the Tonawanda Coke facility (OSPR-12), and according to the landowner a nest on a cell tower (OSPR-14) (Table 6). The platform nest located within a NYSDEC restoration area of Beaver Island State Park (OSPR-5) has successfully fledged young for two consecutive years.

The number of active nest sites, nests to produce young to the fledgling stage, and chicks produced continues to rise in the Niagara AOC since survey efforts began in 2014 (NewEarth 2015b, 2016a, b). Although there is some variability in which nests produce young, the results indicate an overall increase in OSPR productivity in the NR AOC (Graph 5). Results from the only known consistent nest monitoring effort in the area prior to this study found that six chicks have been fledged from the area since nesting platforms were installed in 2007, including one in 2009, two in 2010, three in 2011, and none in 2012 (NYPA 2013). Since 2014 monitoring efforts began, at least 26 chicks have been produced from three to four active nest sites in the NR AOC (Graph 5). Thirty-two chicks have been produced when including NYPA survey data dating back to 2008 (NYPA 2013).

Graph 5. Number of Active Osprey Nest Sites and Total Chicks Produced 2008 – 2017.



Sources: NewEarth Ecological 2015b, 2016a, b; NYPA 2013

[1] Data from 2008-2012 collected by NYPA. Data from 2014-2017 collected by NewEarth. Data was not collected in 2013.

Nest platform OSPR-2, in Buckhorn State Park, was installed in 2007 and until the 2016 survey when the nest failed after incubation, hosted the oldest known consistent use of a platform built specifically for nesting OSPR in the NR AOC. As noted, the nest failed again in 2017. Osprey nesting at this relatively remote site have produced at least 10 young since 2007; including one chick in 2009, two in 2010, two in 2011, none in 2012, two in 2014, three in 2015 (NewEarth 2015b, 2016a, b, NYPA 2013). Aggressive interactions between the resident pair and a third bird in both 2016 and 2017 may have been a factor in nest abandonments. A Bald Eagle located on Navy Island may also be a factor, but this is less likely since the OSPR had previously produced young at this location while the Bald Eagle nest site was active.

Nest OSPR-12, on the abandoned Tonawanda Coke Plant crane, is the oldest known nest site in the Niagara AOC, dating back to 2006. Although located on a manmade structure, the nest is not on a structure built specifically for OSPR nesting. Anecdotal reports indicate that activity at the nest is inconsistent and the nest is known to fail often (NYPA 2013, Adams Personal Communication, 2015b). A pair hatched two young at the nest in 2014, but the nest ultimately failed before the chicks fledged. In 2015 and 2016 at least two young per year (possibly more) were produced from this location (NewEarth 2015b, 2016a, b). Using UAS technology biologists were able to confirm three chicks were produced and reached fledgling stage at this location in 2017.

Table 6. Summary of 2017 Osprey Nest Status.

Site ID	General Location	Nest Status[1]								
		April	May	June (1)	June (2)	July	2017 Final Status	2016 Status	2015 Status	2014 Status
OSPR-1	Adams Slip	IA	IA	IA	IA	IA	No activity	No activity	No activity	No activity
OSPR-2	Buckhorn SP	AD	FL	FL	FL	FL	Nest failed	Nest failed	**At least 3 chicks fledged**	**At least 2 chicks fledged**
OSPR-3	Buckhorn SP	IA	IA	IA	IA	IA	No activity	No activity	No activity	No activity
OSPR-4	Buckhorn SP	IA	IA	IA	IA	IA	No activity	No activity	No activity	No activity
OSPR-5	Beaver Island	AD	IN	IN	YN (2)	YN (2)	**2 chicks fledged**	**At least 2 chicks fledged**	Adult at nest, not breeding	No activity
OSPR-6	East River	IA	IA	IA	IA	IA	No activity	No activity	No activity	Osprey in area, but no use of nest site
OSPR-7	Tifft[2]	AD	IN	IN	YN (1)	YN (2)	**At least 3 chicks fledged**	**At least 2 chicks fledged**	**At least 1 chick fledged**	Nest failed
OSPR-8	Power Plant	NA	NA	NA	NA	NA	No nest site	No nest site	No nest site	No nest site
OSPR-9	Sewer Plant	NA	NA	NA	NA	NA	No nest site	No nest site	No nest site	No nest site
OSPR-10	Buckhorn	IA	IA	IA	IA	IA	A few twigs present	Nest removed	Nest occupied by a duck	Osprey in area, but no use of nest site
OSPR-11	Tifft[2]	IA	IA	IA	IA	IA	No activity	No activity	No activity	No activity
OSPR-12	Tonawanda Coke	AD	IN	IN	YN (3)	YN (3)	**3 chicks fledged**	**At least 3 chicks fledged**	**At least 2 chicks fledged**	Nest failed
OSPR-13	North Grand Island	NA	NA	NA	NA	NA	A few twigs present	NA	NA	NA
OSPR-14	North Grand Island	NA	NA	NA	NA	YN (3)	**At least 2 chicks fledged**	NA	NA	NA

Sources: NewEarth 2015b, 2016a, b.

[1] Nest Status Codes: AD = adult present at site, not incubating; FL = failed nest; FY = young fledged/ready to depart nest; IA = inactive (status unknown); IN = incubating/brooding; NA = no nest site located; YN = hatched young in nest.

[2] Confirmed by Tifft refuge manager.

The nest platform at Tifft Nature Preserve (OSPR-7) was installed in 2007 and has also inconsistently hosted successful nesting pairs. One chick fledged at Tifft in 2011, the nest failed in 2012 and 2013, one chick fledged in 2015, two fledged in 2016, and three fledged in 2017 (NewEarth 2015b, 2016a, b, NYPA 2013, Spiering 2016, Goodrich 2017).

Nest platform OSPR-5, erected in 2010 within the Beaver Island State Park NYSDEC restoration site, is the newest nest to produce young. A lone OSPR was reported at the platform and tending to the nest throughout the 2015 survey season, but never paired. In 2016, at least two chicks (possibly more) were produced by the newly formed pair. Using UAS technology biologists were able to confirm two chicks were also produced and reached fledgling stage at this location in 2017.

4.1.3 UAS Use in Osprey Nest Monitoring

Initial findings indicate UAS can be an extremely beneficial tool for Osprey nest monitoring. As with UAS use for heron monitoring efforts, the use of UAS did not cause any noticeable negative reaction or response from Osprey. As was the case with heron UAS monitoring efforts, the use of UAS did not cause any noticeable negative reaction or response from Osprey, and this is well documented in the videos collected during the survey effort. The UAS did, however, elicit assertive reaction from a flock of bank swallows that appeared to be defending an area near the nest at OSPR-5. The UAS mission was immediately aborted, and a new launch location was used without incident.

Using UAS technology, biologists were quickly able to acquire an accurate assessment of nesting success at OSPR-5 and OSPR-12 without any obvious stress to the nesting birds or chicks/fledglings (Appendix A, Photographs). The UAS was not used to monitor other nest sites due to logistical and safety concerns. Observations from ground-based vantage points can take several hours, repeat visits, and due to the poor line of sight into what are typically deep nests, observers often remain uncertain that all chicks were accounted for. As shown in Table 6, observers were only able to document a minimum number of chicks present during previous survey efforts. Using the UAS, however, biologists were able to quickly confirm the exact number of chicks present and fully evaluate their overall physical appearance and approximate age. Any future UAS monitoring should establish specific UAS survey goals and objectives, utilize methodology that is repeatable, and produce deliverables appropriate for the end-user. UAS were only used to monitor a subset of nest sites; UAS monitoring is recommended at all known nest sites for a rapid and accurate assessment of productivity in the Niagara AOC.

4.1.4 Incidental Observations

On several survey events, bald eagles were observed flying over, or perched along the shoreline of the Niagara River in the NR AOC. Biologists could not confirm if the observations were of the same eagles as those nesting on Strawberry and Navy islands. Eagle activities do not appear to be affecting OSPR nesting.

4.1.5 Disturbances Noted During Survey Efforts

As is the case every summer in the survey area, excessively loud jet boat activity was noted during June and July OSPR survey efforts. Osprey roosting along the river shoreline flush when boats approach, but it is unknown whether the disturbances are affecting nesting activities. The high levels of disturbance/noise in the area may be a factor in the lack of Osprey response/reaction to UAS near nest sites.

4.2 Monitoring of Additional Restoration Sites

Although not a required component of the NR AOC heron and Osprey monitoring effort, biologists performed rapid assessments of avian activity at newly created restoration areas along the shoreline, and to the northwest, of Strawberry Island (Figure 4); including Frog Island and several smaller unnamed islands. Frog Island was designed to provide fish habitat, but elevated areas of the feature continue to be used regularly by several bird species for loafing and foraging, including Caspian Tern, Common Tern, Herring Gull, Ring-billed Gull, Spotted Sandpiper, DCCO and each of the target heron species. A second island located approximately 200 feet to the southeast of Frog Island was completed in 2017 to provide tern nesting habitat. UAS was used to evaluate the island in July 2017. Video quality is not ideal, however, nesting common terns were confirmed on the island. Many ring-billed gulls were also present, and the UAS video documented evidence of a ring-billed gull attack on a young common tern chick. Presence of ring-billed gulls on the newly created site are of concern, particularly since ring-billed gulls are known to have taken over the former tern nesting site at Buckhorn Weir (Figure 4). Excessive boat activity/noise, close encounters of boaters to the island, and high-water levels and wakes from boats may deter bird species from nesting on the small islands and/or cause significant nest failures.

5.0 CONCLUSIONS

This study is the fourth of five annual survey events that will be conducted at an intensive level within the NR AOC and represents a full census of every known location that supports nesting GBHE, BCNH, GREG, and OSPR species within the AOC. The study provides a baseline on which future survey events may be evaluated and offers a foundation for future comparisons with other studies locally and in the region. Notable observations from surveys to date include:

1. Although yearly results vary somewhat, the number of nests to reach incubation stage (or higher) has generally increased annually for OSPR, GBHE, GREG, and DCCO since surveys began in 2014.

2. The number of DCCO and active DCCO nest sites have increased dramatically on Motor Island in the absence of 2017 culling efforts.

3. The increase in DCCO nesting activity on Motor Island in 2017 does not appear to have affected the number of active heron species, and for some heron species the number of active nests are also higher.

4. Nesting activities of DCCO, and to a much lesser extent GBHE, are changing spatially across the island since surveys began in 2014. Higher numbers of nests were noted throughout most of the clusters of large trees, but particularly in the northern and southern ends of the island where nests were previously much less common.

5. The negative effects of guano on rookery habitat is an inevitable, yet often undesirable, component of a rookery ecosystem. However, the increase in birds on Motor Island in 2017, particularly DCCO, has resulted in a rapid and notable increase in bird waste, which is visible on photographs and UAS video. Continued increases in guano input will likely speed up the potentially detrimental (possibly catastrophic) effect on the vegetation and ultimately the species nesting on the island.

6. Evaluate the feasibility of installing man-made heron rookery nest sites on Motor Island as a means to replace nests that may be lost due to deteriorating tree health.

7. Assuming no major influencing events occur, populations of heron and Osprey are likely to sustain at current numbers in the Niagara AOC over the short-term, but are unlikely to increase without additional suitable nesting habitat/locations.

8. Several Osprey appear to be challenging existing pairs at known active nest sites, and in the case of OSPR 13 and 14 have established nests on cell towers which may result in their removal. This despite the availability of several man-made Osprey nesting platforms in seemingly appropriate locations are unused. Existing platforms should be reassessed and modified, relocated, or new platforms installed as needed to improve suitability and increase availability of nest sites.

9. UAS was useful in monitoring efforts and should continue to be utilized as one of several tools available to monitor biological conditions of the Niagara AOC. UAS allowed biologists to rapidly assess nesting heron and Osprey, improve nest counts for some species, collect useful video for long-term monitoring of site conditions, and provided an up to date image of existing nesting areas and newly created restoration sites.

10. Other potential threats to nesting success include: excessive jet boat noise; activity by humans on, or close to Motor Island and Osprey nest sites; presence of eagles and other predators; damage to nest trees from beaver; and invasive species.

6.0 LITERATURE CITED

Adams, C. 2015a. Personal Communication During January 5, 2015 Niagara AOC Project Team Conference Call Involving: Connie Adams, Mark Filipski, and Jennifer Dunn of NYSDEC; Amy Roe of USFWS; and, Stacie Grove of NewEarth Ecological Consulting.

Adams, C. 2015b. Personal Communication During February 17, 2015 Niagara AOC Project Team Conference Call Involving: Connie Adams, Mark Filipski, and Jennifer Dunn of NYSDEC; Amy Roe of USFWS; and, Stacie Grove of NewEarth Ecological Consulting.

Adams, C. 2016a. Personal Communication During November 1, 2016 Niagara AOC Project Team Conference Call Involving: Connie Adams, Mark Filipski, and Jennifer Dunn of NYSDEC; Amy Roe of USFWS; and, Stacie Grove of NewEarth Ecological Consulting.

Adams, C. 2016b. Email Communication from Connie Adams and Michael Todd of NYSDEC to Stacie Grove of NewEarth Ecological Consulting Regarding Ice Out Conditions on The Niagara River 2014 through 2016.

Adams, C. and J. Walters. 2010. 2010 Niagara Frontier Colonial Waterbirds, New York State Department of Environmental Conservation (NYSDEC), Region 9, Buffalo, New York.

Adams, C. and J. Walters. 2011. 2011 Niagara Frontier Colonial Waterbirds, New York State Department of Environmental Conservation (NYSDEC), Region 9, Buffalo, New York.

Adams, C. and J. Walters. 2012. 2012 Niagara Frontier Colonial Waterbirds, New York State Department of Environmental Conservation (NYSDEC), Region 9, Buffalo, New York. October 2012.

Adams, C. and J. Walters. 2014. Colonial Waterbirds of the Niagara Frontier 2014 Nesting Season. New York State Department of Environmental Conservation (NYSDEC), Region 9, Buffalo, New York. December 2014.

Adams, C. and J. Walters. 2015. Buffalo Harbor and Niagara River Common Terns Summary of the 2014 Nesting Season. New York State Department of Environmental Conservation (NYSDEC), Region 9, Buffalo, New York. January 2015.

Adams, C. and J. Walters. 2016. DRAFT Buffalo Harbor and Niagara River Common Terns Summary of the 2016 Nesting Season. New York State Department of Environmental Conservation (NYSDEC), Region 9, Buffalo, New York.

American Ornithological Society (AOS). Fifty-eighth supplement to the American Ornithological Society's check-list of North American birds. Auk 134:751-773. DOI: 10.1642/AUK-17-72.1. Available at: https://www.birdpop.org/pages/birdSpeciesCodes.php

Baicich, P. and C.J.O. Harrison. 1997. A Guide to the Nests, Eggs, and Nestlings of North American Birds. Second Edition. Natural World Academic Press.

Cuthbert, F, L. Wires and J. McKearnan. 2002. Potential Impacts of Nesting Double-crested Cormorants on Great Blue Herons and Black-crowned Night-herons in the U.S. Great Lakes Region. Journal of Great Lakes Research, Volume 28, Issue 2, 2002, Pages 145-154.

Filipski, M. 2012. Remedial Action Plan Stage 2 Addendum, Niagara River Area of Concern. New York State Department of Environmental Conservation. January 2012.

Gerlach, J.D. 2016. Personal Communication via email February 17, 2016 between Connie Adams, NYSDEC and Jeff D. Gerlach, New York Power Authority, White Plains, NY Regarding Relocation of OSPREY Nests.

Goodrich, Z. 2017. Personal communications between Zachary Goodrich, Tifft Nature Preserve, and Stacie Grove, NewEarth Ecological, regarding osprey survey findings by Tifft staff and volunteers.

Hatch, Jeremy J. and D. V. Weseloh. 1999. Double-crested Cormorant (*Phalacrocorax auritus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/441doi:10.2173/bna.441

Hothem, Roger L., Brianne E. Brussee and William E. Davis, Jr. 2010. Black-crowned Night-Heron (*Nycticorax nycticorax*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/074

Lafferty, D., K. Hanson-Dorr, A. Prisock and B. Dorr. 2016. Biotic and abiotic impacts of Double-crested cormorant breeding colonies on forested islands in the southeastern United States. Forest Ecology and Management, Volume 369, 1 June 2016, Pages 10-19

McGowan K. and K. Corwin (Eds.). 2008. The Second Atlas of Breeding Birds in New York State, Cornell University Press, December 2008.

Mccrimmon, Jr., Donald A., John C. Ogden and G. Thomas Bancroft. 2011. Great Egret (*Ardea alba*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/570

Moul, I.E., R.G. Vennesland, M.L. Harris and R.W. Butler. 2001. Standardizing and interpreting nesting records for Great Blue Herons in British Columbia. Canadian Wildlife Service, No.217.

NewEarth Ecological Consulting (NewEarth). 2015a. Beneficial Use Impairment Removal Project, Niagara River Area of Concern, Heron and Osprey Nesting Success and Productivity Work Plan 2014-2018. March 23, 2015.

NewEarth Ecological Consulting (NewEarth). 2015b. Beneficial Use Impairment Removal Project Niagara River Area of Concern, Heron and Osprey Nesting Success and Productivity Monitoring Year 1 (2014) Survey Report. April 23, 2015.

NewEarth Ecological Consulting (NewEarth). 2016a. Beneficial Use Impairment Removal Project Niagara River Area of Concern, Heron and Osprey Nesting Success and Productivity Monitoring Year 2 (2015) Survey Report. February 18, 2016.

NewEarth Ecological Consulting (NewEarth). 2016b. Beneficial Use Impairment Removal Project Niagara River Area of Concern, Heron and Osprey Nesting Success and Productivity Monitoring Year 3 (2016) Survey Report. December 20, 2016.

New York Power Authority (NYPA). 2013. Osprey Nesting Platform Monitoring Report, Niagara Power Project (FERC No. 2216): 2012. Prepared by Gomez and Sullivan/Kleinschmidt Associates. 1/7/2013.

New York Power Authority (NYPA). 2016. Niagara Power Project Relicensing: Habitat Improvement Projects. Available at: http://niagara.nypa.gov/HabitatImprovementProjects/HabitatImprovmentProjects.htm

New York State Department of Environmental Conservation (NYSDEC). 1994. Niagara River Remedial Action Plan. September, 1994. NYSDEC Division of Water, Albany, New York.

National Oceanic and Atmospheric Administration (NOAA). 2016. National Weather Service, Advanced Hydrologic Prediction Unit: Precipitation – Grand Island New York Area. Available at: http://water.weather.gov/precip/

Poole, Alan F., Rob O. Bierregaard and Mark S. Martell. 2002. Osprey (*Pandion haliaetus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/683doi:10.2173/bna.683

RE Grant & Associates. 2002. Double-crested cormorants - are they a cause for concern? Ontario. Ministry of Natural Resources. Available at: http://www.glfc.org/pubs/lake_committees/ontario/cormorant.pdf

Reilly, D. 2017. Personal Communications between Dave Reilly, Owner, Citizen Coalition for Wildlife and Environment, and Stacie Grove, Principal Biologist, NewEarth Ecological Consulting, Regarding activities at Osprey Nest Location 14.

Steenhof, K. and I. Newton. 2007. Assessing Nesting Success and Productivity, Chapter 11. in Raptor Research and Management Techniques, Bird, D.M, KL. Bildstein, D.R. Barber~ and A. Zimmerman (eds). Hancock House Publishers, Blaine, Washington. http://raptors.hancockwildlife.org/staticpagesiindex.php?page=RRi\1T -Book

US Fish and Wildlife Service (USFWS). 2014. Statement of Work: Niagara River Area of Concern (NR AOC) Heron and Osprey Nesting Success and Productivity Surveys.

Vennesland, R.G. 2000. The effects of disturbance from humans and predators on the breeding decisions and productivity of the Great Blue Heron in south-coastal British Columbia. M.Sc. Thesis. Simon Fraser University, BC.

Vennesland, R.G. and R.W. Butler. 2004. Factors influencing Great Blue Heron nesting productivity on the Pacific coast of Canada from 1998 to 1999. Waterbirds 27: 289-296.

Vennesland, R. and D. Norman. 2006. Survey Protocol for Measurement of Nesting Productivity at Pacific Great Blue Heron Nesting Colonies. Prepared by The Heron Working Group. Available at: http://www.heronworkinggroup.org/Heron%20Working%20Group%20Great%20Blue%20Heron%20Colony%20Survey%20Protocol%20-%20FINAL%20-%20November%202006.pdf

Vennesland, Ross G. and Robert W. Butler. 2011. Great Blue Heron (*Ardea herodias*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/025

Walters, J. 2016. Personal Communication via Email between Jacquine Walters of NYSDEC and Stacie Grove of NewEarth Ecological Consulting Regarding 2015 Motor Island Surveys and Predator Control Efforts.

Weseloh, Chip. 2016. Personal Communication via Emails between Chip Weseloh, of the Canadian Wildlife Service, Ontario Region and Stacie Grove, of NewEarth Ecological Consulting Regarding Banding Activities on Motor Island.

APPENDIX A

PHOTOGRAPHIC DOCUMENTATION

Motor Island Rookery- April 2014 through 2017

April 18

May 12

June 1

June 21

July 10

Rookery Center - April 2017 through July 2017

Great Blue Heron and Chicks

Great Egret and Chicks

Black-crowned Night Heron Chick

Black-crowned Night Heron

Changes in subset of control tree over 2017 season
("X" indicates former location of nest in 2015 or 2016, but missing in 2017)

Double-crested Cormorant

UAS View of Motor Island Rookery

Center of Motor Island Rookery

UAS View of Active Osprey Nest 05

Active OSPR Nest 05

Active Osprey Nest 07

UAS View of Active OSPR Nest 12

UAS View of Active Osprey Nest 12
(chicks ready to fledge)

Active OSPR Nest 12

Twigs on Cell Tower Osprey Nest 13

Active Osprey Nest 14

APPENDIX B

2017 HERON NEST MONITORING AND NEST SITE SURVEY DATA FORMS

Niagara River Area of Concern Heron Colony Observation Datasheet Page_____of _____

Date_____Start Time_____End Time_____ Colony_____ Obs Point_____Observer(s)_____

Wind_____Temp (F)_____ Clouds (%)_____ Events That May Have Affected Nesting _____

Comments/General Assessment of Site_____

NEST NUMBER	SPECIES					STATUS							NUMBER OF ADULTS	NUMBER OF YOUNG	AGE OF YOUNG	COMMENTS
	GBHE	BCNH	GREG	DCCO	OTHER	ADULT PRESENT	INCUBATING/BROODING	YOUNG VISIBLE IN NEST	YOUNG PRESENT/BUT HAVE LEFT NEST	NOT VISIBLE	FAILED NEST	NEST INACTIVE				

NIAGARA RIVER HERON NEST SURVEY DATA FORM INSTRUCTIONS

The following instructions provide specific details for filling out the data form to provide consistency in recording survey data.

Header Information

Date: day/month/year (e.g., 15 May 2014). To be completed prior to beginning of survey.
Start Time: Record the start time at the beginning of each survey. Record in military time (e.g., 0600 = 6 am, 1300 = 1 pm).
End Time: Record the end time at the beginning of each survey. Record in military time (e.g., 0600 = 6 am, 1300 = 1 pm).
Observer(s) (List All): List all observer and recorder names.
Colony: Enter the colony number
Observation Point: Enter the observation point identifier
Wind: Use the Beaufort Wind Scale below and record the average Force rating number.
Temp: Record as Farenheit
Cloud Cover: Record as approximate (nearest 10%) cloud cover
Events that may have affected nesting: Describe any known events that may have changed nest chronology or success since the last visit
Comments: Make any other notes about the survey that were not previously addressed

Observation Information

Nest Number: Record the nest number as listed in the photo.
Species: Check the species that is occupying the nest. (BCNH = Black-crowned Night Heron, GBHE = Great Blue Heron, GREG = Great Egret, NONE = No Species Present, OTHER = species not listed, describe in comments)
Status: Check the current status of the nest
Number of Adults: Record the number of adults present at the nest
Number of Young: Record the number of young present at the nest
Age of Young: Record as follows: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks
Comments: Record any additional comments about the nest that haven't been addressed.

Force	Beaufort Wind Scale			Name	Conditions on Land
	knots	km/h	mi/h		
0	< 1	< 2	< 1	Calm	Smoke rises vertically.
1	1-3	1-5	1-4	Light air	Smoke drifts and leaves rustle.
2	4-6	6-11	5-7	Light breeze	Wind felt on face.
3	7-10	12-19	8-11	Gentle breeze	Flags extended, leaves move.
4	11-16	20-29	12-18	Moderate breeze	Dust and small branches move.
5	17-21	30-39	19-24	Fresh breeze	Small trees begin to sway.
6	22-27	40-50	25-31	Strong breeze	Large branches move, wires whistle, umbrellas are difficult to control.
7	28-33	51-61	32-38	Near gale	Whole trees in motion, inconvenience in walking.
8	34-40	62-74	39-46	Gale	Difficult to walk against wind. Twigs and small branches blown off trees.
9	41-47	76-87	47-54	Strong gale	Minor structural damage may occur (shingles blown off roofs).
10	48-55	88-102	55-63	Storm	Trees uprooted, structural damage likely.
11	56-63	103-118	64-73	Violent storm	Widespread damage to structures.
12	64+	119+	74+	Hurricane	Severe structural damage to buildings, wide spread devastation.

Niagara River Area of Concern Heron Colony Observation Datasheet

Date /,i/17 Start Time / JO End Time ! f 5) Colony /t'JOTOR. ISt. Obs Point ION"JRoL. Observer(s) S.6R.OIJ/;.

Wino B.. Temp (F) bO Cfouds (%) 3-0 Events That May Have Affected Nesting _ _ _ _ _ _ _ _ _ _ _ _

Comments/General Assessment of Site _

Nest Number	Soecies					Status											Comments
	co l?	c:x:i	0 0	0 u u a	0 .S	< :g	.a i .ca ..5	>-	j >-	Z0	u..	Z	'{) l: 4. <.				
1	X						y.										
2	X.						y										
3	'I						l										
4				-X			y										
5	Y.						y										
6							'						'x				
7													y				
8													V				
9													)(				
10	Y.						{										
11				""l.		"')(											
12	'I					7	v										
13	'A.																
14	'X						y										
15	X						-r										
16				y:		X											
17	"f.,.						'I										

I Z' /tC, T,u£ bi3HE I1 c.. r, Vf, OCCo Cf OR/6 tvf..S TS

GoNe

Nest Number	Species					Status								Comments
18	X													
19														
20												y		
21	V													
22	)<													
23														
24				X										
25	X													
26				X:										
27				)(										
28	y													
29												><		
30												y		
31	'X													
32				'x.										
33												'X		
34												y		
35				)(										
36				)(										
37				X										
38				X										
39														

Niagara River Area of Concern Heron Colony Observation Datasheet Page _ _ of___.]_

Date s-/1 }17 StaitTime /7 3o End Time 11 00 Colony o,CJ Point WIo/TROt Observer(s) S.c.R.ov t /.-.1..6/lOV

Wind / - Temp (F) C3 Clouds (%) ?0 •/00 Events That May Have Affected Nesting _ _ _ _ _ _ _ _ _ _ _

Comments/Genera1Assessment of Site /00 .s /1'10 E 'C.Co N t S7"/IV6 t/-t-l'tN u(IN 6 ANY

PR.&-v lOtJ) seJQ.\lf.y S11iJC t S.011./ --No cuu..1NG11U -;)017

Nest Number	Soecies					Status										Co mments
I	)(						-.,(_						I			
;).	y						X						I			
3	7-						X'						I			
4				)(												
S'							--,!									
6																
)																
													IV			
q	y															
10							-f.									
ti				X									I			
l)							'y						I			
n	X						y						I			
14	X						--y:						\			
,('	X												I			

17 6BHE) / DCCO

8 OR.JG /vf..S rS GoNt

I f!..G SIJ1<..,, T

// N £w

Niagara River Area of Concern Heron Colony Observation Datasheet Page _ of 3

Date ff9J1J Start Time 17 fP End Time /8()0 Colony flTO(l Obs Point COI>ITPOt Observer(s) _ _ _ _ _ _

Wind J - Temp (F) b 3 Clouds (%) 70-100 Events That May Have Affected Nesting _ _ _ _ _ _ _ _ _ _ _ _

Comments/General Assessment of Site _

Nest Number	Species					Status										Comments
					t								1			
Jb				y												
,7	y						v									
t'I.	)(						y/									
r'f				'X._			y.									W'4 IffPo/V
ao													Y I			Ml({ 1 /1/4
:>1	\I						Y.									
3::.l	)/						'I.									
cl3	)(						'I									
jll				X												
as	'i						'l									
0'"				X			'									
n				)(												
\	X						'X									
;)4.\																
\')				"i.			X									f'{ ES1 RBl tJl l.T > f lf/C £.

r4(Jle..

Niagara River Area of Concern Heron Colony Observation Datasheet

Datse {,;i} 11 Start Time___fJ3_0 EndTime I t 00 Colony fliOTOlt ObsPoint(otJ.ROL..Observer(s)______

Wind \ d-- Temp (F) /,3 CC(%) 7o-/00 Events That May Have Affected Nesting ______

Comments/General Assessment of Site ______

Nest Number	Species					Status											Comments
3/	}(						-r.										
				y			'x						1				
3i													X				
Jl{													X				
1r				y			Y.										
:36							'f.										
37							X										
3i							y										
J'f				'I..			'y										A)f-LU
l/o				'l-			'v										
Ul				{f_.			'1..1..										
t,, ")				y-			-1..										
v				'{.			'I										
I'L,{							'v										
Ll				'I			"										
,17				'I			r										
qi				Y-			"i-										
4q				y			'f.										

Niagara River Area of Concern Heron Colony Observation Datasheet

Date 6_J/17 Sta rt Time /L-/ 40 End Time / SOS- Colony /lWToQ ISL Obs Point Co-Ni f o< Observer(s). _ _ _ _ _

Wind 3 Temp (F) f>S Clouds (%) 0- Events That May Have Affected Nesting _ _ _ _ _ _ _ _ _ _ _

Comments/General Assessment of Site _

Nest Number	Species					Status							(vf S'T GoNE				Comments
	c.,	Z	c., c.,	0 0	£ 0	-a	.g ..S	c	S	Z	μ.,	S Z					
1	'i..							3									
2	'x							3									
3																	
4				)(				!									
5	A							3									
6													)'				
7													)(				
8																	
9													•,				
10	't-							J									
11				'x													
12	y..							;i.									
13	)(							I									
14	1 C							3									
15	y							l									
16							)(										
17	'X							( )									'/uvl<IG ttllet'I 1'RtJtN1" tv r v1f11J tl

1%' G;'H:f Ac1tV£ 11 DC ca 1 t:. IG. NE STS oN E

c). NEW AJ£5TS

Niagara River Area of Concern Heron Colony Observation Datasheet b{I Page _d_ or___J_

Nest Number	Species					Status										Comments
18	X					X		n								you/JG AJor VIS I&(£.
19				X			;<									
20													X			
21	x							3								
22	X							I								
23	x							:J.								
24										X						
25	X							I								
26				x			'X									
27										'X						
28	X							d								
29													X			
30				X			x									
31	X							I								
32										X:						
33													)<			
34													l			
35				'I.			'I..									
36				X			.,									
37				'X												
38				)C			r									
39				)(												N w
40				'I,			'I..									fJfvJ

Niagara River Area of Concern Heron Colony Observation Datasheet , 1, **Page _J_ of L___**

Nest Number	Species					Status										Comments
41				X			X									
42				X			'X									
43				X												
44				X			y									
45				)(												
46										X						
47										,						
48				)<			X									
49										'X						
50				)(			X									
51	"X						X									
52																
53																
54																
55																
56																
57																
58																
59																
60																
61																
62																
63																

Niagara River Area of Concern Heron Colony Observation Datasheet

Date t1fat/n Start Time 13 JO End Time ,}3 3S- Colony MOTO(?. !) <- Obs Point Cc>M' GIL Observer(s) _ _ _ _

Too -d-. Temp (F) 7 - - Cloud(%) 7 .S--- Events That May Have Affected Nesting

Comments/General Assessment of Site

Nest Number	Species					Status											Comments
	(B	2 u m	t, t,	0 µ u 0	t £ 0	E Cl -a Cl. "Cl <(	00 a 0 8 i D 0 ..S	Ci 9 !! 00 Ci	'5 ..c: Ci 0.. Ci 0 >--	§ 0 z	Cl ti..	g .5 z	NfS-r 66/Jf				Co mments
1	'J..							;).									
2	x							3									
3	X							3									
4								'									
5	)(							3									
6													';,(				
7													X				
8													x				
9													'y				
10	X			x				3									
11	x							I									
12	'','																
13								?									
14																	
15	k			y				-3									
16							X										
17								I									

1i A-c.Tr vt GBH£, :Jl(f)-C..Tl Vl. DC(0 D F-ol<MEE.. N S r.S (;o,v.

I tJ Gw . Nf Sr

Niagara River Area of Concern Heron Colony Observation Datasheet ,; | Page or_l_

Nest Number	Soecies					Status										Comments
18	X												;JE-Sr			
19																
20								>					oNE			
21	)(			X					Cl.				x			
								:J								
22	A							3								
23	:X								Cl)							
24				X			x									
25																
28																
26				)<												
27				X			)(	.:).								
30				X												
31	")<			•				3								
32				y		y										
33													v			
34													X			
35				)(												
36	X															
37				X				J.								
38				y			X									
39				X			X									
40				y			'L									

Niagara River Area of Concern Heron Colony Observation Datasheet

6/a.J

Page

of f""--

Nest Number	Species					Status										Comments
41				X			?<									
42										)(						
43				X				5								
44				>(			X									
45				X			X									
46				)(				I								
47				--X			><									
48				)<			X									
49				X			.x									
50				'x			X									
51	I""X							I								
52				)(			'X.									
53																
54																
55																
56																
57																
58																
59																
60																
61																
62																
63																

Niagara River Area of Concern Heron Colony Observation Datasheet

Date 7 /,o/17 Start Time 14 IS- End Time l'ISO Colony "4(o"fo l l. Obs Point CoNfR&: L Observer(s)

ino :S- Temp (Ff=7) CloucfsT¾r Events That May Have Affected Nesting

Comments/General Assessment of Site.

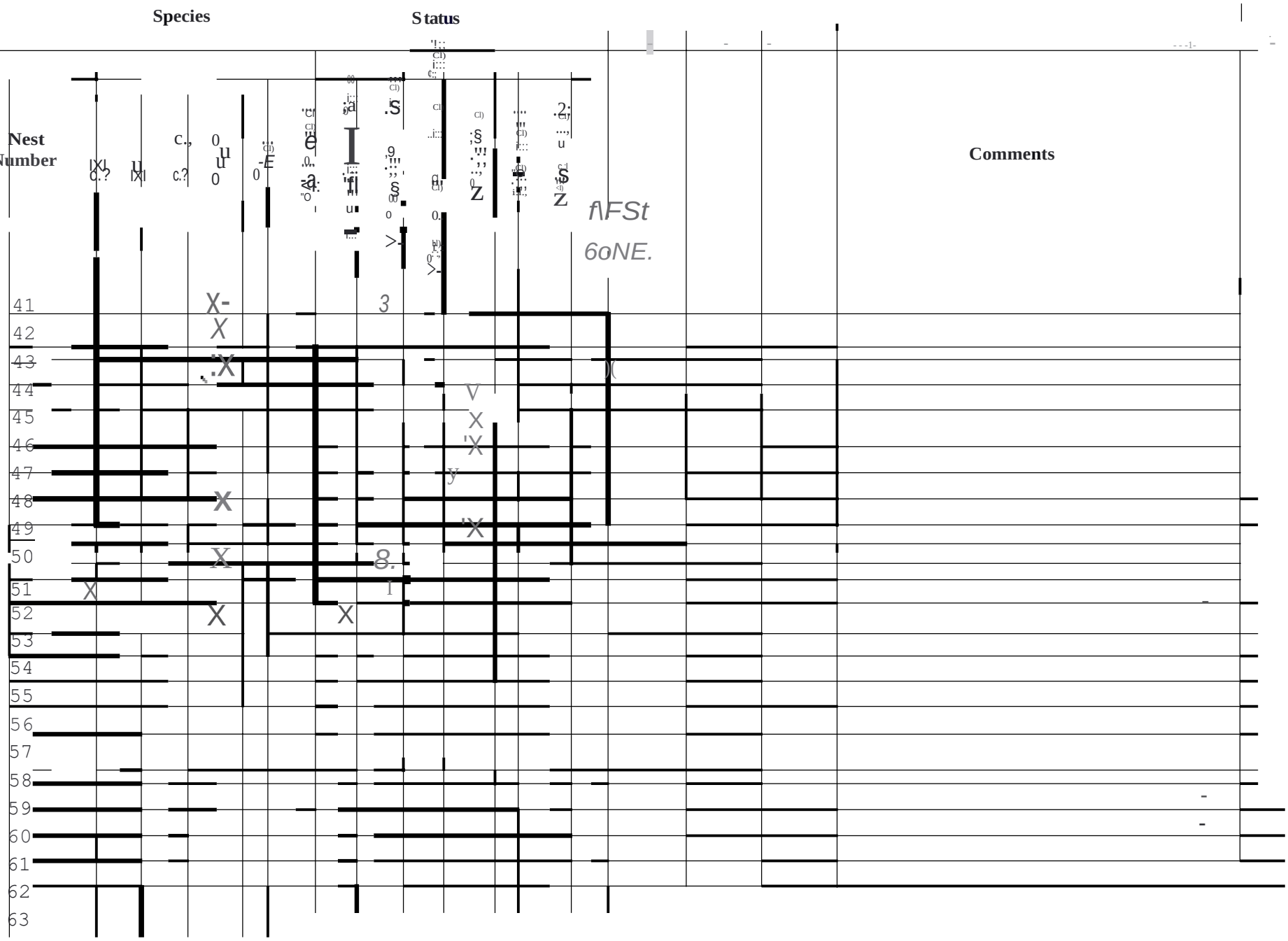
Nest Number	Species					Status							fvFS: 6fJ/J,E			Comments
1	X							:J								
2	;)(											X				
3	'y							I								
4				y				\								
5	X							\								
6													X ·y			
7																
8													y			
9													'/._			
10	'X							:J.								
11	'			'f..				1./								
12	'X							I								
I3	)(.															
14	'X.							3								
15													X			gf#-VJrlf BteoKt,N OP
16				X			X									
17	X							I								

13 A-tT I\Jt. GB E 17 OCCO ID o t SSTS 6.o l\JF

0 IIf

Nest Number	Species					Status										Comments
18	X												X			
19				)(									X			
20														y		
21	X							\								
22	I												X			
23	'X							I								
24				X												
25	x							a					X			
26				x												
27										X						
28	X							:J.								
29														X		
30										X						
31	X							?								
32				)(												
33														X		
34														I-		
35				"I..				a								
36				X				r)..								
37				X				3								
38				X				t.{								
39				'X				3								
40								3								

Niagara River Area of Concern Heron Colony Observation Datasheet 7//o Page _3_ of _d__



Niagara River Area of Concern Heron Colony Observation Datasheet Page_____of _____

Date_____Start Time_____End Time_____Colony_____Obs Point____Observer(s)_____

Wind_____Temp (F)_____Clouds (%)_____ Events That May Have Affected Nesting _____

Comments/General Assessment of Site_____

Species	Nests Adult Tending	Nests Adult Incubating	Nests With Chicks[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Nest - No Activity Noted
GBHE							
DCCO							
GREG							
BCNH							

[1] Indicates the # chicks visible per each nest (each entry is for 1 nest)

NIAGARA RIVER HERON NEST SURVEY DATA FORM INSTRUCTIONS

The following instructions provide specific details for filling out the data form to provide consistency in recording survey data.

Header Information

Date: day/month/year (e.g., 15 May 2014). To be completed prior to beginning of survey.
Start Time: Record the start time at the beginning of each survey. Record in military time (e.g., 0600 = 6 am, 1300 = 1 pm).
End Time: Record the end time at the beginning of each survey. Record in military time (e.g., 0600 = 6 am, 1300 = 1 pm).
Observer(s) (List All): List all observer and recorder names.
Colony: Enter the colony number
Observation Point: Enter the observation point identifier
Wind: Use the Beaufort Wind Scale below and record the average Force rating number.
Temp: Record as Farenheit
Cloud Cover: Record as approximate (nearest 10%) cloud cover
Events that may have affected nesting: Describe any known events that may have changed nest chronology or success since the last visit
Comments: Make any other notes about the survey that were not previously addressed

Observation Information

Nest Number: Record the nest number as listed in the photo.
Species: Check the species that is occupying the nest. (BCNH = Black-crowned Night Heron, GBHE = Great Blue Heron, GREG = Great Egret, NONE = No Species Present, OTHER = species not listed, describe in comments)
Status: Check the current status of the nest
Number of Adults: Record the number of adults present at the nest
Number of Young: Record the number of young present at the nest
Age of Young: Record as follows: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks
Comments: Record any additional comments about the nest that haven't been addressed.

Force	Beaufort Wind Scale			Name	Conditions on Land
	knots	km/h	mi/h		
0	< 1	< 2	< 1	Calm	Smoke rises vertically.
1	1-3	1-5	1-4	Light air	Smoke drifts and leaves rustle.
2	4-6	6-11	5-7	Light breeze	Wind felt on face.
3	7-10	12-19	8-11	Gentle breeze	Flags extended, leaves move.
4	11-16	20-29	12-18	Moderate breeze	Dust and small branches move.
5	17-21	30-39	19-24	Fresh breeze	Small trees begin to sway.
6	22-27	40-50	25-31	Strong breeze	Large branches move, wires whistle, umbrellas are difficult to control.
7	28-33	51-61	32-38	Near gale	Whole trees in motion, inconvenience in walking.
8	34-40	62-74	39-46	Gale	Difficult to walk against wind. Twigs and small branches blown off trees.
9	41-47	76-87	47-54	Strong gale	Minor structural damage may occur (shingles blown off roofs).
10	48-55	88-102	55-63	Storm	Trees uprooted, structural damage likely.
11	56-63	103-118	64-73	Violent storm	Widespread damage to structures.
12	64+	119+	74+	Hurricane	Severe structural damage to buildings, wide spread devastation.

Niagara River Area of Concern Heron Colony Observation Datasheet

Date LI/ 18/ :)0/7 Start Time / lf J..D End Time /74S- Colony Moro /Sl- Obs Point L Observer(s) S. G 0\/€.. / M ,6 0 (/ .c

Wind ___ Temp (F) 58 Clouds (%) 30 Events That May Have Affected Nesting ________________ -= ---==--- - -

Comments/General Assessment of Site O/t..c. /Vf'f7S / IVt fTt lVG- P/V ,V. ('Ni) J iAI-<- S'V/ff,.,,.C

Species	Nests Adult Tending	Nests Adult Incubating	Nests With Chicks[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Nest- No Activity Noted
GBHE	,yt1Md • l.ltl 0tN6 j-N 8 W lll I [, 6 NT) lj..}11 ,-;;; 7 '' 31-\	l--n1 lJ,rf J}f'f l J.Hf JJ1f j llA -t1 t,H1" t),({ l/1.,,(.JK {)'(1· !)if t)f{ iJt1 JrJ1"" l.i(f.₵])-tr 11 1 93		V,rr l l 1			U11 / b
DCCO)\. \	Wf l LHt fJ[Vv %llll/))-11 lJ-tr' lJHT ll	\-111 l.J-/1 l)(f _)}rr lJ,rf (pr H!J jk\ yrt \I J4i'T l ; b l-1 d-		/50-\- CVlJ'§11- r p,ov£JAfAl 11\J- OVT			lJ3 j)1f f.lJ 1,\,1{ l 'I µ,:,.., 15 .Prir/ Of J5'L
GREG	1}11 11l	LHT LHT LHT LHT LHT 1;,rf ,A11 v,ff i)A'(!J>'f' ll 57		111 \ 'f			1,/J '-f
BCNH	LHT LHT (,r:rio) \\	J.LW Mr .Mf M 1J11 \\j(\),tT 3D		{µ{' ,)t(lt/1%) /J-tl -+111 1			W \I 7

llLuJ)j ,v W \\ 3 l IS,- tv Ntw A 'i t\ Of I/.\A it(.,. E SHORELINE

[1] lnd icates the# chicks visible per each nest (each entry is for 1 nest)

;n oN N- E.NO PR,1-E..tJ ON"' l/ 6tJ , - S1s '$b /l'1QST IN N £./\, ft1?.f- 0 f , filb! rvrnf<-

Date r/,d{l ol) StartTime J'-/r-O EndTime 11 00 Colony MDTOf.. I LAN.t) ObsPoint_Observer(s) S,Gf!!.OV / }t •

Wind--1.:±_ Temp (F) Clouds (%) Events That-May-Have Affected-Nesting - -- -6 RQVE

Comments/General Assessment of Site NORT\.t /V'{J (J L J LY - bf 0) f.Jrz5T5 Alf IV l Y O C[ı,, ,0IE:/;}

,OO', /J'i w OCCO AJf; S15 1r AJ, St /fl,

Species	Nests Adult Tendin2	Nests Adult Incubating	Nests With Chick.s[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Inactive
GBHE		IJ4Qt Y Q 1					
(CO './e	II\ (j) o of ANO ONii I	¹JA1 w--t'f l1-tf I µ-nJ;-t'fl-f11JA'tlt) J.\-11U/41l,H1' :u-'1"' 1)11" j.H'\' U-½'1AA l.»f 1)-f'f 1}-tr L,1-tT /Jrf Jj-tf /Jt('	S6t f1168 iF-d- (801() Or i f 5E NGIJ.,J	It(\Jtf(JJt(lJffJt11)If] µrr (J,,\ft.Af 11\l v1		, 1 .4tl	tµ,(/ 111 fJE IJJ a,
GREG							
BCNH		I\I O		11 e)			

[1] Indicates the # chicks visible per each nest(each entry is for I nest)

Niagara River Area of Concern Heron Colony Observation Datasheet Page ___ of 2._

Date S-/ld--) 0'7 Start Time /YS-0 End Time/ t (X) Colony /MO, O(< JSl ,4NI) Obs Point _ Observer(s) S, 6 _ _ _ _ _

__ intl _____ Temp (f) b3 Clouds (%21-0 LOOEvents That May l:fu_v ffected.Ne_s_ting

Comments/General Assessment of Site /J1,t OL1- ' u . t; -,R; S: n , s... V l)S Vt) I/J 1.11=-

l 6 I' t/F (.... oy1N6 Joo'5 JJfw 1ul) /t/Fr rs

Species	Nests Adult Tendin	Nests Adult Incubating	Nests With Chicks[1]	Adu lts Not Tied To Nest	Chicks Not Tied To Nest	Dead	Inactive
GBHE	V	J11tir11mJ;11 WJJk)'l)KJ)f(., J%Wr JJ1f IH,,1 1	J , , 0 Sour + I ;v() p	5			/I W
DCCO	269	JJ,\1 !)-t1' J..H1 1% lyf 1)1\ t}{\ U1) !}f1 %_ \ 1}11 :}fl J,Hf Y.J:f 1H'J U11 IH1J)df I% IltI £#fur-,- /ill	t1111!-I IM O INC 252 /)ef I)r1 /)If LAf/Jef;HfJJK¢ M IJ)(utr ;}.r' J-H1}MfUef"	/00-1- (()/A Ni 60/JV·6 (t)l,I'S,ANLY 200+ ON FROG IS'-	Ill [	/µ1 (0 11// 1.Y @ E1.s-.1-1or2E & R VC f I ///
GREG	0i	WI J.rtT U.\f1-tttJ.'t(IJ,\f //H'//I	'J-"f)HfJ){f J)11))t1 ,.,	@			(])
BCNH	@	J-111 \\H		1)11 7 IJ#.I-H1" I \\ ;?			// I/ ,r:;:

[1] Indicates the # chicks visible per each nest (each entry is for I nest)

rn A"Y SC N1-\ IJ't1v

r.,, S ',, oc<o ,W,FW.,n

Niagara River Area of Concern Heron Colony Observation Datasheet

Date 6/1/2011 StartTime 13:?? End Time 16:?? Colony [illegible] ObsPoint Observer(s) [illegible]

Wind 3 4 Temp (F) 61 Clouds (%) 20 Events That May Have Affected Nesting

Comments/General Assessment of Site

Species	Nests Adult Tending	Nests Adult Incubating	Nests With Chicks [1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Nest- No Activity Noted
GBHE	[illegible]	[illegible]	3-,3 ,3 [illegible]			1	[illegible]
DCCO	[illegible]	[illegible]		[illegible]			[illegible]
GREG	[illegible]	[illegible]	J,J,J,;;.;; ,J,3 ;d, 3,3 [illegible]				1/
BCNH	[illegible]	[illegible]	1, 1 J . 1,3,a a; ,3 1, [illegible]				[illegible]

[1] Indicates the# chicks visible per each nest (each entry is for 1 nest)

Niagara River Area of Concern Heron Colony Observation Datasheet

Page _il__of

Date b/t/o17 Start Time f I) End Time /63 f) Colony Nl0.0 lS\ Atv.Q _Obs Point _ Observer(s).________

Wind 3 !i_Temp (F) f',b7 Clouds(%) ao Events That May Have Affected__Nesting

Comments/General Assessment of Site.________________________________

Species	Nests Adult Tending	Nests Adult Incubating	Nests With Chicks[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Nest- No Activity Noted
GBHE							
DCCO		/-H'Y'),fff fµf ltM u-K" ()ff lJX f:lf\ /)ff L.H1' LJ.11'.¢. AA \-l-K Utl L\1\)-\i\ l.HflMftrrf 1* Utl 1¥(	IJ-t't IB1 µtf #f1' Utf 3t>o 285 5 9 1	,C_			
GREG							
BCNH							

[1] Indicates the# chicks visible per each nest (each entry is for l nest)

Niagara River Area of Concern Heron Colony Observation Datasheet

Page _ 1_ of___;?_

Date 6/oil)do17 Start Time .ll S:-O End Time /C:/ Colony ,7r,e L4J'JNt Obs Point _ Observer(s) . GROVE / M. GROVE

Wind 3 Temp (f) 1 Clouds (%) 50-80 Events That May H ve Affected Nesting

Comments/General Assessment of Site CotJ F1R tt E.!) C!itCt.,. .: /1 ,-dv} of- -:1£ ''En fP "'i"/ GBVf .f. J" t=(<o r.A f>.et;v svP-vey (1,011L/ iE1vo, "' NF-srs

Species	Nests Adult Tending	Nests Adult Incubating	Nests With Chicks[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Nest - No Activity Noted
GBHE							
DCCO							
GREG							
BCNH							

[1] In dicates the # chicks visible per each nest (each entry is for I nest)

fllt s1s 1rJ , • LS t ...t,.i J6 tu(-. -"" "10 J, ,\S ' rJ6 vr:,P."f ow \JH 1e1t ,-r'f 1N \3(rv\.\,c,r,fG

Wlh1l1 f}1

Date G\).\\-;}.0\7 StartTime l/c;-"O EndTime 1 $l(Colony (" 01 vp ' :.l r1 N J) ObsPoint_Observer(s) s,Po\Je,J,et,6 0V€

WindO-3 Temp (F) 7 Clouds (%) SO;i llEvents That May Hav Affected Nesting,

Comments/General Assessment of Site

Species	Nests Adult Tending	Nests Adult Incubating	Nests With Chicks[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Nest - No Activity Noted
GBHE							
DCCO		Tft-U'{ 164 t- flt a'-ls JJ r-5 1 L/Sl CHIC	3-, J, ;;), 1,3, 3,1,ol 3, l,;l, l, d 1 l,'4. ;z,.:2; 1 11oZ. "3. 31-J J/ \ c9 d,.1r-.				
		D Ceo	;i ;;2 ;i ;). i (),d- --.cl-, \ &, l l,) ,.2. -1, a, 1 ,i ,1,J...;i.,,, d,.J 3 d, 1				
		,U,(, ,01 \ \\X\' LIA\ ob	\,3, ,9.,()-/tl.·L\, \ l 3 3 3\';} ,cl 1 J. a. 3 ld-. \\ d1'd-. t,\ \ . A ') "2				\!,.r(ll \ \

OtlO 74 Gif3 j6 f(ll(.,JI ftl ,1110 th l/ l/ Htcr-5 r

Q- 3 l l Dl / 'i 3 fJ(lQ 11J/c

Niagara River Area of Concern Heron Colony Observation Datasheet

Date [illegible] Start Time [illegible] End Time 1630 Colony [illegible] Obs Point [illegible] Observer(s) [illegible]

Wind [illegible] Temp (F) 77 Clouds(%) [illegible] Events That May Have Affected Nesting [illegible]

Comments/General Assessment of Site [illegible]

Species	Nests Adult Tending	Nests Adult Incubating	Nests With Chicks[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Nest-No Activity Noted
GBHE			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DCCO		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
GREG		[illegible]	[illegible]		[illegible]		
BCNH							

[1]Indicates the # chicks visible per each nest (each entry is for 1 nest)

[illegible]

Niagara River Area of Concern Heron Colony Observation Datasheet

Date 7/ |0 / 7 Start Time /0'-f S End Time)630 Colony /J!)TOR- [$ l. Obs Point /_ Observer(s) {' (°(2.0 v£_

W.ind__I_ Temp{ l 77 Clouds(%) O Events That May Have Affected Nesting _

Comments/General Assessment of Site _

Species	Nests Adult Tending[2]	Nests Adult Incubating	Nests With Chicks[1]	Adults Not Tied To Nest	Chicks Not Tied To Nest	Dead	Inactive
GBHE			?J, '3, J, ;\, 3, , , / '5, . 3. S 3, .;;...				
DCCO		µ-rf)I} I 01	, .3. li ½ 3, 1./ ;3, ;;;13 J,3, , 1, l , '3, l. L(,ıl , Sr,/ 3 .{ d ,-3 ;,, ,, , .i.. , 3, 1, . 3J, ,1 lJ.- \ \ \ d, j .3	I			I 1 / /
GREG			n q w/cft!	/Cj			
BCNH		pcJ.,.O	-(ttl L"/ ld-- 7flf <l'P/ 76 1 NESTS ct+tC[9				

[1] Indicates the# chicks visible per each nest(each entry is for 1 nest)

APPENDIX C

2017 OSPREY NEST MONITORING SURVEY DATA FORMS

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date_____ Start Time_____ End Time_____ Observer(s)_____Wind_____

Temp (F)_____ Clouds (%)_____ Events That May Have Affected Nesting _____

Comments/General Assessment of Site_____

Start Time	End time	nest ID	nest status	# of adults	# of young	age of young	Comments

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date ,4/ 8[dOI1 Observer(s) S . G«.oV - I'll,GR0 v[-Wind f - ;l

Temp (F) 51-5'f Clouds(%)),o- o Events That May Have Affected Nesting _____ _____

Comments/General Assessment of Site _____

START TIME	ENDTIME	NESTID	NEST STATUS	#OF ADULTS	#OF YOUNG	AGE OF YOUNG	COMMENTS
tt/t7 l73f	1 7.5' 0	I	-;J:f),				
Y|rs 0 10	Oc:t 30	'-/	r ii		-		
O"t \.{o	10 05'	S	fJ,				
, os-o	l DO	/0	lJD	I			Pt..ft<,m itcrs oμ vrfl..1,Y lo<..I ;Of)
, o o	,aoo		A-.D	a			It! P t)SLI vER!IJG r,cKS re) !"/IS r1/t/G NCST
J L/O'r	J L{ I t)	S-	D	a.	-=		?AI SIT11/J6 ON NcSr .. MOil!NC SilC S
18 10	I i3tJ	6	:r I}				
							10/oa SA!t1E. e, DS JP/tr R Ut'I NG t oT H-
						(J	(,1>'1'£ [V ite I tr 8t1T J)Po/lrl) p1,..7I".I'll'/-(.
							wtt(N J)06S . c ye LISTf P&oPt..f: tμE,fG
							1J6 S£(<.vr.,() - f \..V S H I A16 r1tr1t '/ R£Sr1N6
							'" 1R..ff{ VOO' TO (£

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL= Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date J I '1/'J.0{1 Observer(s) 5" GRw f:. / /ti. GP-oVt Wind .7

Temp (F) 53-• 5 Clouds (%) 100 - Events That May Have Affected Nesting fr/iT T 'r:ov-GHOUT DAY

Comments/General Assessment of Site 1 1 - 11 I "'- NC7 S' /.Np. AI(;J / r;N -()oS<; NCUBATING

8vi /Ii i I n T ll K,t N 6 [O Ii[IL f- OJVI vJ , N J(J / ? 1f-IN

ST ART TIME	ENDTJME	NEST ID	NEST STATUS	#OF ADULTS	# OF YOUNG	AGE OF YOUNG	COMMENTS
1'310	l dS"	) ;;z	A/>	3			e11 ., .JJ JJf ST. ...,W0 fl fw Ill I<.8i
							(11,"' ,_µr-, t>r.JE oF- ytl; JE. 1.,,/i.1-Jr tJ () /v S -r
							...C- 1 ,0 Pl I+W ,, ,,, , I\ R. µt::rr OS-
13,<0	13 5'		rlo	9-			,e,,u;€>11Jtrr, c) tJO J 0 1 N; /) SOON '1· "
l LI 40	S ;).O	7	hV	3			'TliVo 8 , :0S" () I\ / fJl ' 1 .0
							f t\ „ vu ovre. H in..- /f 1vt 1. IJ /J
\S"35	15 4S'	11	1"A	0	..-		

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date S-/1) OI] Observer(s) S.&J ov £ Wind o -- ;J.

Temp (F) b\) Clouds(%) f>()..I()O. Events That May Have Affected Nesting

Comments/General Assessment of Site

START TIME	END TIME	NESTfD	NEST STATUS	# OF ADULTS	#OF YOUNG	AGEOF YOUNG	COMMENTS
05'3)	o S"L/.)	0 7	} N	I			
O f, J-	0 7OS"	1l	'A	-			
IYOS	14 lS-	0	I N	I			
I'bIS-	,i 30	()'1	I A	- --			

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV= Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date S 13 017 Observer(s) t',I RD\JI; Wind

Temp-(F) 5o,S Clouds(%) /0() EventsThatMayHaveAffectedNesting

Comments/General Assessment of Site

START TIME	ENDTIME	NEST ID	NEST STATUS	# OF ADULTS	# OF YOUNG	AGE OF YOUNG	COMMENTS
S/13 ○ , ○	C) b 5 Q	O S	IN	\			
C>l \O	01d.<;"		JA	0			No t3Ul.OS - s r ,er ()flf5r#r
07l\)	0'600	\;+	?	C)			r/O g1Rf)5
0%30	O<t;50	05	!A	0			
oi3o	osro	() <-j	-rA-	0			
ocrocr	oq30	I 0	((\j	;;i.			5"Tl C/CS (J /J UT(L, ,.,,. t'OtE
o'l05	oq30	0	TP.	0			l µ IJFSi I OAI f f /2,C ;, ,tj$OVr,
							G.AGL VIS/fJte IN -,ee£ (Jf J IS.lAf"l/JJ
R tJ							To wfS7
1s-J (;	lSsO	J	1/J	I			n .ltl N f: <; t-
,u? -	I q<'"0	O r	J/V	;l			I o /v JvJ:.Sr I /N P(R.c J. / A/JI
							fl Y,I'/6 tJIP-(,/M /N P-57'

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date S-[3,\o 11 Observer(s) 5 6 R..<Nf I /A6 0\Jf Wind

Temp(F) S-7- Clouds(%) JS''' Events-That May Have Affected Nesting

Comments/General Assessment of Site

START TIME	END TIME	NESTID	NEST STATUS	# OF ADULTS	# OF YOUNG	AGE OF YOUNG	COMMENTS
06\	06'JO	7	TN	J			J /NC/Jt,AT'/Nf.J . I S!Tf/N6 o# JV{$',-
				-			/JPT vc.c. r, YIN6 -r ,c _s aN '''ff'',
o5lfo	0600	3	-:JA	-			
0100	07rJI	4	:Fft				
Q$a)	Oi17	£	:t.4	- -			
(06 8	065 r}.	/J	IA				

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date G{ı|.d0lJ Observer(s) f. 6 to VC/ M,4 l c;Vl Wind

Temp (F)__b__l Clouds (%) 5:0 Event s T hat May Have Affected Nesting

Co mments/General Assessment of Site

START TIME	END TIME	NEST ID	NEST STATUS	# OF ADULTS	# OF YOUNG	AGE OF YOUNG	COMMENTS
;ol 7	IO3a	S	/N		-	-	J ()N Nt.sr 't' t·t 6THE MQI/1N6 (-,P_ IA #rsr;
							Ofi-1\G IN(f, iCl-ltNtJ ;V(A 6'Y
1,s-0	17 0 0	/:l	IN	I		-	s, rr 1N6' UJIAJ IN r,/f ft-
,, 15	17 '10	:J..	FL	7	-		/ flt O· 6) Nf.Sr F1 r S- /v1 / N T',\-EN
							A{)/)(., 81 ().$ ftPR.,VI l Lf+/11()[t) (i)
							NF-s, jrl OTHF SoAR(0 ..,9(JV[. THb. /
							Ot! Ptt7 SIJ ro /\Iv.I. /Vtl ACC [S.S/0/\/
							&,,.v0 811217 (0 Nf51 P<..evv rv l?f -4/.l
							(. 1 O 5£ . Oi{ f6 dl O t:J/"' IVES r--
							Pf IM..1JO Tu N W, N p,.,,e..j t-\t /2
							Ac.-r, v, Ty rC> A1£ S7
)7 /.5"	I7'-10	J()	IA-				
J'b o	1&s-0	I	//t				

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0- 2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 w eeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date i;:('Jotd-o11 Observer(s) 5 G fLOVi, / f'i,6eoV8 Wind____d

Temp(F) F5 Clouds(%) CA.0 Events That May Have Affected Nesting

Comments/General Assessment of Site

START TIME	END TIME	NEST ID	NEST STATUS	#OF ADULTS	#OF YOUNG	AGE OF YOUNG	COMMENTS
0"0 S	Ob d-5"	0 d-	AD	B,.	-	-	P1'-IR. Rf,8UtLO/N6 #£--Sr
ooo S	O1	I D	A f')	I			J 811 0 r Ro#! Do, {)1;-1fl. 170{)/ N6 pf,4-7& / 4
						-	10 TO() OF U'rl vl.l' Y iO WJ,€ j
O7O,	O7J.S-	0 3	:rA	0	-----	-	TOD StitJP "/
0 7'-1)	ot,oo	0 L(	I-Ir	0			f,t/'/11'/6 - rw s--11 r

Nest Status: AD = Adult Present at Nest, Not Incubating; IN= Incubating/Brooding; YN = Young are visible in the nest;
NV = Not Visible; FL = Failed Nest; IA =Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niaiara River ea of Concern Osprey Nest Observation Datasheet

Date 6/ / 0 17 Observer(s) 5,6e vf M,tPaV& Wind_ ! _

Temp (F) 1:ct' Clouds(%) 1a_.S 0-- Events That May Have Affected Nesting _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Comments/General Assessment of Site_ _

START TIME	END TIME	NEST ID	NEST STATUS	# OF ADULTS	#OF YOUNG	AGE OF YOUNG	COMMENTS
0535""	O.>S-7	O ,	'IN	I	I	ot.	ADUvi' I) N /VEST. J CH/tJt, LOW /J
							/..JFST O.SS 1J1 · Hf es
6SO	0,1	I I	1A				
0 7 30	07 I.ft	0;-	rn	:)	J	I	/Jo YOuN6 1/ff,tJCf C-t/Ee I
							..,,'<ON£ ft')G)r*G
""I :	OC,iOS	} "">	(A				

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date b) J.a., d.o 1 Observer(s) S. 6ROJ. /:..-6RtN Wind __

Temp-(F) 75' Clouds(%) D ... JO E vents That May Have Affected Nes ting_________________

Comments/General Assessment of Site___________________________________

START TIME	END TIME	NESTID	NEST STATUS	# OF ADULTS	# OF YOUNG	AGE OF YOUNG	COMMENTS
C"1 d-0	O't'-10	()5'	IN		,.J.		D orvE. poO,A6-£ cttPTt11dE:.D I /,,0 tiL7 ;O ; ON
							NtSr. I Pl P-Clt f O)r--c..,y;NG- f (l/1111
oqs	ID ;J 0	la	, ,		3		»eotve Fo o1 A6 t r" ,, 1 ue f t:J OSPk'
							N FiA61-1i J R.E-JJS U A/> (? /./ S T .
I\ 30	, on	01	I Pr	0	C>		

Nest Status: AD = Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest;
NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: 1 = 0-2 Weeks; 2 = 2-5 Weeks; 3 = 5-8 weeks

Niagara River Area of Concern Osprey Nest Observation Datasheet

Date 7/ &./aO,7 Observer(s) S.6 eo \IE Wind /

Temp (F) is- Clouds (%) .:60 Events That May Have Affected N sting

Comments/General Assessment of Site

START TIME	END TIME	NEST ID	NEST STATUS	#OF ADULTS	# OF YOUNG	AGE OF YOUNG	COMMENTS
J 7'-IS-	Ji /0	13	IP.	0	0	-	N S 1' SiAA.rfl) NIJT WflI E!T/f8US'ltIJ
							Dc c te.EPe>R..rM s 1 N6 /f,t}()CT
							CG.Ll TOWE te. ON /if Ol!N1N6 oF 7 / 1:
J<gJS-	li .30	0.)/D	I.fr	o	-	-	fJt:) ttC TJV/TY
Ji38	JC/JO	1 '-I	'IN	l	a	:J.	LAN()bWNf RS /(f._(JQ(rr , tf ,s NFST ? PI J
							/Jl1ST 1./- r- YrS, C.1-f/ CJt:.S 1;1'JCH y;f!.
							- IV /JVt;. A-i IE sr ::J /N
							/VES r /JJ()"1V ,.it!T t.J/V/lf IE- 16
							C0/1FI ti?' ii - /)/v l'/C11Vf
							CGl l iOvVf/2 LIrPGf AJfr T

Nest Status: AD= Adult Present at Nest, Not Incubating; IN = Incubating/Brooding; YN = Young are visible in the nest; NV = Not Visible; FL = Failed Nest; IA = Nest Inactive (Status Unknown)

Nestling Age: l = 0-2 Weeks; 2 = 2-5 Weeks; 3 =5-8 weeks