

Conservation of Black Terns – A Michigan Species of Special Concern

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Background

Black terns (*Chlidonias niger*) are a Michigan Species of Special Concern that require mats of floating vegetation in marsh wetlands for nesting. Since 2013, Detroit Audubon and Audubon Great Lakes have studied Black Terns at St. Clair Flats, Michigan with the primary goals of estimating colony size, breeding success and productivity of this Michigan Species of Special Concern. St. Clair Flats has been and remains Michigan's largest colony for this important species. The data collected are being used to determine land management and conservation strategies needed to abate threats to breeding success and remove limiting factors to colony occupancy. A species of conservation concern in most Great Lakes states, the Black Tern, is receiving increasing attention by federal and state agencies, including the Upper Mississippi River/Great Lakes Joint Venture.

Status and Trends

Black Tern populations have experienced a decline of 48-71% between 1991 and 2006 in Michigan, and range-wide losses of 61% between 1966 and 1996 (Scharf, 2011). This constitutes a three percent annual reduction in numbers. New research (Wyman and Cuthbert, 2017) shows that colony abandonment has occurred at a faster rate than the population decline, and suggests that large colonies, like those at St. Clair Flats, hold the highest conservation value. Both the proximate and ultimate causes of the population decline are unclear. Preliminary demographic data from studies in breeding colonies in Wisconsin (Shealer, 2007) suggest adult survivorship may be too low in some areas to support population maintenance.

Basic demographic information for most colonies is lacking. Any effort to measure population demographics involves a long-term dataset and annual focused effort, and this project is no exception. Models from Wisconsin (Shealer, 2007) and Maine (F. Servello, pers. comm.) required trapping of over 1,000 adult Black Terns over a decade or more in order to properly estimate adult survivorship, for example. Shealer (2007) estimates adult survivorship in those populations at approximately 62-65%, which is too low to viably maintain a population. In order to better evaluate survivorship at a regional scale, long-term mark-recapture surveys need to be replicated in additional colonies. These replicative studies will confirm adult and natal site fidelity (best achieved with satellite transmitters), juvenile survivorship to breeding age (2 years), colony exchange rates (transmitters), and all relevant demographic information (Putnam, 2016). These concerns led to the expansion of the productivity survey to include trapping and banding of adult and young Black Terns in 2013. This dataset will inform land managers how best to remove limiting factors to Black Tern population growth.

Colony Locations

Black Terns changed nesting locations between and within seasons, in response to changing distributions of floating dead bulrush stem mats and water levels. 2013 was a record low water level year in the Great Lakes and 2019 was a record high water level year. The distribution of Black Tern subcolonies on St. Clair Flats has reduced over time, with some notable between-year changes, particularly 2018-2019. Perhaps most notably, Muscamoot Bay was the epicenter of breeding activity from 2016 onward, while Strawberry subcolony and others west of Harsen's Island dropped

precipitously. Mackie subcolony increased significantly, and was then abandoned, as were Doty and Fisher subcolonies, while other colonies stayed roughly the same. Many areas which were fairly deep in 2015 and 2016, such as Strawberry and Mackie, were too deep for nesting and monitoring in subsequent years.

Deep water has many potential adverse effects to Black Tern nesting success. It is suspected that in high water years, vegetation mats trapped within ice sheets have more easily been lost in early spring storms, as ice ventures out to the middle of Lake St. Clair. A decline in available nesting mats has been observed as water levels have increased over time. In addition to a loss of vegetation mats, increased wave action during storm events causes more frequent nest failures. Higher water levels are also allowing larger motorboats to travel through historically narrow channels throughout the flats. Larger boats create more of a wake than small mud boats, which can also cause nearby nests to fail. One potential silver lining to the increase in water depth is that it makes the colonies increasingly difficult for land-based predators to reach.

While Black Terns are clearly adept at adjusting to micro-habitat conditions between years and within years (during re-nest attempts), they are losing nesting substrate as water levels continue to rise and remaining subcolonies are more subject to nest failure during storm events in high water level years. Nesting subcolonies are being pushed east, inland towards Harsens Island, and fewer adults are breeding at St. Clair Flats than ever before.

Black Tern Nesting at St. Clair Flats

The minimum tally of pairs found nesting at St. Clair Flats over the years confirms that roughly 300 adults are present at St. Clair Flats annually. This suggests at least 150 single nesting attempts (Table 1). Given the high number of nest failures and subsequent re-nesting attempts, the overall number of nests found may not be a suitable surrogate for estimating the actual number of adults. Population estimates could potentially include some double counting of adults that switched colonies during the brief periods when we conducted peak counts. From 2016 onward, most of these counts were made during June 9-22 during concentrated flush counts.

Table 1. The total estimated minimum number of nests and adult Black Terns at St. Clair Flats during 2013-2019. These estimates are inherently subjective (see text), and these numbers represent what we believe are reliable minimum estimates, and very likely undercounts.

| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Adults | 600 | 340 | 300 | 300 | 300 | 220 | 180 |
| Nests | 50 | 68 | 81 | 100 | 201 | 123 | 154 |

More nests have been found each year at St. Clair Flats (Table 1). This very likely is not representative of an increase in the number of nests, but rather an increase in the technicians' skill at finding them. Given that an estimated 300 adults are present each year, likely more (see above), these findings suggest that technicians are missing a lot of nests. Missing nests is unavoidable, as not all areas can be searched effectively each week. Colonies that fail early are often missed entirely, because surveyors are unable to access a colony prior to a storm failure or predation event. A more complete

survey would require more technicians, boats, and person-hours. Ultimately, this would require more funding and multiple technicians, or perhaps daily visits of one technician.

Hatching and Fledging Success

Ideally, hatching and fledging success would be measured by following the ultimate fate of each egg, but with current technology, this is not yet possible. Instead, as previously mentioned, hatching success is used as a surrogate for fledging success and is based on the estimated number of eggs hatched versus the estimated number of eggs failed. Many nests still have unknown fates each year, and below hatching success ranges account for these unknowns. Hatching success has declined over time as water levels rise. Effort in the field between 2017 and 2019 was consistent compared to years past.

In an effort to better measure fledging success, Audubon Great Lakes and partners at Indiana University deployed NanoTags, a type of radio transmitter, on 15 pre-fledged chicks in 2019. Using the Motus wildlife tracking system, signals from tagged fledged chicks should be picked up by Motus towers along the migratory route south. Data review from Motus towers is still pending.

Table 2. The number of total Black Tern nests found on St. Clair Flats during 2013-2019.

| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|------------------|--------|--------|--------|--------|--------|--------|--------|
| Hatching Success | 47-95% | 55-84% | 50-81% | 26-99% | 35-89% | 29-68% | 19-73% |

Banding of Adults

The number of banded adults has steadily increased over the years due to technicians fine-tuning capture methods over time (Table 3). In 2016, there was a slight drop in capture rates due to reduced effort in the field and a focus on training a new technician. In 2017, an increase in capture rates and effort resulted in 63 newly banded adults.

In 2019, the focus shifted from banding adults to monitoring nests and chicks so chicks could be captured and NanoTags could be deployed prior to fledging.

Banding of Chicks

Chick banding totals are presented in Table 3. While 432 flightless chicks have been banded, the actual number present was certainly much higher. Prior to 2019, adult capture had been the primary focus, so chick capture rates were lower with the exception of 2017, when multiple partners were in the field at peak hatching time, allowing for many more chicks to be captured and banded.

Table 3. Summary of annual adult and chick Black Terns banded at St. Clair Flats since 2013. Totals represent only newly banded adults (omits recaptures).

| Year | New Adults | Recaptured Adults | Chicks |
|------|------------|-------------------|--------|
| 2013 | 9 | 0 | 32 |
| 2014 | 12 | 0 | 67 |
| 2015 | 37 | 0 | 76 |
| 2016 | 31 | 2 | 66 |
| 2017 | 63 | 9 | 132 |

| | | | |
|----------------------|------------|-----------|------------|
| 2018 | 37 | 11 | 14 |
| 2019 | 12 | 14 | 45 |
| Project Total | 201 | 39 | 432 |

Recaptures

39 individuals have been recaptured to date, including four natal recruits. More recaptures are expected to be captured as adult and chick banding continues. The most exciting recapture to date (band #2451-31818), was banded as a chick in Mackie colony on June 30, 2014 and recaptured in Muscamoot on June 20, 2016. This bird was not captured in 2015 and represented the first ever natal recruit for St. Clair Flats.

Storms

Strong thunderstorms continue to be the primary threat to tern nests on St. Clair Flats. Six camera traps were set-up in 2018 in an effort to assist in identifying nest failures with certainty; however, these cameras only covered 10 nests. These results are based on a combination of nest cameras and nest monitoring efforts that observed nest failures following storm events each year. In particular, Fisher Highway appeared to experience significant nest loss, and subsequent abandonment by nesting adults following the May 28 and June 4-5, 2016 storms (E. Rowan, unpub. data) and has not been recolonized since. Increased water depth during 2016-2019 may have exacerbated storm damage, as wave action could have been more intense.

Predation Issues

Mammalian and avian predation generally are minimal at the flats, with weather a more important source of nest and chick loss (Putnam 2016). Only a few cases of nest depredation events have been observed since monitoring began. In 2016, eggs were found destroyed by what appeared to be piercing, possibly by a bird of some kind. However, no diurnal heron activity in the colonies was noted (other than a flyover by a Great Blue Heron at Fisher Highway on July 7). MDNR biologists reported single Black-crowned Night-Herons (unpub. data) in 2016 on Harsen’s Island, though none have been observed on the flats.

Chick predation was extremely difficult to document, given that chicks are frequently on the move and impossible to locate after a short time following hatching. That said, a single chick was found with laceration wounds on its belly and back, injuries that were most consistent with a smallmouth bass attack (John Darling, Erin Rowan pers. comm.). Pike or muskellunge would have produced puncture wounds, and a Snapping Turtle (*Chelydra serpentina*) would have killed the chick. This chick recovered in the care of a licensed rehabilitator and was released. It is also possible that fish predation may be exacerbated by deeper water, as pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieu*), or muskellunge (*Esox masquinongy*) may be better able to access the nesting areas. This merits further study.

A single raccoon was observed in May of 2016 swimming across Doty channel toward Doty East, though no Black Terns were yet nesting. This is a potential predation source to be aware of in the future. Each year technicians witnessed northern water snakes (*Nerodia sipedon*), especially near Mackie and Doty East, and also in Muscamoot. Eggs were found in Little and Big Muscamoot with pairs of puncture

wounds surrounding intact nests that were empty in 2018 and 2019. Northern water snakes are probable egg predators, though more study is needed. Muskrats and mink continue to be present in the Black Tern colonies at St. Clair Flats, but do not seem to exert undue predation pressure.

New Technology

Motus Wildlife Tracking System (motus.org) uses coordinated automated radio telemetry arrays to track the movements of wildlife internationally. Digitally encoded radio transmitters, or NanoTags, are affixed to individuals and broadcast signals to Motus towers, which have been erected across the globe. Fourteen of these NanoTags were attached to banded Black Tern adults in 2017, and a Motus tower was erected on Harsens Island thanks to partners at Canadian Wildlife Service. Fifteen NanoTags were attached to banded Black Tern chicks in 2019 as well, and two additional Motus towers are being erected along western Lake St. Clair in 2020. Motus data will help determine migration routes and wintering grounds of the Black Terns at St. Clair Flats, and shed light on fledging success.

Nine geolocators were also deployed on adults in 2017, and six have since been recovered, three in 2018 and three in 2019.

Two camera traps were utilized in 2017, and six were utilized in 2018, thanks to partners at the Detroit Zoo and Common Coast Research. Camera traps were installed in 2019 as well, but due to technical difficulties, were unable to record footage. The continued use of camera traps will hopefully elucidate causes of nest failure and potential nest and hatchling predation at St. Clair Flats.

Surveys of Additional Black Tern Colonies

As previously mentioned, to better understand Black Tern survivorship at a regional scale, long-term mark-recapture surveys need to be replicated in additional colonies. Outside of St. Clair Flats, Audubon Great Lakes and partners surveyed Black Terns at Ogontz Bay (Delta Co., Michigan) beginning in 2016. This site was abandoned in 2017. The colony reappeared at Ogontz Bay in 2018, but was inactive again in 2019. Baseline surveys of a Black Tern colony were conducted at Wigwam Bay State Wildlife Area (Arenac Co., Michigan) in 2017. In 2018 and 2019, this colony was regularly monitored, and adults and chicks banded. This research aims to measure the impact of wetland management on Black Tern nesting activity. Vegetation management that creates openings in dense emergent marsh monocultures is being used to recreate habitat that should be preferred by nesting Black Terns.

Management Next Steps

In 2019, Audubon Great Lakes obtained a MI DNR Wildlife Habitat Grant to enhance wetlands within the diked units of the St. Clair Flats State Wildlife Area. This project will have similar goals as the project at Wigwam Bay. The diked wetlands at St. Clair Flats have greater protection from storm events and human disturbance compared to undiked wetlands, and managers have the ability to manipulate water levels. Each year, adult Black Terns are observed feeding in diked wetland units, but only one pair attempted to nest there in 2017. Unfortunately, this nest failed, due to a storm that caused the nesting substrate to break apart. In the fall of 2020, openings will be created within dense stands of cattail and *Phragmites* within the marsh, and the cut vegetation will be left behind. This will help to create hemi-marsh conditions by increasing the amount of open space, while combatting the spread of *Phragmites* (stems will be flooded). Further, cut plant debris will be left in place in the hopes that Black Terns utilize

it for nesting. This habitat work will also benefit breeding and migratory waterfowl, and breeding marsh birds.

Partners at Detroit Audubon received funding from National Audubon to build and install Black Tern nesting platforms throughout St. Clair Flats in 2020. These platforms have been successfully used by Black Terns at Ogontz Bay and will hopefully help reduce nest failures at St. Clair Flats.

To best inform management at a statewide level, Audubon Great Lakes is working with multiple partners as part of the Great Lakes Black Tern Conservation Initiative to expand Black Tern colony monitoring across Michigan and other areas in the Great Lakes. A proposed larger-scale monitoring project will incorporate efforts to identify threats related to predation and invasive species, and will directly inform where restoration efforts should be prioritized and whether conservation actions should focus on providing platforms or invasive species management.

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