Identification of Critical Nesting Habitat for Wetland Birds in Michigan: Eastern Upper Peninsula—Year Two Progress Report

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Photo: Looking across Cranberry Lake, Chippewa County, Michigan.
Inset photo: Ed Schools conducting fieldwork as part of wetland bird study at Munuscong Bay Wildlife Management Area (photos by M. Sanders)

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Introduction

Both coastal areas and inland wetlands provide unique habitats that sustain considerable native biodiversity. Informed management of these ecosystems is required to enhance the long-term viability of native species and sustainability of ecological resources. Devising appropriate protection and restoration strategies relies on the availability of current status assessments of environmental features and associated biota. Nearly two-thirds of the birds that are listed as federally threatened or endangered in the United States as associated with wetlands (Mitsch and Gosselink 1993). In Michigan at least 19 bird species currently listed (endangered, threatened, or of special concern) are associated with wetlands. Although much is known about many terrestrial or landbirds of the Great Lakes, the ecology of most marsh-dependent species has received less attention (Weeber and Vallianatos 2000). The wetland birds, as a group, have suffered severe population declines over the last several decades (McPeek and Brewer 1991). Draining and filling of wetlands, and other human actions continue to threaten habitat for these birds and other flora and fauna. Many of the remaining Great Lakes wetlands are fragmented due to intensive agriculture or urban development. Additionally, the spread of exotics such as common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*), into coastal and inland waterways presents a very serious threat to the ecological integrity of these systems further fragmenting suitable wetland bird nesting habitats. Some wetland birds are area sensitive, not occurring at small, isolated sites (Brown and Dinsmore 1986). Wetland birds provide great value as indicators of environmental integrity, as well as substantial aesthetic and recreational value to those who enjoy the outdoors.

In 1996, the State of the Lakes Ecosystem Conference (SOLEC) began to evolve from a small group of indicators to an initiative developing a comprehensive set of basin-wide indicators that would more accurately report on progress under the Great Lakes Water Quality Agreement (Weeber and Vallianatos 2000). Through this process, a recommended set of indicators was presented at SOLEC 1998, two of which are directly related to this project – wetland bird diversity/abundance and threatened and endangered species.

Our purpose is to identify the most critical sites in Michigan for the continued protection of wetland birds. Many projects (MNFI Great Lakes Marsh Work, Great Lakes Marsh Monitoring Program, MSU graduate studies, Important Bird Areas Programs, and the Michigan Breeding Bird Atlas Project) have already begun to study wetland birds in Michigan. Most, however, have been limited in scope or have answered specific research questions, therefore lacking the state-wide perspective needed to identify and potentially prioritize these critical wetlands. The data that exists needs to be compiled, analyzed, summarized, and presented at the appropriate spatial scale that is useful to land managers, planners, and others. New and updated inventories and ecological assessments of these coastal wetlands will provide valuable data describing 1) the status of important wetland breeding bird communities and species, 2) current status of encroaching exotic species at survey sites, and 3) conservation management needs for coastal wetland bird species. Inventories will help fill information gaps that currently exist and will provide a much stronger foundation for devising sound conservation and management strategies.

This multi-year project will help public land managers and planners identify the wetland bird species, communities, and habitats of concern - both in their local areas and statewide. The first year focused on public lands on the eastern side of Michigan's Lower Peninsula along the coastal areas of Lake Huron, Lake Erie, and Lake St. Clair (Cuthrell and Monfils 2004). Year two **(this report)** was carried out in the Eastern Upper Peninsula. With additional funding it is hoped that all coastal wetlands in Michigan will be completed.

The Michigan Natural Features Inventory (MNFI) is prepared to undertake research to: 1)

gather reports and other records for nesting wetland birds in these coastal wetlands and incorporate the information into an environmental decision-making process for planning and management, 2) conduct targeted wetland bird surveys on public lands where records older than 20 years exist and update occurrence records and population status estimates for these wetland bird species, 3) collect ecological data at survey sites to characterize critical habitats and communities necessary for sustaining viable populations of wetland birds in Michigan and elsewhere, and 4) disseminate this information to key land management partners.

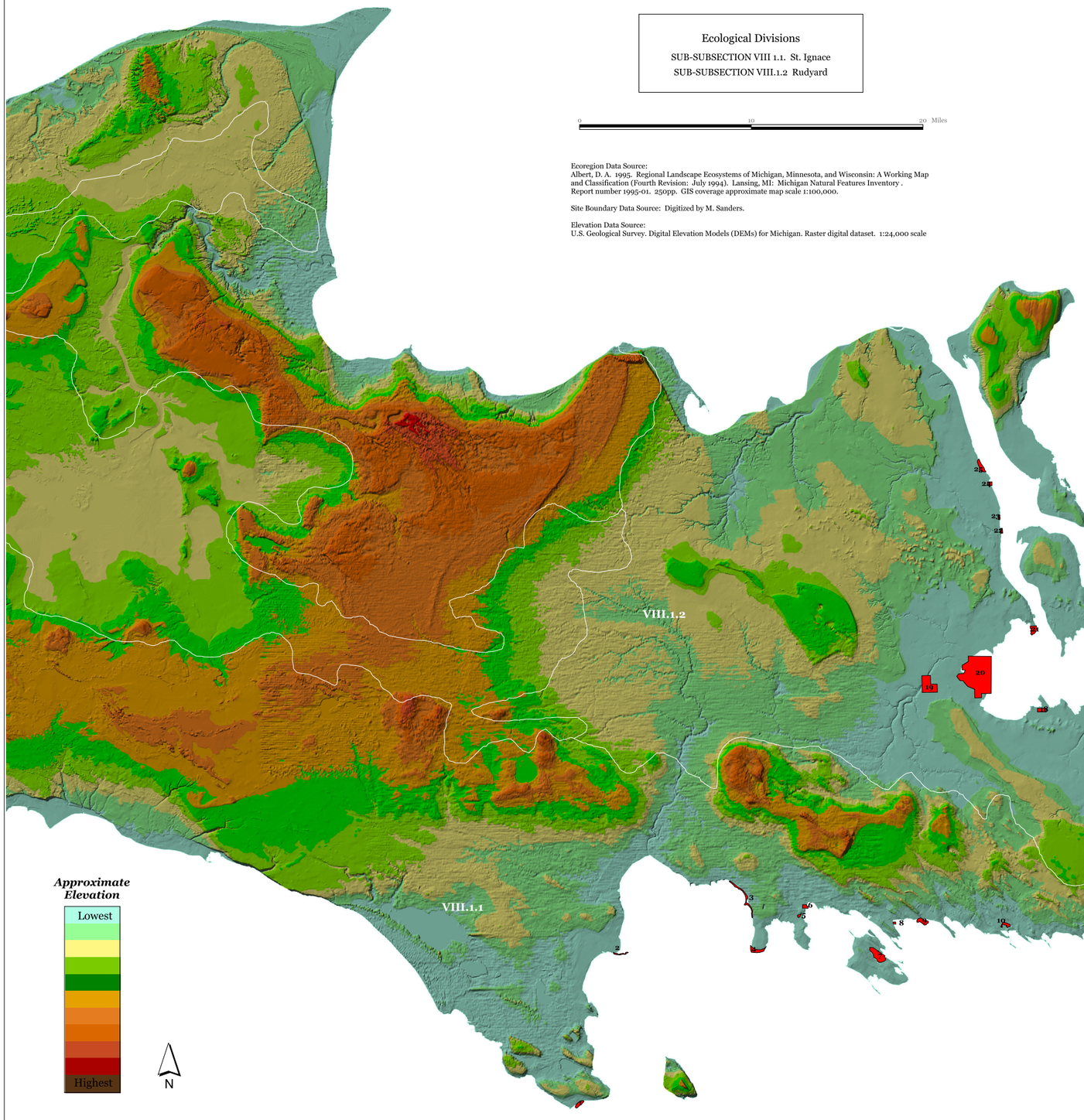
This progress report presents the results of the second year of a four-year project to conduct systematic inventories of selected Great Lakes wetlands to identify critical nesting habitat for rare wetland birds. Over the past two decades MNFI has surveyed numerous coastal communities and rare species found in or allied with Great Lakes wetlands. In this compilation we provide the results of wetland bird inventories conducted by MNFI zoologists, focused on public lands on the southern shoreline of Lake Huron in the eastern Upper Peninsula and the marshes associated with the St. Mary's River. Important wetland bird nesting habitats are highlighted in a site summary section as well as depicted as regional maps. Also provided are brief descriptions of these survey sites and results of bird surveys, and summaries of data review activities. In addition, an analysis of the project to date is provided as both an overview and a basis for assessing the future direction of this multi-faceted effort.

Study Area

The study sites for the second year of the wetland bird inventory included emergent and submergent wetlands associated with Lake Huron, the St. Mary's River, Munscong Bay, and Drummond Island along the eastern shoreline of Michigan's Upper Peninsula (Figure 1). Several sampling locations or points were visited on at least one occasion by MNFI staff. Most sites were within five publicly owned parcels including portions of Hiawatha National Forest, Mackinac State Forest, Michigan State University's Dunbar Forest Experiment Station, Munuscong Bay Wildlife Management Area, and Potaganassing Wildlife Floodings. We focused our efforts on publicly owned parcels or those sites which had older wetland bird occurrences.

Regional Landscape Ecosystems of Michigan, Minnesota, & Wisconsin (Albert 1995) provides a useful framework for understanding broad patterns of occurrence for natural communities, species, and natural disturbance across the state. The landscape units integrate climatic, landform, soil, and vegetation factors. The classification is hierarchically structured with three levels in a nested series, from broad landscape regions called sections, down to smaller subsections and sub-subsections. Survey sites identified in this study spanned two subsections including the St. Ignace subsection and the Rudyard subsection (Figure 1).

Figure 1. Wetland bird study area (with MNFI sampling locations numbered) 1-25



Ecoregion Data Source:
Albert, D. A. 1995. Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification (Fourth Revision: July 1994). Lansing, MI: Michigan Natural Features Inventory . Report number 1995-01. 250pp. GIS coverage approximate map scale 1:100,000.

Site Boundary Data Source: Digitized by M. Sanders.

Elevation Data Source:
U.S. Geological Survey. Digital Elevation Models (DEMs) for Michigan. Raster digital dataset. 1:24,000 scale

Sampling Locations	Number
Point La Barbe	1
Grosse Point on St. Martin's Bay	2
St. Martin Bay	3
St. Martin Point	4
Loon Lake	5
Mismer	6
Marquette Island - Duck Bay	7
Cedarville Bay	8
Flower Bay	9
Prentiss Bay	10
Huron Point	11
Cranberry Lake Floodings	12
Maxton Bay	13
Potagannissing River Wildlife Floodings	14
Scott Bay	15
Point aux Frenes	16
Rocky Point	17
Maple Point	18
Munuscong State WMA Potholes	19
Munuscong State WMA	20
Kemps/Conley's Point	21
MSU Dunbar Forest Experiment Station	22
12 Mile Road Marsh	23
10 Mile Road Marsh	24
9 Mile Road Marsh	25

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St. Ignace (Sub-section VIIII.1.1)

The St. Ignace Sub-subsection is characterized by sandy lake plain and exposed limestone or with thin soils over limestone. The growing season ranges from 130 to 140 days, longest along the Great Lakes shorelines (Eichenlaub *et al*. 1990). Annual average precipitation is around 30 inches. Annual snowfall averages 60-80 inches and is fairly uniform across the sub-subsection.

Along the Lake Huron shoreline there were many broad coastal marshes in protected coves and embayments during presettlement times. These were especially common in and around the Les Cheneaux Islands (Albert 1995). The substrate in these marshes was often clay or marl (Albert et al. 1989). In some of the embayments, there were extensive fens, dominated by stunted white pine, northern white cedar, tamarack, and black spruce, and containing marly pools. Much of the coastal zone along northern Lake Huron and Lake Michigan where soils were thin overlay bedrock dominated by balsam fir-spruce-cedar forests and northern hardwoods.

Roads and highways have probably had the most negative impact on coastal wetlands in the area. They have been responsible for disrupting the wetland hydrology and facilitating shoreline development. Several emergent marshes along northern Lake Huron have been degraded by highway construction. In addition the highways have lead to increased residential development which is quite dense on many of the Les Cheneaux Islands.

Rudyard (Sub-subsection VIIII.1.2.)

The Rudyard Sub-section of lake plain contains fine-textured soils and has been more intensively managed for agriculture than any other part of Upper Michigan. Elevation ranges from 580 to 800 feet (177 to 244 m) and the sub-section encompasses 666 square miles (1,725 sq km). The average growing season ranges from 120 days in the north to 140 days in the south (Eichenlaub *et al.* 1990). Average annual precipitation is 32 to 34 inches.

The clay soils are somewhat poorly drained closer to the St. Mary's River along the eastern edge of the sub-section. Soils are generally well drained on the ground moraine of Sugar and Neebish Islands.

The poorly drained shorelines of the clay lake plain support some of the most extensive marshes of Michigan (Albert 1995). The emergent marsh zone can be a mile wide, and the wet meadow zone along the shoreline is often another quarter to half mile wide. A large part of the marsh at the mouth of the Munuscong River has been diked for waterfowl management. The wetlands along the St. Mary's River are particularly important for waterfowl migration.

Methods- bird surveys

The MNFI receives information from a variety of sources including university researchers, government and non-government organizations, nature centers, and the general public. This information is screened for reliability, accuracy, and whether the data conforms to the natural heritage methodology standards. Only then is it entered into our Biological and Conservation Database (Biotics Database). For this specific project, data from the Michigan Breeding Bird Atlas Project, the Great Lakes Marsh Monitoring Program, several university graduate thesis projects, and other data sources were compiled. This information was added to the Michigan Natural Features Inventory's Biotics Database. Maps were generated using this information and key wetland bird nesting areas were delineated.

Wetland birds which are currently listed as Michigan endangered, threatened, or of special concern were the primary survey targets (Table 1). The Natural Heritage Biotics Database was consulted for known occurrences of rare wetland birds throughout the study area. Information on various species was gathered by consulting expert ornithologists, zoologists, wildlife biologists, pertinent unpublished reports, and a variety of published sources. Survey areas were prioritized based on their potential for supporting State and/or Federally listed wetland bird species, and by the degree to which they have been recently surveyed Areas along the coast where no recent work had been conducted were given top priority. Potential for listed wetland birds was determined by several characteristics including the existence of historical records, presence of appropriate habitat and location within a range currently known for one or more listed birds. Survey sites for each target species or group were selected based on historical occurrence records, air photo interpretation, current land cover maps, and by consulting with individuals knowledgeable about the eastern shoreline of Michigan's Upper Peninsula. In addition, MNFI ecologists identified potential survey sites. A field schedule was developed based on prior Michigan observation and collection dates for each species.

Common Name	Scientific Name	State Status	State Rank	Global Rank
American Bittern	*Botaurus lentiginosus*	Special Concern	S3S4	G4
Least Bittern	*Ixobrychus exilis*	Threatened	S2	G5
Caspian Tern	*Sterna caspia*	Threatened	S2	G5
Forster's Tern	*Sterna forsteri*	Special Concern	S2	G5
Common Tern	*Sterna hirundo*	Threatened	S2	G5
Black Tern	*Chlidonias niger*	Special Concern	S3	G4
Marsh Wren	*Cistothorus palustris*	Special Concern	S3S4	G5
Yellow Rail	*Coturnicops noveboracensis*	Threatened	S1S2	G4
Common Moorhen	*Gallinula chloropus*	Special Concern	S3	G5
Common Loon	*Gavia immer*	Threatened	S3S4	G5
Black-crowned Night Heron	*Nycticorax nycticorax*	Special Concern	S2S3	G5
Osprey	*Pandion haliaetus*	Threatened	S4	G5
Wilson's Phalarope	*Phalaropus tricolor*	Special Concern	SN	G5
King Rail	*Rallus elegans*	Endangered	S1	G4G5
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Special Concern	S2	G5
Northern Harrier	*Circus cyaneus*	Special Concern	S3	G5
Short-eared Owl	*Asio flammeus*	Endangered	S1	G5
Great Blue Heron Rookery	-	-	-	-

Table 1. Endangered, threatened, and special concern bird species and natural features which were targeted for surveys or for which data was entered into our database.

The sampling window for these wetland bird species occurred during mid May through June when bird detectability is high. Early morning surveys began at, or shortly after, sunrise and ended around 1100 EST. Evening surveys began again around 1900 EST and terminated around 2300 hours EST. Bird species presence/absence and relative abundance were recorded at each survey site. Surveys were not conducted if sustained winds exceeded 24 km/h or during periods of heavy rain. Survey methods included 1) 100m fixed radius plots for passerines, 2) con-specific taped playback call surveys for rails, bitterns and marsh wrens, and 3) visual surveys for terns and other birds along line transects. Standard Natural Heritage Special Animal Forms were completed for all rare bird occurrences. Data from all sightings included numbers of individuals seen or heard and the extent and quality of occupied habitat. These data were then entered into Biotics. In addition, a list of all birds observed at each location was compiled. This data will be part of the Michigan Breeding Bird Atlas II project.

Methods- data review/transcriptions

An important component of the wetland bird project is the preparation of field information for use within MNFI's new, Geographic Information System (GIS) based data platform. A GIS system allows the known spatial extent of an occurrence to be represented. This spatially represented data is far more useful for resource managers, land-use planners, scientists, and the general public than a traditional natural heritage database. Before the advent of GIS, occurrences were recorded with an estimated lat/long point and a mapping precision. Three types of precision were used: second (S), minute (M), and general (G). "Second" precision means the location was known exactly. "Minute" precision means the location was known to within a mile. "General" means that the location is only known to the township level.

Now, with GIS, the known spatial extent of an occurrence can be digitally represented. Data best represented by a point (i.e. single bird nest, small populations, etc.) are represented with a small, approximately six-meter radius circle. Older, pre-GIS records are represented spatially by applying a buffer to the estimated lat/long point. The buffer size is based on the mapping precision of the occurrence. Second precision records are assigned a 100 meter diameter buffer, minute precision records are assigned a 2,000 meter buffer, and general records are assigned an 8,000 meter buffer.

During the wetland bird survey, new natural features data were transcribed and entered with respect to heritage data standards developed for the spatial representation of element occurrences. Heritage data standards and methodology are defined by NatureServe (www.natureserve.org). Under heritage methodology, only the known extent of an occurrence may be digitized. For example, if the only information known about an occurrence is that it occurs within a specific legal section, with no more precise spatial information, the section boundary becomes the extent of the occurrence.

In addition to digitizing MNFI data obtained during the 2004 wetland bird surveys, information from outside sources was also entered and digitized. Then all existing breeding bird information within the study area was carefully reviewed, and where possible circular buffers replaced with a digitized spatial extent. This digitizing effort entailed closely examining source information for previously documented records, including field forms and any associated maps indicating the specific locations and the spatial extent of the records. The result of the digitizing effort is a natural features data set that supplies more precise and useful information than either a stand-alone database or circular spatial extents derived solely from a mapping precision protocol.

Results

From our 2004 field work, a total of 67 element occurrences were either updated or newly transcribed. Of these, 52 were updated occurrences and 13 were either new occurrences or transcribed for the very first time. The data mining process was used to systematically examine all natural features information recorded for the eastern shoreline of Michigan, resulting in the digitizing of 67 bird occurrences (Appendix II-III). Of these, 52 were updated element occurrences and 13 were newly transcribed (Table 2). The St. Ignace subsection contains 56 wetland bird occurrences (Appendix II), and the Rudyard subsection 17 occurrences (Appendix III).

Five new occurrences were documented in 2004 for the Yellow Rail (*Coturnicops noveboracensis*, state threatened), three new occurrences were documented for the American Bittern (*Botaurus lentiginosus*, state special concern), one new occurrence for the Least Bittern (*Ixobrychus exilis,* state threatened), three new occurrences. New information was gathered for many species. For example, 7 breeding records for the Osprey (*Pandion haliaetus*, state threatened) were updated as part of the data mining component of this study. These data, along with data from the last breeding bird atlas, help provide a more complete picture of wetland bird breeding habitats along the southern shoreline of Lake Huron in the eastern Upper Peninsula.

Common Name	State Status	Updates	New	Total
American Bittern	Special Concern	6	3	9
Least Bittern	Threatened	1	1	2
Caspian Tern	Threatened	7	0	7
Forster's Tern	Special Concern	0	0	0
Common Tern	Threatened	8	0	8
Black Tern	Special Concern	7	0	7
Marsh Wren	Special Concern	3	3	6
Yellow Rail	Threatened	1	5	6
Common Moorhen	Special Concern	0	0	0
Common Loon	Threatened	3	0	3
Black-crowned Night Heron	Special Concern	2	0	2
Osprey	Threatened	7	1	8
Wilson's Phalarope	Special Concern	0	0	0
King Rail	Endangered	0	0	0
Yellow-headed Blackbird	Special Concern	0	0	0
Northern Harrier	Special Concern	4	0	4
Short-eared Owl	Endangered	1	0	1
Great Blue Heron Rookery	-	2	0	2
TOTALS		**52**	**13**	**67**

Table 2. Summary of data that was updated or newly added to MNFI's Biological and Conservation Database during 2004.

Site Summaries

A goal of this project is to identify critical nesting habitats for wetland birds in Michigan. As established in the format of several other coastal zone inventories, we provide here a summary description of the significant wetland sites. These summaries are categorized by Ecoregion as defined previously in the Study Site section. These descriptions are provided to help summarize the importance of these wetland areas as well as provide context for the study area. While a complete analysis requires multi-year data, areas we feel are important to nesting wetland bird species are highlighted.

MNFI visited 23 sites and we identified the following sites of conservation value to wetland breeding birds based on field surveys in 2004, existing element occurrence records, habitat value for rare birds, existing protections, and site viability. Below is a brief description of each site containing information on general habitat types, survey results, existing rare bird records, potential for other rare bird occurrences, and opportunities for conservation and management. Since MNFI staff could not survey all of these sites multiple times, inventory needs are also identified as applicable.

St. Ignace Sub-section

Straits Area

1) **Point La Barbe** – This strip of Great Lakes Marsh lies just west of St. Ignace, following Boulevard Drive along the northern Lake Michigan shoreline. Great Lakes marshes are non-forested wetlands directly influenced by and connected to large freshwater lakes. These areas represent important habitat for migrating and breeding waterfowl, shorebirds, and passerines.

   Great Lakes marshes generally exhibit predictable vegetative patterns. A submergent zone with water celery (*Vallisneria americana*), *Potamogeton spp*., and common waterweed (*Elodea canadensis*), an emergent marsh with cattail (*Typha glauca*), bulrush (*Scirpus spp*.), arrowhead (*Sagittaria spp*.), and burreed (*Sparganium spp*.); and a meadow which periodically floods during storm surges. Meadow species include sedges (*Carex spp.*), dogwood (*Cornus spp*.), willow (*Salix spp*.), speckled alder (*Alnus rugosa*), and sweet gale (*Myrica gale*).

   Seiches, storms and water level flucuations can drastically alter vegetation over short periods. Some vegetation zones are destroyed, others created, and all zones are forced to shift to accommodate water levels.

   Historic records for our target species include a Marsh Wren from June 2001 (Byrne, 2001), and a Black-crowned Night Heron colony on Green Island in the straits of Mackinac south of Pte. La Barbe from 1976-1985. Three Marsh Wrens responded to taped calls during an MNFI foot survey in May 2004. There was no sign of the Night Heron colony. Other birds observed include Sora and 30-40 Great Egrets on Green Island. Cattail marsh is extensive enough for American Bittern nesting so additional survey work is recommended.

2) **Grosse Point on St. Martin Bay** – The survey site is located on the western part of St. Martin Bay and northern extension of Horseshoe Bay, north of St. Ignace, Michigan. Great Lakes marsh habitat extends southward from the point; with cobble beach to the north. Due to the extreme difficulty in accessing the area, our survey was limited to the cobble beach community to the north. Cobble beaches occupy gently sloping shorelines of large freshwater lakes. The cobble- and

boulder-studded shoreline is periodically inundated during high water. Natural weathering of the underlying sheets of limestone and dolomite creates neutral to slightly alkaline conditions between the cobbles and boulders. Northern reed grass (*Calamagrostis inexpansa*), bluejoint grass (*C. canadensis*), sweet gale and sedges occupy pools and wetter areas. A field survey by MNFI zoologists on 6 June 2004 recorded ten Common Loons and two Common Terns. The loons were observed in open water and this may indicate breeding activity of an assemblage of non-territorial or unsuccessful breeders. The Common Terns were observed foraging in flight. The limited vegetation poses little potential for Yellow Rail, American Bittern, Least Bittern or Marsh Wren. It is recommended that future survey efforts be conducted in the Great Lakes marsh habitat south of the Point. In addition, the marl conditions of the cobble beach may warrant Hine's Emerald Dragonfly (*Somatochlora hineana*, state and federally endangered) surveys.

Les Cheneaux Area

3) **Cedarville Bay** – this small, isolated wetland is located at the boat access just south of where Pearson Creek enters the bay. Habitat type includes sedge meadow changing to cattail marsh toward the water. A Marsh Wren responded to taped calls on the evening of 20 May, 2004. A Caspian Tern was observed foraging overhead on this same date. Great Blue Heron, Sora, and Pied-billed Grebe were also observed. Although small, there is potential for American Bittern breeding in this cattail marsh. Area is surrounded by development so any additional monitoring would be valuable.

4) **Marquette Island – Duck Bay** – This protected embayment lies on the east side of Marquette Island and supports wide areas of emergent marsh and shrub swamp/wet meadow along its shore. These wetlands represent pristine Great Lakes marsh habitat. Indeed, protection from storm waves allows submergent plants to grow to depths of 6 feet in clear waters (Albert, 2003). MNFI zoologists conducted a boat survey along the entire shoreline on 21 May 2004. An American Bittern and two Yellow Rail observations represented two new element occurrences. Foraging activity (fly over) was observed for Black Terns, Osprey, Common Tern, and Caspian Tern, but these observations do not meet specifications documenting breeding and were therefore not entered in the Biotics database. A record for an active Bald Eagle nest was updated with two young on nest. Suitable habitat in the embayment warrants additional surveys for Least Bittern and Marsh Wren.

5) **Flower Bay** - This site is located on Hill Island Road off M-134 just east of Cedarville. Flower Bay lies east of the Hill Island Road causeway, with Cedarville Bay to the west. A large bulrush dominated marsh lies east of the causeway; an extensive sedge meadow to the west. An evening survey on 20 May 2004 failed to record any target species. However, the area supports good Yellow Rail habitat and additional survey work is needed.

6) **Mismer Bay –** This extensive Great Lakes marsh complex extends southward on the east side of the Point Brule peninsula. Vegetation type/pattern is typical of GL marsh habitat. Rainy weather prevented an extensive survey of this area during 2004 field season. Three Black Terns were observed foraging on 21 May 2004. Has potential for American Bittern, Least Bittern, and Marsh Wren. An extensive boat survey is recommended.

7) **Cranberry Lake Wildlife Floodings –** This State of Michigan site is part of the Lake Superior State Forest. These isolated backwaters of Joe Straw Creek lie approximately one mile north of M-134 and is accessed via a two-track marked Cranberry Lake Wildlife Floodings. One American Bittern responded to taped calls during an MNFI field survey on 9 June 2004. Two Common Loons were also seen and heard but no breeding activity was noted. Extensive stands of cattails are found throughout this complex but access is difficult by land. There is suitable habitat for Marsh Wren, American Bittern, and Least Bittern. It is recommended that a boat survey be conducted throughout the area targeting these species.

Figure 2. Looking across Cranberry Lake to where an American Bittern responded to taped calls, 9 June 2004.

8) Huron Point – This site is located just east of the M-134 and M-48 intersection in western Chippewa County where Albany Creek enters Lake Huron. A survey on 8 June 2004 by MNFI staff failed to locate any target species. Two Common Terns were observed foraging overhead. Habitat here was deemed unsuitable to warrant additional rare bird surveys.

9) Loon Lake – a small secluded lake owned by a local conservation organization. Sedge on emergent zone with tamarack-dominated boreal forest moving upland. Further surveys not recommended.

10) **Prentiss Bay** – This small sedge meadow complex is located along M-134 near the Chippewa County/Mackinac County line. One Yellow Rail responded to taped calls during a nocturnal survey by MNFI staff on 20 May 2004. Highway traffic noise was excessive. Future surveys for Yellow Rail are warranted. Additional field work targeting Bittern, Marsh Wren, and Black Tern is not recommended due to the lack of cattail marsh habitat.

11) **St. Martin Bay** – This open embayment marsh represents one of the longest continuous stretches of Great Lakes marsh on Lake Huron. The marsh stretches eastward from Pontchartrain Point on the west to approximately one-half way down the St. Martin Point peninsula. The habitat is made up of a narrow wet meadow zone, less than 100 m wide in spots, with 200-300m of emergent marsh zone. A border of rich conifer swamp or cedar-dominated upland is found inland. Blue-joint grass and sedges (*Carex stricta* and *C. lasiocarpa*) dominate the wet meadow. Common shrubs include sweet gale and speckled alder. A dense band of hardstem bulrush (*Scirpus acutus*), threesquare (*S. americanus*) and spikerush (*Eleocharis smallii*) comprises the emergent zone. The marsh is very low in biodiversity, characteristic of other narrow open embayment marshes where there is minimal protection from wave action.

A Yellow Rail was heard in the wet meadow zone along Carpenter Road, one mile from M-134 on the evening of 8 June 2004. No other target species were located during the survey. Bald Eagles nest in the conifer uplands lining the bay. Because of size and quality of habitat, more Yellow Rail surveys are warranted. The site lacks suitable habitat for Bitterns, Marsh Wrens or other targeted species.

Figure 3 Wet meadow zone along Carpenter Road, St. Martin Bay, where Yellow Rail responded to taped call on 8 June 2004.

12) **St. Martin Point** – this site is an area of extensive cobble beach located on the western side of Search Bay at the end of Carpenter Road. Vegetation is patchy with several vernal pools throughout. Northern reed grass, blue-joint grass, sweet gale, and sedges occupy pools and wetter areas. A survey conducted by MNFI staff on 8 June 2004 failed to locate any target species. The vegetation/habitat is unsuitable in terms of type and density for our targeted bird species. A Hermit Thrush was heard singing from the adjacent woodlands.

Drummond Island – Three sites on Drummond Island were surveyed for terns and other state-listed bird species in early June 2004. These surveys consisted of visually searching wetlands by foot and canoe and playing taped calls for Marsh Wren, American Bittern, Least Bittern, and Terns. Yellow Rail surveys were conducted at night, normally after 2200 EST.

13) **Potaganassing River Wildlife Floodings –** This state-owned site represents the backwaters of the Potaganassing River and is comprised of a chain of four lakes. Our efforts consisted of a canoe survey on the morning of 11 June 2004. We put in above the dam near Morton Bay Forest Campground and paddled upstream. Strong easterly winds hindered progress and limited our survey to First Lake only. Extensive cattail marshes line both sides of the river as it opens up into First Lake. A total of 30 Black Terns were observed during the day and three nests with eggs were located. This confirmed previous breeding observations by MNFI during 1990 and 1996. One American Bittern responded to taped calls in the eastern end of the lake. Two Soras, two Pied-billed Grebes and one Common Loon were heard as well. Loon breeding activity was recorded on First Lake in 1993 and 1994. These backwaters contain excellent wetland bird habitat, especially cattail marsh. Marsh Wren and Least Bittern probably nest here as well. The site is extensive and can only be accessed by boat. Additional survey effort is recommended for all lakes in the chain.

14) **Scott Bay** – This protected bedrock embayment is located on the northern shoreline of Drummond Island and is classified as Great Lakes marsh. Protected embayments are common where glacial activity has carved into exposed bedrock resulting in deep shoreline indentations, offering shelter from wind and wave energy. Our survey points were located along Maxton Road near the northern end of Scott Bay. Two Yellow Rails responded to taped calls on both sides of Maxton Road on 10 June 2004. A Common Loon was heard from the west. Three Yellow Rails responded to taped calls and clicking of stones during a 1996 MNFI survey. Historic records also indicate American Bittern and Northern Harrier breeding activity in the area. Time and other limitations prevented a complete survey of the area, especially along the shoreline. A boat survey is recommended in order to access the more remote locations.

Figure 4. Great Lakes Marsh on Drummond Island where Yellow Rails were located in 1996 and 2004.

15) Maxton Bay – This site is located where the Potagannissing River empties into Lake Huron. Looking west from where the Maxton Road bridge crosses the river, an extensive cattail marsh and sedge meadow are found on both sides of the river. Cattails give way to sedge meadow to the west. Both sides of the Bay are privately owned; MNFI staff conducted a land survey of the north side. Three Marsh Wrens responded to taped calls among the dense cattail stand. Three Black Terns exhibited territorial behavior and were probably nesting in the marsh across the river. Two American Bitterns responded to taped calls in the area of the boat launch at the former Maxton State Park. Historical records include an American Bittern calling east of the bridge in 2000, and Black Tern breeding activity to the west. A nocturnal survey for Yellow Rail is recommended for the western most part of the wetland. Also, a boat survey is recommended for the entire area.

Rudyard Subsection

1) St Mary River Marshes – The St. Mary's River is "one of three connecting channels in Michigan," and joins lakes Superior and Huron (Albert, 2003).Most of the coastal wetland habitat still remains along the river despite dredging for commercial traffic. A long narrow fringe of Great Lakes marsh extends for miles along the shore (Albert, 2003). The following areas were surveyed along the St. Mary's during the 2004 field season.

1a) 9 Mile Road Marsh – this site is located at the eastern terminus of 9 Mile Road (M-28). Survey efforts were

restricted to the small parcel of state land located to the south of road. Two Black Terns were observed foraging overhead. An element occurrence for an active Bald Eagle nest was updated with two individuals observed on the nest. An American Bittern responded to taped calls from a location across the St. Mary's River, but not recorded as a site occurrence. One Northern Harrier foraging overhead. Scharf (1999) reported Black Tern breeding at several locations along the 22-Mile stretch of the St. Mary's River via floatplane surveys in 1989-91. Additional aerial or water surveys are needed to update these records.

1b) 10 Mile Road Marsh – This area of extensive marshland is located at the eastern end of 10 Mile Road. The marsh is relatively wide and contains suitable marsh bird habitat. We received no response to a series of taped calls. Two Black Terns, two Forster's Terns, and an Osprey were observed foraging overhead. A Common Loon was seen feeding in the river. Three Northern Harriers (two males, one female) were involved in a territorial dispute. Four Sharp-tailed grouse were flushed and flew into a nearby woodland. The size and quality of habitat at these sites warrant further survey efforts.

1c) 12 Mile Road Marsh – This site is located at the eastern end of 12 Mile Road. The shoreline can only be accessed by crossing private property. MNFI staff was denied access to site on 19 May 2004. The wetland in this area is not extensive and additional survey efforts are not recommended.

2) MSU Dunbar Forest Experimental Station – This 5,700-acre tract near Sault Ste. Marie is Michigan State Univerity's largest off-campus facility. It is located where the Charlotte River enters the west Neebish Channel. A 20 May 2004 survey originating northward from the boat launch was conducted by MNFI zoology staff. The shoreline habitat here is unsuitable for marsh birds. The small patches of bulrush (*Schoenoplectus* spp.) and assorted grasses found throughout would not support breeding activity. Four Common Terns and two Caspian Terns were observed foraging overhead. One Common Loon and a LeConte's Sparrow were also observed. Additional survey work is not recommended.

Munuscong Bay Area

3) Munuscong State WMA – This large, connecting river-delta marsh is part of the Munuscong State Wildlife Management Area. The site contains broad, well-developed shrub swamps, wet meadows and emergent zones. Approximatley 800 acres were altered by diking and the creation of waterfowl potholes. The rest of the area is more diverse and relatively undisturbed. (Albert, 2003). Current management efforts (e.g., removing dikes) are being directed at returning the site to natural conditions. Munuscong Bay has long been an important stopover and breeding location for wetland birds and passerines. Walkinshaw (1991) reported Yellow Rail breeding activity and stated that "Yellow Rails were singing day and night" during a period of low lake levels in June 1934. Monfils and Prince reported breeding activity for American Bittern, Least Bittern, Black Tern, and Marsh Wren (Monfils & Prince, 2003). Scharf (1999) confirmed Black Tern nesting sites along Munuscong Island. The MNFI database includes element occurrence records for Osprey, a Great

Blue Heron Rookery, Bald Eagle nests, and Common Terns. In 2004, MNFI staff conducted surveys in the former diked impoundments on the north side of the Munuscong River, and canoe surveys in the Munuscong River delta to the north and east of the state forest campground. American Bittern, Least Bittern, Yellow Rail, and Marsh Wren responded to con-specific taped calls at several locations. Three American Bitterns, one Least Bittern, and two Marsh Wrens were observed among the dense cattail stands in the river delta. Two Yellow Rails and one Marsh Wren were located in the sedge-dominated impoundments to the north of the river. Although Black Terns, Osprey, Common Terns, and Bald Eagle were observed flying over during a two-day period, these did not warrant an element occurrence due to the lack of breeding evidence. The area contains a diverse variety of wetland habitats. More survey efforts are recommended for the emergent marshes of the river delta.

Figure 5. Cattail marsh in Munuscong State WMA where Least Bitterns were heard in June 2004.

4) **Conley's Point/Kemp's Point –** this peninsula is located on the northern part of Munuscong Bay, and was recently acquired by the State of Michigan. The northern portion of the peninsula is largely a sedge meadow community interspersed with Speckled alder (*Alnus rugosa*) and willow (*Salix* spp.). The extensive hummocky terrain makes foot travel difficult. To the south it grades into classic Great Lakes marsh habitat. The emergent marsh contains hybrid cattail *Typha glauca*), Bulrush (*Schoenoplectus* spp.), arrowhead (*Sagittaria* spp.), and bur-reed (*Sparganium* spp). The meadow, which periodically floods during storm surges, includes *sedges* (Carex spp.), dogwood

(*Cornus* spp.), willow, speckled alder, and sweet gale (*Myrica gale*).

Great Lakes marshes are non-forested wetlands directly influenced by and connected to large freshwater lakes. These areas represent important habitat for migrating and breeding waterfowl, shorebirds, and passerines. Data mining efforts indicated no historic records for our targeted species, although, Black Tern nesting activity has been observed on Kemp's Island and along the West Neebish Channel. Two Yellow Rails responded to taped calls near the southern tip of the point on the evening of 2 June 2004. One Clay-colored Sparrow, a Northern Mockingbird, and American Woodcock were also recorded on 20 May 2004. Continued monitoring for Yellow Rail and Black Terns is recommended for the southern part of the peninsula.

5) **Munscong State WMA Potholes –** These constructed wetlands lie west of the main part of the Munuscong State Wildlife Management Area. This area was developed by the Michigan Department of Natural Resources in conjunction with the Michigan Department of Transportation and Ducks Unlimited as part of a mitigation project for the purpose of creating a waterfowl breeding and hunting area. Eighteen wetlands ranging in size from 0.05 to 1.0 ha were constructed for wetlands lost in a US 2 road expansion project (Monfils, 1996). Wool grasses (*Scirpus spp.*), soft rush (*Schoenoplectus tabernaemontani*), and various sedges (*Carex spp.*) dominate the wet meadow zone. MNFI staff conducted morning and evening foot surveys on 3 June and 8 June 2004. Four American Bitterns, two Northern Harriers, and 5 Upland Sandpipers were observed on 3 June. A lone Black Rail, an accidental species in Michigan, was heard calling during the 3 June evening survey. This **likely represents the first UP record** for this species as we were unable to find documentation of any records in the literature for this part of the state. Virgina Rail, Sora, and LeConte's Sparrows were also heard during the evening survey. A Short-eared Owl was observed sitting in the middle of Gray Road during 8 June evening survey. The extensive sedge meadow would probably support Yellow Rail, although none were recorded during the survey period. Additional surveys targeting Yellow Rail, Black Rail and Short-eared Owls are recommended.

6) **Maple Point** – this small, isolated cattail marsh is on land owned by the State of Michigan. MNFI staff conducted taped call surveys on 9 June 2004. No targeted species responded to the calls. The site may be too small and isolated for Bitterns, Marsh Wrens, and other wetland birds. No additional surveys are recommended for this site. However, extensive Great Lakes marsh habitat lies on both sides of the peninsula. The broad emergent marsh (1500-2000' width) and wet meadow zone need to be thoroughly surveyed.

7) **Rocky Point** – this site is accessed off Rocky Point Road and is part of the Lake Superior State Forest. MNFI staff attempted to survey the eastern part of the point on 9 June 2004. The survey could not be completed due to limited access and because riprap shorelines have altered the habitat. Twelve Common Tern nests were reported 500m off the tip of the point in 1982. Future surveys to update these records and to access the western part of the point are recommended.

8) **Point aux Frenes** – this site is located on the northern part of Raber Bay and is part of the Lake Superior State Forest. The area has broad, well defined emergent and wet meadow vegetative zones. The emergent marsh is dominated by hybrid cattail (*Typha glauca)* and rushes (*Scirpus spp*.).

Sedges (*Carex spp.*) dominate the wet meadow zone. MNFI zoologists surveyed the site on 9 June 2004. Two new element occurrences were recorded at this site. Two American Bitterns responded to taped calls from the emergent zone, and two adult Ospreys were observed on a nest in the forested area to the north. Five Black Terns were observed foraging overhead but did not display breeding behavior. The habitat seems suitable for Yellow Rail, Marsh Wren and Least Bittern. This wetland is very extensive and additional monitoring is recommended.

Future Efforts and Recommendations

The shorelines and coastal wetlands of Michigan provide important habitat for a number of rare and declining species of wetland birds, as well as numerous common species of wildlife. Continued surveys will not only add to our knowledge of this unique group of wetland birds, but will help to identify and prioritize sites for continued protection and management. We have learned from the first two years of work, for instance, that some rare bird species are in need of focused inventory effort. The King Rail was not recorded from any site including The St. Clair Flats which are considered to be Michigan's best remaining site for the species. Additional systematic surveys to locate King Rail in Michigan are needed. In addition, more information on the rail is critical to the development of management strategies and future research is needed to assess the effects of various land management practices on rail populations.

The survey work in 2004 located a total of five Yellow Rail sites. This more than doubled the known number of occurrences for the species in the state. This is encouraging for this state threatened species and additional surveys may locate even more breeding sites.

Based on these highly successful first few years of surveys and data collection, continued wetland bird inventories are strongly warranted. This report summarized the second year of a project which was conceived to take four years to systematically cover the coastal wetlands of Michigan. It is hoped at the end of this project that most of the important coastal wetland bird breeding sites in Michigan will be identified and prioritized in terms of protection and management. Future efforts are planned for the shorelines of Michigan, and Superior.

Acknowledgements

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Appendix I

Wetland Bird Data Form

MNFI BIRD SURVEY FORM

I. TARGET SPECIES/GROUP_____

II. LOCATION INFORMATION Site Name_____ Mgmt. Name_____

Date_____ Surveyor(s)_____

Quad_____ Town/Range_____ Sec. _____ 1/4 Sec_____

Directions/access_____

II. BIRD LIST (list all birds observed) **POINT/TRANSECT # _____**

	WITHIN 50 METERS		50 – 100 METERS		OUTSIDE 100 METERS	
SPECIES	SEEN	HEARD	SEEN	HEARD	SEEN	HEARD

II. GENERAL SITE DESCRIPTION_____

_____

_____

Soil Type_____ Geology_____

Potential habitat for target species present? ☐ES ☐O ☐NSURE Comments_____

If you answered yes to the above, please rate the relative quality of the site to the target species or group:

☐IGH ☐ODERATE ☐W ☐OR Justification_____

III MANAGEMENT CONSIDERATIONS

Evidence of disturbance_____ _____

Exotic species_____ Other threats (e.g. ORV's, excessive mt. bike use, etc.)_____

Restorability of site_____

Stewardship Comments _____

IV. ZOOLOGICAL INDICATOR SPECIES_____

V. SPECIES LIST(S) _____

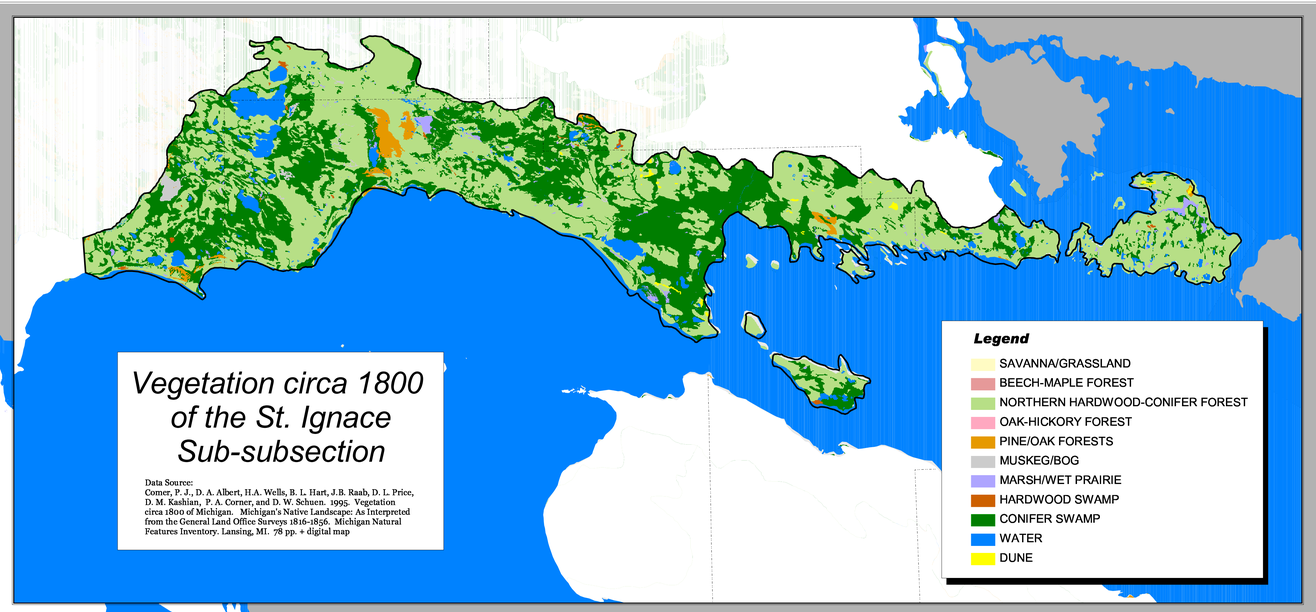
_____

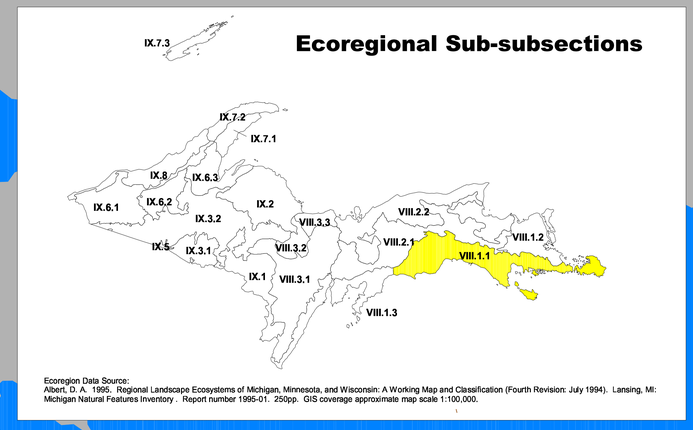
Appendix II

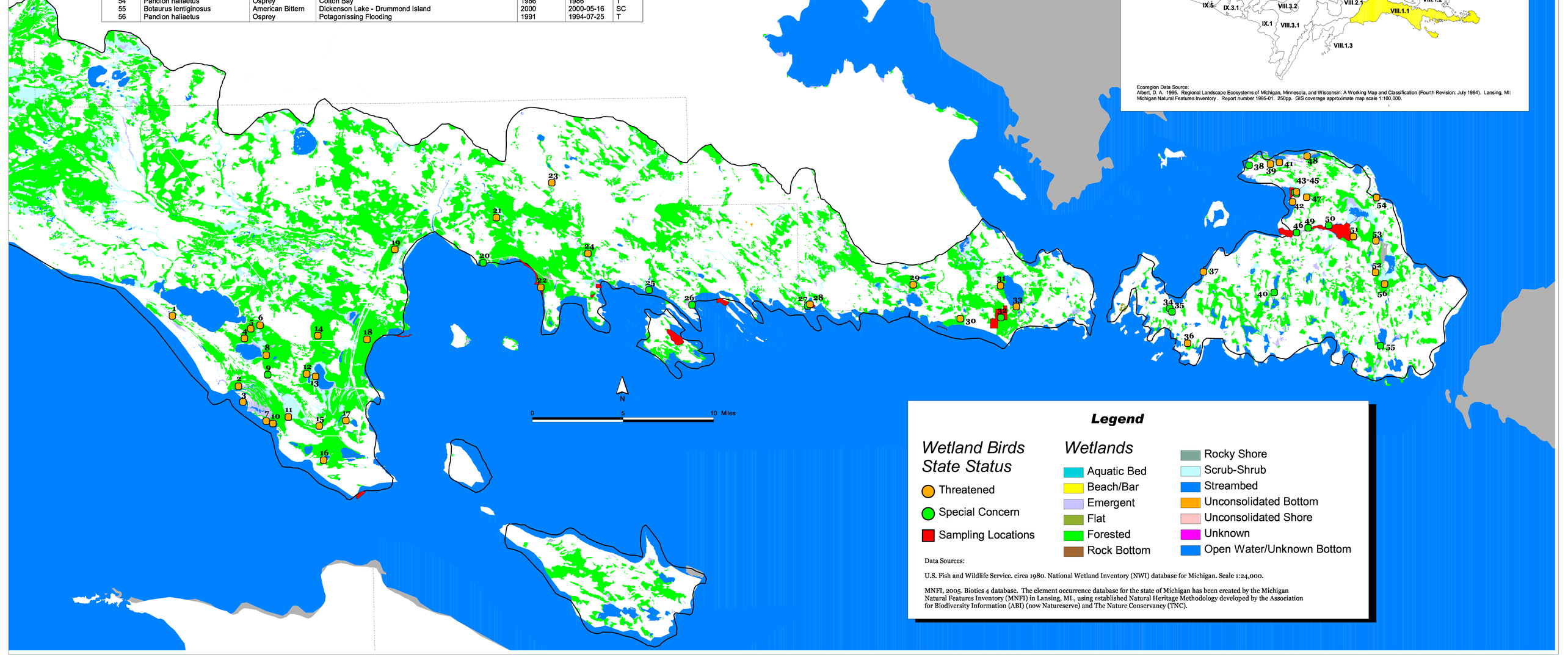
Wetland bird habitats and associated element occurrence map for the St. Ignance Sub-section

Wetland bird habitats and associated element occurrence map for the St. Ignace Sub-subsection

Map #	Scientific Name	Common	Survey Site	Firstobs	Lastobs	Status
1	Pandion haliaetus	Osprey	Brevort Lake South	1975	1994-07-25	T
2	Pandion haliaetus	Osprey	Pointe Aux Chenes Creek	1977	1994-07-25	T
3	Sterna hirundo	Common Tern	Pointe Aux Chenes	1976	1985	T
4	Pandion haliaetus	Osprey	Round Lake	1988	1994-07-25	T
5	Pandion haliaetus	Osprey	Round Lake Northwest	1992	1994-07-25	T
6	Pandion haliaetus	Osprey	Round Lake	1977	1992-07-28	T
7	Pandion haliaetus	Osprey	Kitchen's Creek North	1991	1994-07-25	T
8	Pandion haliaetus	Osprey	Round Lake East	1992	1994-07-25	T
9	Circus cyaneus	Northern Harrier	Round Lake Road	2001-07-17	2001-07-17	SC
10	Pandion haliaetus	Osprey	Kitchen's Creek	1981	1994-05-24	T
11	Pandion haliaetus	Osprey	Kitchen's Creek Pipeline	1992	1992-06-29	T
12	Pandion haliaetus	Osprey	Cranberry Lake	1997	1992-06-24	T
13	Sterna caspia	Caspian Tern	Hay Lake	1986	1986-07-05	T
14	Pandion haliaetus	Osprey	Summerbee Creek	1976	1989-07-24	T
15	Pandion haliaetus	Osprey	Hoban Creek	1994	1994-07-25	T
16	Pandion haliaetus	Osprey	Freschette Lake	1985	1985-07-22	T
17	Pandion haliaetus	Osprey	Castle Rock	1988	1994-07-25	T
18	Pandion haliaetus	Osprey	Horseshoe Bay	1983	1993-05-16	T
19	Pandion haliaetus	Osprey	I-75 And M-134	1987	1994-07-25	T
20	Chlidonias niger	Black Tern	Pontchartrain Shores	1996	1996-06-10	SC
21	Pandion haliaetus	Osprey	Crooked Creek Southwest	1977	1994-07-24	T
22	Coturnicops noveboracensis	Yellow Rail	St. Martin Bay	2004-06-08	2004-06-08	T
23	Pandion haliaetus	Osprey	Crooked Creek Northeast	1985	1985-07-22	T
24	Pandion haliaetus	Osprey	Morgan Springs	1987	1987-07-25	T
25	Chlidonias niger	Black Tern	Mackinac Bay	1996	1996-06-10	SC
26	Cistothorus palustris	Marsh Wren	Cedarville Bay	2004-05-20	2004-05-20	SC
27	Chlidonias niger	Black Tern	Prentiss Bay	1996	1996-06-10	SC
28	Coturnicops noveboracensis	Yellow Rail	Prentiss Bay Marsh	2004-05-20	2004-05-20	T
29	Pandion haliaetus	Osprey	Big Trout Lake	1981	1990	T
30	Pandion haliaetus	Osprey	Huron Point	1993	1993-07-24	T
31	Pandion haliaetus	Osprey	Caribou Lake West	1994	1994-07-25	T
32	Botaurus lentiginosus	American Bittern	Cranberry Lake Wildlife Floodings	2004-06-09	2004-06-09	SC
33	Pandion haliaetus	Osprey	St. Vital Bay	1984	1994-05-24	T
34	Botaurus lentiginosus	American Bittern	Pigeon Cove Wildlife Flooding	2001-05-18	2001-05-18	SC
35	Circus cyaneus	Northern Harrier	Pigeon Cove Wildlife Flooding	2001-06-18	2001-06-18	SC
36	Pandion haliaetus	Osprey	Gravel Lake	1983	1992	T
37	Pandion haliaetus	Osprey	Rabbit Bay - Drummond Island	2000-06-16	2000-06-16	T
38	Botaurus lentiginosus	American Bittern	Bruce Point Marsh - Drummond Island	2000	2000-05-17	SC
39	Pandion haliaetus	Osprey	Grand Marais Lake West - Drummond Island	1979	1991-05-20	T
40	Botaurus lentiginosus	American Bittern	Marl Lake	2001-07-17	2001-07-17	SC
41	Pandion haliaetus	Osprey	Grand Marais Lake East	1982	1985-07-22	T
42	Pandion haliaetus	Osprey	Scott Bay	1993	1994-07-25	T
43	Circus cyaneus	Northern Harrier	Scott Bay North	1996	1996-06-09	SC
44	Botaurus lentiginosus	American Bittern	Scott Bay North	1996	1996-06-09	SC
45	Coturnicops noveboracensis	Yellow Rail	Scott Bay North	1996	2004-06-10	T
46	Cistothorus palustris	Marsh Wren	Drummond Island - Fairchild Property	2004-06-10	2004-06-10	SC
47	Pandion haliaetus	Osprey	Drummond Island - Maxton Plains	1975-?	1992-07-28	T
48	Pandion haliaetus	Osprey	Dawson Lake	1992	1994-07-25	T
49	Botaurus lentiginosus	American Bittern	Potagannissing River Wildlife Flooding - Drummond Is	2000	2004-06-11	SC
50	Chlidonias niger	Black Tern	Potaganassing River Wildlife Floodings	1996	2004-06-11	SC
51	Pandion haliaetus	Osprey	Potagonissing Flooding, First Lake	1992	1994-05-24	T
52	Pandion haliaetus	Osprey	Potagonissing Flooding, Fourth Lake	1975	1994-05-24	T
53	Pandion haliaetus	Osprey	Potagonissing Flooding, Third Lake	1977	1992-05-09	T
54	Pandion haliaetus	Osprey	Colton Bay	1986	1986	T
55	Botaurus lentiginosus	American Bittern	Dickenson Lake - Drummond Island	2000	2000-05-16	SC
56	Pandion haliaetus	Osprey	Potagonissing Flooding	1991	1994-07-25	T







Appendix III.

Wetland bird habitats and associated element occurrence map for the Rudyard Sub-section

Wetland bird habitats and associated element occurrence map for the Rudyard Sub-subsection

Legend

Wetland Birds State Status

- Threatened
- Special Concern
- Sampling Locations

Wetlands

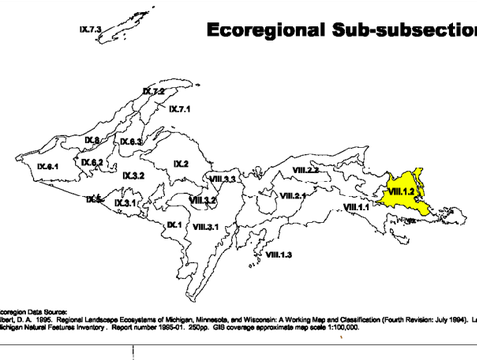
- Aquatic Bed
- Beach/Bar
- Emergent
- Flat
- Forested
- Rock Bottom
- Rocky Shore
- Scrub-Shrub
- Streambed
- Unconsolidated Bottom
- Unconsolidated Shore
- Unknown
- Open Water/Unknown Bottom

Data Sources:

U.S. Fish and Wildlife Service. circa 1980. National Wetland Inventory (NWI) database for Michigan. Scale 1:24,000.

MNFI, 2005. Biotics 4 database. The element occurrence database for the state of Michigan has been created by the Michigan Natural Features Inventory (MNFI) in Lansing, MI., using established Natural Heritage Methodology developed by the Association for Biodiversity Information (ABI) (now Natureserve) and The Nature Conservancy (TNC).

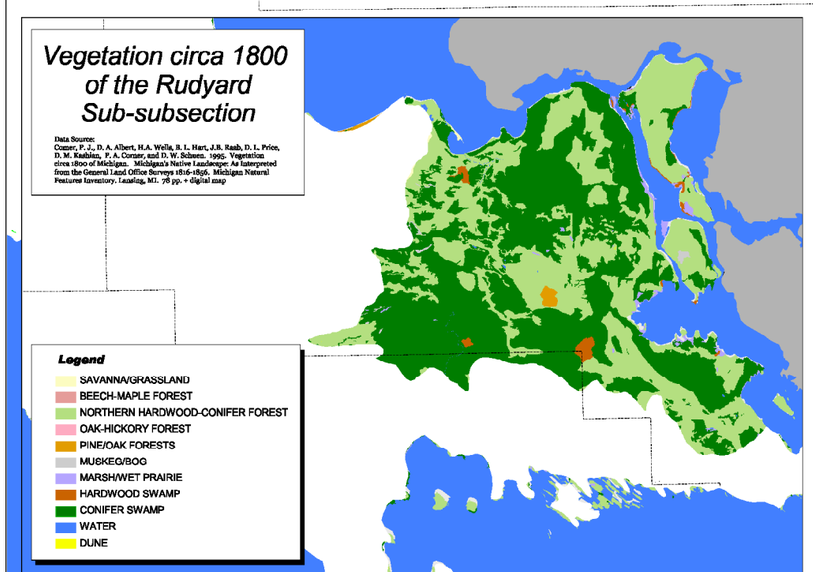
Ecoregional Sub-subsections



Ecoregion Data Source:
Albert, D. A. 1995. Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification (Fourth Revision: July 1994). Lansing, MI: Michigan Natural Features Inventory. Report number 1995-01. 250pp. GIS coverage approximate map scale 1:100,000.

Vegetation circa 1800 of the Rudyard Sub-subsection

Data Source:
Comer, P. J., D. A. Albert, H.A. Wells, B. L. Hart, J.B. Raab, D. L. Price, D. M. Kashian, R. A. Corner, and D. W. Schuen. 1995. Vegetation circa 1800 of Michigan. Michigan's Native Landscape: As Interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory. Lansing, MI. 38 pp. + digital map



Legend

- SAVANNA/GRASSLAND
- BEECH-MAPLE FOREST
- NORTHERN HARDWOOD-CONIFER FOREST
- OAK-HICKORY FOREST
- PINE/OAK FORESTS
- MUSKEG/BOG
- MARSH/WET PRAIRIE
- HARDWOOD SWAMP
- CONIFER SWAMP
- WATER
- DUNE

CHIPPEWA

MACKINAC

0 5 10 Miles

N

Map #	Scientific Name	Common	Survey Site	Firstobs	Lastobs	Status
1	Pandion haliaetus	Osprey	Pointe aux Frenes	1992	1994-07-25	T
2	Botaurus lentiginosus	American Bittern	Pointe aux Frenes	2004-06-09	2004-06-09	SC
3	Pandion haliaetus	Osprey	Lake Superior State Forest	2004-06-09	2004-06-09	T
4	Sterna hirundo	Common Tern	Rocky Point	1982	1985	T
5	Pandion haliaetus	Osprey	Barbeau Point	1975	1994-07-25	T
6	Botaurus lentiginosus	American Bittern	Munuscong Bay WMA - Munuscong Delta	2004-06-02	2004-06-02	SC
7	Cistothorus palustris	Marsh Wren	Munuscong Bay WMA	2004-06-02	2004-06-02	SC
8	Pandion haliaetus	Osprey	Winter Point	1978	1994-07-19	T
9	Pandion haliaetus	Osprey	Munuscong Bay Northwest	1984	1994-07-25	T
10	Sterna hirundo	Common Tern	Neebish Island	1976	1977	T
11	Pandion haliaetus	Osprey	Oak Ridge Tower	1991	1994-07-18	T
12	Pandion haliaetus	Osprey	Sand Island	1978	1994-07-19	T
13	Pandion haliaetus	Osprey	Sugar Island South	1984	1994-05-24	T
14	Pandion haliaetus	Osprey	Duck Lake	1982	1984-07-24	T
15	Pandion haliaetus	Osprey	Duck Lake - Sugar Island	1981	1985-07-22	T
16	Pandion haliaetus	Osprey	Spectacle Lake	1991	1993-06-05	T
17	Pandion haliaetus	Osprey	Sugar Island South Inland	1993	1993-07-24	T

Appendix IV.

Bird species list for all sites sampled during 2004.

Common Name	Scientific Name	State Status	Point La Barbe	9 Mile Marsh	10 Mile Marsh	12 Mile Marsh	Munuscong WMA	Dunbar Forest Exp. Station	Kemp's Point	Cedarville Bay	Prentiss Bay	Flower Bay	Marquette Island - Duck Bay	Mismer Bay	Loon Lake	Munuscong Potholes	Maple Point	Rocky Point	Grosse Point	St. Martin Bay	St. Martin Point	Huron Point	Cranberry Lake	Pte aux Frenes	Maxton Bay	Scott Bay	Potaganassing R. Floodings
Common Loon	***Gavia immer***	**T**						c					d						h				j			k	l
Pied-billed Grebe	*Podilymbus podiceps*									c			d										j	j			l
Double-crested Cormorant	*Phalacrocorax auritus*		a	b	b					c			d			g			h			j	j		k		
American Bittern	***Botaurus lentiginosus***	**SC**		b									d			g							j	j			l
Least Bittern	***Ixobrychus exilis***	**T**					f																				
Great Blue Heron	*Ardea herodias*			b			f			c													j		k		l
Great Egret	*Ardea alba*		a																								
Green Heron	*Butorides virescens*		a																								
Turkey Vulture	*Cathartes aura*									c						g									k		
Canada Goose	*Branta canadensis*		a	b	b			c	c,d	c			d			g							j				
Mute Swan	*Cygnus olor*		a							c			d														
Gadwall	*Anas strepera*															g											
American Wigeon	*Anas americana*															g											
American Black Duck	*Anas rubripes*						f																				
Mallard	*Anas platyrhynchos*		a					c		c			d			g									k		l
Blue-winged Teal	*Anas discors*			b												g											
Northern Shoveler	*Anas clypeata*																										
Northern Pintail	*Anas acuta*																										
Green-winged Teal	*Anas crecca*															g											
Redhead	*Aythya americana*															g											
Ring-necked Duck	*Aythya collaris*																										
Bufflehead	*Bucephala albeola*							c																			
Common Goldeneye	*Bucephala clangula*																		h								
Common Merganser	*Mergus merganser*				b										d												
Osprey	***Pandion haliaetus***						f						d											j	k		
Bald Eagle	***Haliaeetus leucocephalus***	**T**		b			c,f						d														
Northern Harrier	***Circus cyaneus***	**SC**		b	b											g										k	
Red-tailed Hawk	*Buteo jamaicensis*																										
American Kestrel	*Falco sparverius*																										

Common Name	Scientific Name	State Status	Point La Barbe	9 Mile Marsh	10 Mile Marsh	12 Mile Marsh	Munuscong WMA	Dunbar Forest Exp. Station	Kemp's Point	Cedarville Bay	Prentiss Bay	Flower Bay	Marquette Island - Duck Bay	Mismer Bay	Loon Lake	Munuscong Potholes	Maple Point	Rocky Point	Grosse Point	St. Martin Bay	St. Martin Point	Huron Point	Cranberry Lake	Pte aux Frenes	Maxton Bay	Scott Bay	Potaganassing R. Floodings
Ring-necked Pheasant	*Phasianus colchicus*				b																						
Ruffed Grouse	*Bonasa umbellus*																							j			
Sharp-tailed Grouse	***Tympanuchus phasianellus***	**SC**			b																						
Wild Turkey	*Meleagris gallopavo*							c	c							g											
Yellow Rail	***Coturnicops noveboracensis***	**T**					b		f				d							i					k		
Black Rail	***Laterallus jamaicensis***															g											
Virginia Rail	*Rallus limicola*										c					g											
Sora	*Porzana carolina*		a						d	c						g											l
American Coot	*Fulica americana*																										l
Sandhill Crane	*Grus canadensis*			b	b			c	d							g											
Killdeer	*Charadrius vociferus*							c											h			j					
Spotted Sandpiper	*Actitis macularia*																		h			j					
Upland Sandpiper	*Bartramia longicauda*															g											
Least Sandpiper	*Calidris minutilla*												d														
Wilson's Snipe	*Gallinago delicata*			b	b	b	c	c	d				d			g,i							j		k	l
American Woodcock	*Scolopax minor*								d,f																		
Ring-billed Gull	*Larus delawarensis*		a																		i	j	j				
Herring Gull	*Larus argentatus*																								k	k	
Caspian Tern	***Sterna caspia***	**T**						c					d									j			k		l
Common Tern	***Sterna hirundo***	**T**					f	c					d						h			j					
Black Tern	***Chlidonias niger***	**SC**		b	b		f						d	d										j	k	k	l
Rock Dove	*Columba livia*								c																		
Mourning Dove	*Zenaida macroura*							c																			
Short-eared Owl	***Asio flammeus***	**E**														i											
Ruby-throated Hummingbird	*Archilochus colubris*								c									g									
Belted Kingfisher	*Ceryle alcyon*															g							j		k		
Red-bellied Woodpecker	*Melanerpes carolinus*								c																		
Yellow-bellied Sapsucker	*Sphyrapicus varius*																	g									
Downy Woodpecker	*Picoides pubescens*								c														j				
Hairy Woodpecker	*Picoides villosus*								c																		

Common Name	Scientific Name	State Status	Point La Barbe	9 Mile Marsh	10 Mile Marsh	12 Mile Marsh	Munuscong WMA	Dunbar Forest Exp. Station	Kemp's Point	Cedarville Bay	Prentiss Bay	Flower Bay	Marquette Island - Duck Bay	Mismer Bay	Loon Lake	Munuscong Potholes	Maple Point	Rocky Point	Grosse Point	St. Martin Bay	St. Martin Point	Huron Point	Cranberry Lake	Pte aux Frenes	Maxton Bay	Scott Bay	Potaganassing R. Floodings
Northern Flicker	*Colaptes auratus*			b				c	c																		
Pileated Woodpecker	*Dryocopus pileatus*																	g									
Eastern Wood-Pewee	*Contopus virens*																		h								
Alder Flycatcher	*Empidonax alnorum*															g								j			
Willow Flycatcher	*Empidonax traillii*															g											
Eastern Phoebe	*Sayornis phoebe*								c																		
Great Crested Flycatcher	*Myiarchus crinitus*								c										h								
Eastern Kingbird	*Tyrannus tyrannus*			b																							
Warbling Vireo	*Vireo gilvus*																										
Red-eyed Vireo	*Vireo olivaceus*								c																		
Blue Jay	*Cyanocitta cristata*			b	b			c	c										h						k		
American Crow	*Corvus brachyrhynchos*		a	b	b				d							g							j		k		
Common Raven	*Corvus corax*		a					c								g									k		
Tree Swallow	*Tachycineta bicolor*									c	c			d		g		g	h						k		
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*						f																				
Barn Swallow	*Hirundo rustica*			b																							
Black-capped Chickadee	*Poecile atricapillus*			b	b			c	c				d			g				i			j				
Tufted Titmouse	*Baeolophus bicolor*								c																		
White-breasted Nuthatch	*Sitta carolinensis*								c																		
Sedge Wren	*Cistothorus platensis*				b		f		c	c			d														
Marsh Wren	***Cistothorus palustris***	**SC**	a				f			c															k		
Blue-gray Gnatcatcher	*Polioptila caerulea*								c												i						
Eastern Bluebird	*Sialia sialis*			b	b				c																		
Veery	*Catharus fuscescens*																		h								
Hermit Thrush	*Catharus guttatus*																		h		i						
Wood Thrush	*Hylocichla mustelina*					b																					
American Robin	*Turdus migratorius*								c																		
Gray Catbird	*Dumetella carolinensis*							c																			
Northern Mockingbird	*Mimus polyglottos*								c																		
Brown Thrasher	*Toxostoma rufum*								c																		

Common Name	Scientific Name	State Status	Point La Barbe	9 Mile Marsh	10 Mile Marsh	12 Mile Marsh	Munuscong WMA	Dunbar Forest Exp. Station	Kemp's Point	Cedarville Bay	Prentiss Bay	Flower Bay	Marquette Island - Duck Bay	Mismer Bay	Loon Lake	Munuscong Potholes	Maple Point	Rocky Point	Grosse Point	St. Martin Bay	St. Martin Point	Huron Point	Cranberry Lake	Pte aux Frenes	Maxton Bay	Scott Bay	Potaganassing R. Floodings
European Starling	*Sturnus vulgaris*								c																		
Cedar Waxwing	*Bombycilla cedrorum*		a						c									g									
Blue-winged Warbler	*Vermivora pinus*				b														h								
Tennessee Warbler	*Vermivora peregrina*					b																					
Northern Parula	*Parula americana*						c												h								
Yellow Warbler	*Dendroica petechia*				b		c,f	c	c												i						
Magnolia Warbler	*Dendroica magnolia*																		h								
Chestnut-sided Warbler	*Dendroica pensylvanica*								c																		
Yellow-rumped Warbler	*Dendroica coronata*								c									g									
Black-throated Green Warbler	*Dendroica virens*						c	c	c				d						h								
Blackburnian Warbler	*Dendroica fusca*								c																		
Pine Warbler	*Dendroica pinus*				b																						
Black-and-white-Warbler	*Mniotilta varia*		a				c						d						h		i						
American Redstart	*Setophaga ruticilla*				b	b	c		c				d						h				j				
Ovenbird	*Seiurus aurocapillus*					b	c	c	c																		
Common Yellowthroat	*Geothlypis trichas*		a	b	b		f	c	c,d				d			g								j	k		
Eastern Towhee	*Pipilo erythrophthalmus*																										
Chipping Sparrow	*Spizella passerina*							c	c,d																		
Clay-colored Sparrow	*Spizella pallida*								c																		
Field Sparrow	*Spizella pusilla*																										
Savannah Sparrow	*Passerculus sandwichensis*			b			c	c								g			h								
Le Conte's Sparrow	*Ammodramus leconteii*						c,f	c								g,i											
Song Sparrow	*Melospiza melodia*			b				c	c							g			h								
Swamp Sparrow	*Melospiza georgiana*		a	b	b		f	c	d	c	c		d			g								j	k		
White-throated Sparrow	*Zonotrichia albicollis*			b				c					d						h					j			
Northern Cardinal	*Cardinalis cardinalis*																										
Rose-breasted Grosbeak	*Pheucticus ludovicianus*																										
Indigo Bunting	*Passerina cyanea*																										
Bobolink	*Dolichonyx oryzivorus*			b												g											
Red-winged Blackbird	*Agelaius phoeniceus*		a	b				c		c	c		d			g								j			l

Common Name	Scientific Name	State Status	Point La Barbe	9 Mile Marsh	10 Mile Marsh	12 Mile Marsh	Munuscong WMA	Dunbar Forest Exp. Station	Kemp's Point	Cedarville Bay	Prentiss Bay	Flower Bay	Marquette Island - Duck Bay	Mismer Bay	Loon Lake	Munuscong Potholes	Maple Point	Rocky Point	Grosse Point	St. Martin Bay	St. Martin Point	Huron Point	Cranberry Lake	Pte aux Frenes	Maxton Bay	Scott Bay	Potaganassing R. Floodings
Eastern Meadowlark	*Sturnella magna*															g											
Common Grackle	*Quiscalus quiscula*								c																		
Brown-headed Cowbird	*Molothrus ater*		a				c	c	c																l		l
Baltimore Oriole	*Icterus galbula*								c																		
House Finch	*Carpodacus mexicanus*																										
American Goldfinch	*Carduelis tristis*			b				c								g											
House Sparrow	*Passer domesticus*							c																			

Dates: a=18MAY04, b=19MAY04, c=20MAY04, d=21MAY04, e=1JUN04, f=2JUN04, g=3JUN04, h=4JUN04, i=8jUN04, j=9JUN04, k=10JUN04, l=11JUN04
Observers: a,b,c,d = Mike Sanders, Jennifer Olson; e,f,g,h = Mike Sanders, Ed Schools; I,j,k,l = Mike Sanders, Ryne Rutherford

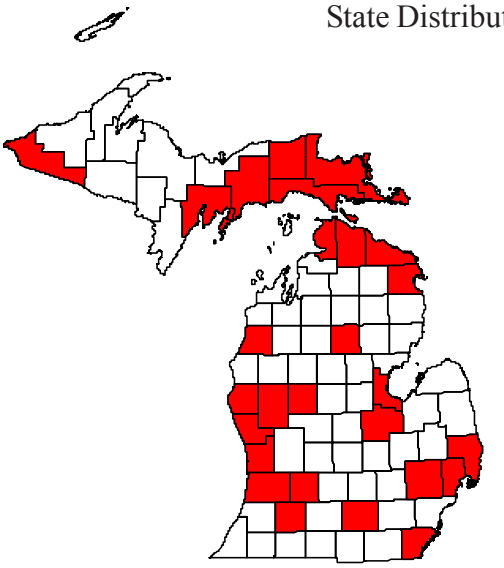
Appendix V.

Wetland bird abstracts

Chlidonias niger Linneaus — black tern

Photo by Barbara Simpson

State Distribution



Best Survey Period

Status: State special concern

Global and state rank: G4/S3

Family: Laridae (gull and terns)

Total range: Two subspecies are recognized, *C. niger surinamensis* found in North America, and *C. niger niger*, the Eurasian counterpart. In North America, black terns occur across most of southern Canada and the northern United States. They breed in all provinces of Canada except Prince Edward Island and Newfoundland. However, they are most common from central British Columbia across the prairie provinces to central Ontario and southern Quebec (Novak 1991). In the northern United States, black terns breed south to central California, northern Utah, Wyoming, Kansas, Iowa, Illinois, Indiana and Ohio to central and northern New York and northern New England. In Michigan, this species occurs mainly along the Great Lakes shorelines, but are also found at some inland locations (Chu 1994). Black terns usually migrate along the Atlantic coastline and mainly winter in marine and coastal areas south of the Gulf Coast through Central America to northern South America.

State distribution: Nesting black terns have been recorded in 27 Michigan counties (Brewer et al 1991; Natural Heritage Biological and Conservation Datasystem 2000). About half of all breeding records occur along the shores of the Great Lakes. In the southern Lower Peninsula they are well established at inland marshes and lakes. They occur primarily along Lake Michigan and Lake Huron as well as at several of the larger inland lakes in the northern Lower Peninsula. In the Upper Peninsula, black terns are also present along the shores of Lake Michigan and Lake Huron. However, they are absent from the Lake Superior shoreline west of Chippewa county and are almost absent in the western Upper Peninsula (Brewer et al. 1991).

Recognition: The **distinctive black head and underbody** with **gray wings, back, and tail** easily distinguishes this species from any other tern species in the state. Their size is also a key to recognition. With an **average length of only 9.75 inches (25 cm)** and a **wingspan average of 2 feet**, black terns are the smallest tern species to occur in Michigan. In North America, only the least tern is smaller averaging 9 inches (23 cm). **Under-tail coverlets are white**, while **eyes and beak are dark**. **Legs are reddish-black**, but this can be a difficult characteristic to identify. **In flight, the tail is short and slightly forked** and the species is highly acrobatic, often swooping and diving low over land or water. Juveniles and wintering adults are white or patchy black-and-white below with a gray tail. Wintering black terns can be easily confused with the Eurasian white-winged tern. However, a dark ear patch extending down from a black crown is a distinguishing characteristic of the black tern. Vocalizations include a harsh metallic *kik*, often produced when alarmed. Another softer common call is the *kyew* or *kyew-dik*.

Best survey time: The best survey time for black terns in Michigan begins during mid-May and

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continues through mid-August. Survey time for breeding birds is best between mid-May and late July. However, they can be seen in the state as early as mid-April in the Lower Peninsula and early May in the Upper Peninsula. Early October is the latest they have been found in Michigan (Chu 1994).

Habitat: Black tern colonies occur in freshwater marshes and wetlands with emergent vegetation found along lake margins and occasionally in rivers (Dunn and Argo 1995). Vegetation can vary greatly, but cattails (*Typha* sp.) or bulrushes (*Scirpus* sp.) are characteristically dominant in black tern colonies (Dunn 1979, Cuthbert 1954). Vegetative cover varies between dense and sparse but nests are usually protected from direct open water to avoid dangers such as wind and wave action. Overall, black terns tend to nest at sites with a 50:50 vegetation cover:open water ratio (Hickey and Malecki 1997). However, suitable marsh habitat of 5 ha or more is thought to be necessary. Nests are largely composed of the previous seasons' vegetation, found near the building site. In many instances nests are depressions in floating matted vegetation, found on logs or boards, and occupying abandoned muskrat lodges. Nesting occurs in water depths ranging from 0.5 m to 1.2 m (Dunn 1979, Mazzocchi et al. 1997). Spatial separation between nests can vary between 3 m to 30 m (Cuthbert 1954; Dunn 1979). This semi-social distribution is unusual for tern species and black terns are often labeled as a loosely colonial breeding bird (Brewer et al. 1991).

Biology: Black terns are a neotropical migratory species. Most reach the southern areas of the breeding range in early to mid-May. By mid to late August they are returning to their wintering locations in Central and South America. Pair mating occurs prior to arrival on the breeding grounds, and a short period of communal feeding and courtship behavior occurs before nest building begins (Dunn and Argo 1995). Both parents are involved in creating the nest and egg laying begins soon after nest completion. In Michigan's northern Lower Peninsula, egg laying starts in late May to early June (Cuthbert 1954), while in the southern part of the state, mid to late May is quite possible. Egg laying can continue into late July. Black terns generally lay 3 eggs per clutch, but numbers ranging from 1 to 5 are possible. Although black terns are considered a single-brooding species, nest failure does occur and they will re-nest if the first attempt fails. Both parents assist with the incubation process, which lasts 20-23 days (Bergman et al. 1970). Young black terns fledge 18-21 days after hatching. After fledging, parents continue to assist in feeding the young with food items consisting largely of small fish and insects (Dunn and Argo 1995). By late July or early August large numbers of black terns concentrate along Michigan's southern Great Lakes shores in preparation for fall migration. The southern migration begins soon after and few remain in Michigan by late September. Juvenile terns will not return to the breeding grounds until their second summer after fledging. They remain further south along the Gulf Coast. The maximum age recorded for the North American subspecies (*C. n. surinamensis*) is just less than 8.5 years.

Conservation/management: Black tern populations have decreased markedly since the mid 1960s. From 1966-1996, population declines throughout the North American breeding range were 3.1% annually. In Michigan, the decline was as high as 8.8% annually for the same time frame (Peterjohn and Sauer 1997). The drop in black tern populations in Michigan has been most evident in the southern tier of counties as well as the southeastern portion of the state. Many limiting factors exist as the cause or causes for such drastic declines including habitat loss, contaminants, and human disturbance.

An estimated 50% of Michigan's original wetlands have been drained, filled or altered and 70% of coastal wetlands have been lost throughout Michigan since European settlement (Cwikiel 1996). Similar situations have occurred in Canada. Compounding the problem, very little information concerning black tern winter ecology or the limiting factors on the wintering grounds is available. In addition to outright habitat loss are the corollary problems of habitat degradation, water and food quality and successional change. If pollutants, disturbance, or exotic invasion has changed the character of a wetland, it may become unsuitable for nesting black terns. Many wetlands exist today, which simply do not sustain colonies (Novak 1990). Toxic chemicals or contaminants including organochlorides (PCBs, DDT) and metals have been found in black tern eggs (Weseloh et al. 1997). Although studies have not determined biological effects on the birds, evidence indicates accumulation of these contaminants may lower reproductive success (Faber and Nosek 1985). The effects of human disturbance on black terns are poorly studied. However, activities other than habitat destruction include fishing, swimming, boating and prolonged human presence. Boat wakes can wash out black tern nests thereby submerging eggs or drowning chicks. Repeated and prolonged human presence in black tern colonies will prevent adults from incubating eggs or feeding offspring. When the adults are not present at the nest, exposure to weather or predation is more likely (Novak 1991).

Conservation and management options for the black tern, necessary to ensure a population stabilization or increase, include habitat preservation through land acquisition and conservation easements. Active management techniques involving artificial wetland production and management as well as artificial nest platform implementation are also viable options.

Finally, a standardized methodology for surveying and sampling black tern populations in the state is essential (Hands et al 1989).

Research needs: Additional study is required to properly assess black tern numbers and trends in Michigan. Productivity measurements, foraging, diet and nutrition studies will assist in conservation efforts. Also, comparative studies across habitats and regions are necessary for insight into behavior and ecology. Finally, metapopulation dynamics and demography investigations are both essential components to understanding black tern population ecology (Nisbet 1997).

Related abstracts: common tern (*Sterna hirundo*), Caspian tern (*Sterna caspia*)

Selected references:

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Nisbet, I.C. 1997. Status, biology, and management of the black tern: Symposium summary and overview. Colonial Waterbirds 20(3):622-625.

Novak, P.G. 1990. Population status of the black tern (*Chlidonias niger*) in New York State, 1989. New York State Dept. of Environ. Conservation, Div. of Fish and Wildlife - Nongame Unit, Delmar, NY. 30 pp.

Novak, P.G. 1991. Status of the black tern in the northeastern United States. The Nature Conservancy - Lower Hudson Chapter, Katonah, NY.

Peterjohn, B.G. and J.R. Sauer. 1997. Population trends of black terns from the North American Breeding Bird Survey, 1966-1996. Colonial Waterbirds 20(3):566-573.

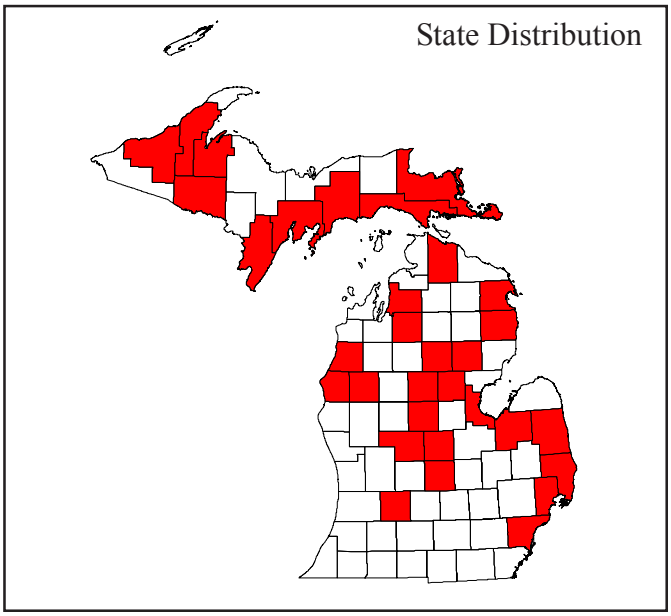
Weseloh, D.V.C., J. Rodrigue, H. Blokpoel, and P.J. Ewins. 1997. Contaminant concentrations in eggs of black terns (*Chlidonias niger*) from southern Ontario and southern Quebec, 1989-1996. Colonial Waterbirds 20(3):604-616.

Abstract citation:

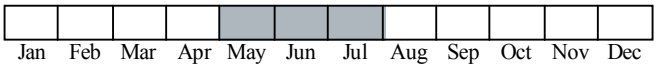
Currier, C.L. 2000. Special animal abstract for *Chlidonias niger* (black tern). Michigan Natural Features Inventory, Lansing, MI. 3 pp.

Funding for abstract provided by Michigan Department of Natural Resources - Parks and Recreation Division and Wildlife Division.

Circus cyaneus Linneaus — northern harrier



Best Survey Period



Status: State special concern

Global and state rank: G5/S3

Family: Accipitridae (hawk family)

Total range: The northern harrier is a holarctic breeding species divided into two recognized subspecies. *C. c. hudsonius* is found in North America and *C. c. cyaneus* (hen harrier) is the Eurasian counterpart. In North America, northern harriers breed south of the tundra in Alaska and throughout Canada, south to southern California east to southern Texas and across to northern Virginia (Hands et al. 1989). The winter range extends from southwestern Canada east to southern New England, south to California, Central America and the Caribbean. The southern range limit is Panama and they are rarely seen in northern South America (Bent 1937).

State distribution: In Michigan, the northern harrier breeds throughout the state where appropriate habitat is found. Nesting records exist for 32 counties in Michigan (Brewer et al. 1991, Michigan Natural Features Inventory 2001). The Michigan Breeding Bird Atlas suggests four areas in the state with high occurrence rates. These areas include: 1) the Gladwin-Midland county area in the central Lower Peninsula; 2) Dickinson, Menominee, and Delta counties in the south-central Upper Peninsula; 3) Schoolcraft, Mackinac, and Chippewa counties in the eastern Upper Peninsula; and 4) the Tuscola-Sanilac county area in the thumb region (Brewer et al. 1991).

Recognition: Northern harriers are **slim bodied, long-legged and long-tailed** hawks. Average harrier length is 17-23 inches and the wingspan averages 38-48 inches. They are a sexually dimorphic species in respect to both size and color. Females are about 50% heavier and 12.5% larger than males (MacWhirter and Bildstein 1996). The **female** is **brown above** and **buff-colored with brown streaks below**. The **male** is **pale gray above** and **white below with black outer primary feathers**. The **white patch at the base of the tail is distinctive** for adults and juveniles of both sexes. Also, the presence of an **owl-like facial disk is a unique characteristic** of the species. This facial feature provides excellent auditory capabilities and aids in prey capture. Juvenile birds resemble females but are cinnamon colored below and only streaked on the belly. In flight, harriers usually fly just above the ground with only periodic heavy wing beats, banking and gliding slowly over open habitats. Vocalizations include an alarm or excited call usually described as *ke-ke-ke* or *chek-ek-chek-ek* (Brown and Amadon 1968).

Best survey time: Northern harriers can be seen in Michigan from mid March to early November. The best

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survey time for northern harriers begins in early April and continues through late October. Survey time for breeding birds is best between early May and late July. Surveys should be performed in suitable habitat for nesting harriers. Survey methods include observations of a food pass from the male to the female, which often indicates an active nest. Also, observation of a hunting female requires searching near the area of observation, as they stay close to the nest site while hunting. Lastly, presence of young birds in close proximity may indicate a nest site.

Habitat: The northern harrier utilizes many types of open habitats including meadows, inland marshes, old fields, prairies, and even cultivated areas. However, populations in the Midwest and northeast prefer wet habitats for nesting. These habitats are usually large, undisturbed wet meadows and grasslands with a tall and often dense vegetation presence (Apfelbaum and Seelbach 1983). Vegetation types vary greatly and can include grasses, sedges, forbs, goldenrod, and low shrubs. Northern harrier habitat must also be of suitable size. In Washtenaw County, Michigan, territories averaged about 640 acres (Craighead and Craighead 1969). Northern harrier hunting habitat is determined by several factors including proximity to the nest site and prey abundance and location. Female harriers tend to hunt adjacent to the nest site, where males extend their hunting ranges farther from the nest and may enter into different habitat types (Martin 1987). Since voles and other small mammals are primary prey items, harrier habitats are closely associated with prey habitats (Schipper et al. 1975).

Biology: The northern harrier winters in much of the United States as well as Central America and the Caribbean. Therefore, spring migration can vary greatly from very short to long distance. Winter territories and communal roosts are usually abandoned by late February to early March (MacWhirter and Bildstein 1996). During spring migration, adult harriers precede juveniles and males precede females to the breeding grounds (Hamerstrom 1969). Migrating harriers begin arriving in Michigan in mid March. At Whitefish Point, in Chippewa Co. Michigan, spring migration peaks by mid April to mid May (Berkelman et al. 1989).

Courtship in northern harriers is often termed a "sky dance." This ritual is usually accomplished by the male and involves sharp dives and circular rolls (Bent 1937). Although pairs can mate in successive years, northern harriers do not mate for life. In fact, polygyny (one male mating with more than one female in a breeding season) is well documented in the species. The frequency of polygyny is related to sex ratios on the breeding grounds (England 1989) and especially to abundance of prey (Simmons et al. 1986). The female initiates copulation. Nest building begins with both sexes bringing nest material, but the female completes most of the actual building (Toland 1985). Nests are built in dense vegetation on the ground and are comprised of dead grasses, small twigs, and feathers as lining. The average clutch size for northern harriers is 4.4 eggs (MacWhirter and Bildstein 1996). One clutch per breeding season is standard, although renesting is possible if the original nest is damaged or lost (Duebbert and Lokemoen 1977). Incubation begins with the first egg laid. During this time, the female alone incubates the eggs. She is rarely away from the nest and is usually fed at the nest by the male. Incubation lasts 26-32 days (Breckenridge 1935). Young are brooded by the female and the male continues to provide food for both the female and chicks. Young harriers remain in or near the nest for another 30-35 days until flight is achieved (Hammond and Henry 1949).

In Michigan, fledging usually occurs by mid July. Fall migration for northern harriers is protracted, beginning in mid August and continuing through late October. Stragglers can be found into early November. Juveniles migrate before adults and females precede males (Bildstein et al. 1984). Interestingly, small populations of northern harriers may overwinter in the extreme southern counties of the state (Craighead and Craighead 1969). The Maple River State Game Area, the Allegan State Game Area, and the Pt. Mouille State Game Area are three important overwintering sites for northern harriers in Michigan (Cuthrell, D., pers. comm.).

Conservation/management: Occurring in marshes and open landscapes, the northern harrier was once described as one of Michigan's "commonest and best known birds" (Barrow 1912). However, their numbers have declined since the 1960's. This decline is most noticeable in the southern counties of the state where grassland and wetland loss has been the most rapid (Adams et al. 1988). The species was on the National Audubon Society's *Blue List* from 1972 to 1986 (Tate

1986). The U.S. Fish and Wildlife Service has identified the northern harrier as a *migratory nongame bird of management concern* for Region 3, which includes Michigan (U.S. Fish and Wildlife Service 1987). Northern harriers are now listed as endangered or threatened in 12 northcentral and northeastern states and listed as a special concern species in another three, including Michigan.

The major factor affecting northern harrier populations is habitat loss both on breeding and wintering grounds. Fifty-four percent of wetland area in the U.S. has been lost since European settlement (Tiner 1984). In Michigan, approximately 70% of wetlands have been lost (Comer 1996). The practices of draining wetlands for agricultural fields and filling wetlands for residential uses help to explain this dramatic loss. Since the harrier prefers to breed in shallow, freshwater wetlands, this reduction in potential habitat is a serious threat. Conversion of open grassland habitats to monotypic farming also contributes to shrinking of suitable breeding habitat (Duebbert and Lokemoen 1977). Loss and degradation of fresh and saltwater marshes, grasslands and open floodplains have also reduced habitat throughout the species wintering range. Other factors exist and are contributing to decreasing populations of northern harriers. Pesticides and other contaminants have serious effects on harrier populations. Studies have shown negative impacts by organochlorides (Hamerstrom 1969) and other chemicals such as DDT, DDE and PCB's (Anderson and Hickey 1972). Human disturbance is another factor affecting northern harriers. For much of the 20th Century, harriers were targeted and shot. Until the early 1930's, 3,000-5,000 birds were recreationally shot yearly in the Kittatinny Ridge area of Pennsylvania (Broun 1935). Even today, northern harriers are under pressure on wintering and communal roost locations in areas of the U.S. Harriers also are sensitive to human and agricultural activity. Human presence near the nest sites may cause birds to desert. Even research activities such as trapping and banding (Hamerstrom 1969) and placing observation blinds (Simmons 1983) can have deleterious effects on nesting harriers. Agricultural practices such as repeated mowing or heavy grazing can destroy nests and cause birds to abandon otherwise suitable habitat.

With habitat loss the major threat to northern harrier populations, habitats used on the nesting and wintering grounds need to be preserved. The focus of this preservation should be where large tracts of suitable habitat already exist. Conservation easements, continuation in the Conservation Reserve Program of the 1985 Farm Bill, purchases of new acreage, and law enforcement are important tools to aid in preservation of harrier habitat. In wetland habitats, management of water levels is very important. Levels should be kept low (<6 in.) during the nesting season to prevent nest inundation (Hands et al. 1989) and elimination of the prey base. Another management option for grassland habitats is periodic burning. Burning every 2-5 years helps to prevent succession and encroachment of woody vegetation (Duebbert and Lokemoen 1977). Lastly, nest visitations and disturbances should be avoided. In areas where human disturbances could potentially threaten nesting northern harriers, the creation of buffer zones surrounding nest sites is a possible solution (Serrentino 1992).

Research needs: Monitoring of northern harrier occurrences on existing public and private managed areas is a high priority. Training of land managers to identify the species as well as recognize suitable habitat for northern harriers is also necessary. Identification of important overwintering sites in southern Michigan is also important. Implementation of standardized and accurate survey methods would assist in determining trends of northern harrier populations in Michigan. Additional studies during the breeding season are necessary to determine the causes of mortality and breeding failure, and the occurrence and frequency of polygyny. Studies involving the size of hunting ranges at sites with varying densities of habitat types and individuals are also required. Information regarding food habits, hunting habitat selection, prey abundance and breeding success relationships (Serrentino 1992) is needed. Lastly, determining the types and levels of disturbance harriers will tolerate in Michigan's three important overwintering sites is essential to northern harrier success in the state.

Related Abstracts: southern wet meadow, lakeplain wet-mesic prairie, Henslow's sparrow, grasshopper sparrow, dickcissel, short-eared owl

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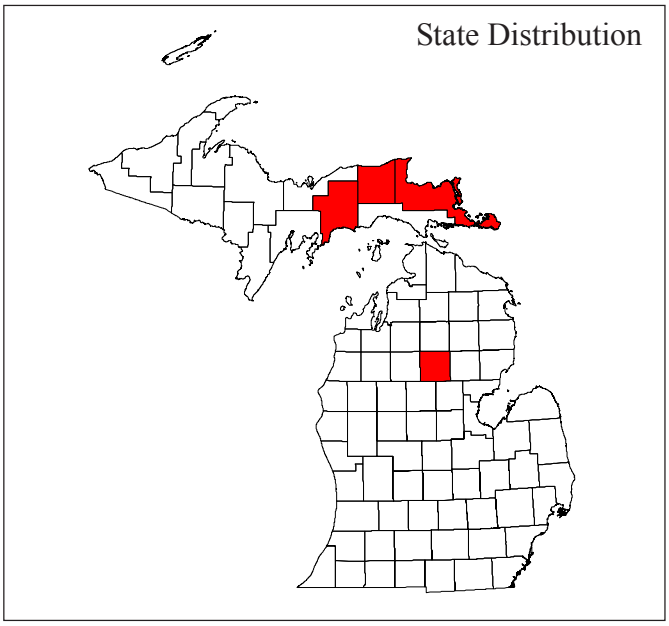
Coturnicops noveboracensis Gmelin — yellow rail

Photo by Theodore A. Bookhout



Best Survey Period

Status: State threatened

Global and state rank: G4/S1S2

Family: Rallidae- Rails, Gallinules and Coots

Total range: The yellow rail is primarily found in central and southern Canada and the northern United States. Its range during the breeding season includes the Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, the northern Great Lakes region, North Dakota and the extreme Northeast. Populations may be gone from Ohio and Illinois but disjunct populations likely still occur in scattered locales in the West and Mexico. The winter range includes coastal marshes from North Carolina west through Texas and into Mexico as well as scattered reports along the central California coast (Bookhout 1995, Environment Canada 2001, Evers 1994).

State distribution: Historically, the yellow rail has had a widely scattered and poorly known distribution with few confirmed breeding records. The first positive Michigan nest record was discovered in Oakland County in 1920 but this nest was destroyed some days later. In 1934 it was estimated that fifty pairs nested on the Munuscong Bay State Park marsh in Chippewa County, however none were found the following year and the area has not been surveyed in the recent past. Yellow rails have been found summering (without breeding evidence) in Alger, Jackson, Keewanaw and Schoolcraft counties (Wood, 1951). Known and suspected breeding records for the yellow rail have been documented from five areas in four counties including: Drummond Island (Chippewa Co.), northwest of the community of Trout Lake (Chippewa Co.), the vicinity of Sleeper and McMahon Lake (Luce Co.), the Seney National Wildlife Refuge (NWR) marshes (Schoolcraft Co.) and Houghton Lake marshes (Roscommon Co.) (Burkman pers. comm., Michigan Natural Features Inventory 2001, Walkinshaw 1991).

Recognition: Although rarely seen, this secretive small rail is approximately 6-7.5 inches (15-19 cm) in length, with a 10-13 inch (25-33 cm) wingspan. It is **tawny yellow above** and is **streaked with wide dark stripes crossed by white bars**. When flushed its flight pattern appears weak. In flight **a pronounced white wing patch on the trailing edge of its wings** is a distinctive identification character along with its **short wings, stocky body, short tail and dangling legs**. Its bill is relatively short and thick and its chin and upper throat are nearly white. Males are indistinguishable from females, except in the breeding season the dark olivaceous bill of the male becomes corn yellow. The yellow rail is most often identified by its **rhythmic metallic ticking call** given in an alternating series of

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"tic tic, tic tic tic" that resembles the sound of a typewriter or two stones being tapped together. The voice has an echoing quality and it can be difficult to discern its origin at times (Burkman pers. comm.). It is not easily confused with other rails as they are much larger. The immature sora (*Porzana carolina*) is nearly twice as large, has a solid brown back, white undertail coverts, and lacks the white wing patch (Bookhout 1995, Evers 1991, National Geographic Society 1987).

Best survey time: The best time to survey for the yellow rail in Michigan is between mid-May and mid-July when males are giving their territorial calls (Bart et al. 1984). Although some observers have reported hearing intermittent calls during the day, calling is most incessant and pronounced at night usually beginning after total darkness. The best method for surveying this elusive bird is to visit suitable habitat on nights with little or no wind or rain and to listen for its call. Burkman (pers. comm) found that surveys conducted on clear nights with minimal cloud cover yielded the best results. If the yellow rail is not detected initially, the surveyor can imitate its call by tapping two stones (or two quarters) together or use a playback recording of its call and then listen for a response.

Habitat: The breeding habitat of the yellow rail in Michigan is characterized by extensive wet sedge meadows dominated by *Carex lasiocarpa*. The substrate ranges from moist to standing water up to 18 inches (46 cm) and the quality of habitat is diminished by the invasion of woody species and cattail (*Typha* sp.)(Bookhout 1995). Habitat at Seney NWR includes homogenous areas of > 90% *Carex lasiocarpa* interspersed with islands of scrub-shrub wetlands and sand ridges with young to mature woody growth (Bookhout and Stenzel 1987). Because *Carex lasiocarpa* is a mat forming species, the dead stems bend over and persist for several years, forming a dense horizontal carpet a few centimeters above the soil or water. In some regions this sedge is positioned above sphagnum moss (Burkman 1993). Burkman (pers. comm) found that when the dominant vegetation of *Carex lasiocarpa* was replaced over time by another type of sedge or grass that the yellow rail no longer nested in these areas. Other species of sedge and grass, which are thicker, do not bend over and form the dead, loose layer of vegetation that the yellow rail uses for cover. Community associates include sandhill crane (*Grus canadensis*), common snipe (*Gallinago gallinago*), sedge wren (*Cistothorus platensis*), savannah sparrow (*Passerculus sandwichensis*), Le Conte's sparrow (*Ammodramus leconteii*) in the north, and Henslow's sparrow (*Ammodramus henslowii*), in the south (Walkinshaw 1991).

Biology: Yellow rails return to Michigan from their wintering grounds from late April to mid May. Although not often encountered during migration, bird-watchers have found them on a regular basis in Benzie County and the Waterloo Recreation area (Jackson and Washtenaw counties). During migration they travel at night and towards morning they may land in sedge or open grassy habitats, or might be found in unexpected places such as suburban lawns (McPeek 1994). Pair formation likely occurs on the breeding grounds and yellow rails are presumed to be monogamous. Within one week of arrival males establish territories, which can overlap (average 19.0 acres {7.8 ha}) and give their clicking calls nightly during the pre-incubation period which last about one month. Female areas average 3.0 acres (1.2 ha) during pre-incubation, and decrease to 0.7 acres (0.3 ha) during incubation (Bookhout and Stenzel 1987). The yellow rail is considered by some to be a semi-colonial nesting species as it is more typical to find groups of birds nesting together than it is to find single pairs. Thus, a larger sedge meadow is needed to accommodate several pairs of birds and the marshes used for nesting are discreet and scattered throughout their breeding range (Burkman pers. comm.). Nests are woven from grass and are usually placed over shallow water in a tussock or on top of dead grass. Nests are four to five inches in diameter and one to one-and-a-half inches thick, with a deep cup. They are concealed in a natural hollow with an overhanging tuft of vegetation or under a canopy of grass. Both sexes take part in nest building but females finish the nests (Baicich and Harrison 1997, Savaloja 1981). At Seney NWR, nests of 6-10 eggs are laid between the last days of May and early June (Stenzel 1983). Eggs are creamy buff and capped at the large end with a wreath of reddish brown spots. Incubation is done solely by the female and lasts 16-18 days. The female tends the glossy black nestlings, which leave the nest within two days of hatching. The young become independent in three weeks and fly in 35 days (Baicich and Harrison 1997, Bookhout 1995). Renesting may occur if initial nests are unsuccessful. Females give a variety of calls: *rowr* (given when the nest is disturbed), whining (used to attract the young) and moans (given when brooding). Young chicks and

juveniles give various *wees and peeps,* while only juveniles have been heard to give barks (Stalheim 1974).

Although the yellow rail calls primarily at night it is not actively nocturnal. At night it is sedentary and does most of its feeding during the day in areas of shallow water, concealed by dense vegetation. The yellow rail picks its food from the ground and from the surface of the vegetation. Birds in captivity have been observed submerging their heads one-and-a- half inches (3-4 cm) under water, presumably to feed on invertebrates (Stalheim 1974). Small freshwater snails constitute a large part of the yellow rails diet supplemented by other aquatic and terrestrial invertebrates (Bookhout 1985, Savaloja 1981, Stalheim 1974, Stenzel 1983). Although rarely seen, the yellow rail walks by placing one foot directly in front of the other, leaving a straight line of tracks or runs with its head stretched forward and feathers sleeked back, often flashing out wings for balance (Bookhout 1975, Stalheim 1974). Burkman (pers. comm.) reports that when calling yellow rails on very calm nights, the first indication that a bird is near is that the sedge moves in a line towards the person imitating its call. When disturbed it will freeze, relying on its camoflauge, or may submerge itself in water, or fly feebly, barely clearing the top of vegetation (Bent 1926, Ehrlich 1988, Stalheim 1974). It will commonly chase other yellow rails that intrude its territory causing the other rail to run away quickly with a squeaking call. Calling generally ends in mid-August with fall migration beginning in late August and continuing through early October in southern Michigan (Evers 1991).

Conservation/Management: In Michigan, the few known yellow rail breeding sites are relatively protected by private, state and federal agencies, although in the past loss of wetlands to human activity played a primary role in its disappearance from other areas of the state. Good interagency and interstate communication and coordination is needed to best manage this species. A cooperative effort with Great Lakes states to survey and manage known breeding marshes would be very useful and would benefit several other species as well (Burkman pers. comm.). Long term management of these sites which takes into account the impacts of vegetative succession, changes in hydrology and human disturbance is needed (Evers 1994). Succession of vegetation acts as a limiting factor because invasion of woody vegetation reduces the suitability of wetland habitat for yellow rails. Without active management, wet sedge meadows can become occupied by dense stands of leatherleaf (*Chaemadaphne calyculata)*, bog birch (*Betula pumila*) or willows (*Salix* spp.), which results in the depletion of habitat available to nesting yellow rails (Burkman 1993). Prescribed fire has been used successfully in northern Michigan as a management tool to rejuvenate sedge growth, limit woody growth and impede the establishment of boreal flora such as sphagnum moss (Evers 1994). Burkman (1993) in her study at Seney NWR, found that yellow rails apparently responded positively to burned habitat. All of the rails (n=8) detected during surveys were found on burned plots that had lower percentages of shrubs and higher percentages of *Carex lasiocarpa* than on control plots. Burkman (pers. comm.) emphasizes the need to rotate prescribed fires so not all areas of a known marsh are unavailable in a given year.

It is important to understand how water level fluctuations impact yellow rail populations. Curently it is not known what water depths are optimal for this species (Burkman pers. comm.). Marginal water level changes in seasonal and annual water depths are natural but ditching or altering water flows (which result in drier habitats) and diking and flooding areas have negative effects on preferred microhabitat structure (Evers 1994). Manipulation of water levels on refuges to benefit migratory waterfowl could adversely affect yellow rails if the objective is to provide deepwater marshes. Retention of wet sedge meadows as a component of marsh habitat is essential to maintenance of yellow rail populations (Bookhout 1995). Although direct human disturbance is probably not a limiting factor, since hunting of yellow rails has been closed since 1968, continual visits by large groups may damage the rail's microhabitat and disturb breeding success. Since this species is dependent on transitory habitats, this suggests that it can colonize new sites as they become available. Thus, management and protection of occupied as well as unoccupied, potentially suitable habitat throughout the state is crucial for the long-term survival of the yellow rail in Michigan (Evers 1994).

Research needs: Many believe that this species is more abundant than encounters would indicate. Systematic surveys across the known breeding range should be developed and run for several years to determine whether this is actually true and would reveal the habitats occupied by the yellow rail (Bookhout 1995). Burkman (pers. comm.) recommends focusing

surveys on historical known sites with some additional short term effort in locating previously unknown locations since she believes that nesting sites for this species are limited. Inclusion of the yellow rail in state breeding bird surveys would provide updated information on population trends as well (Burkman 1993). Due to its secretive nature and poorly known distribution, many aspects of the natural history of yellow rails remains unknown. The lifespan and survivorship of this species is unknown and no data is available on annual and lifetime reproductive success (Bookhout 1995). It is not known why the personnel at Seney have never retrieved a banded bird, despite the fact that they have been banding male yellow rails for years (Burkman pers. comm.). Research should emphasize how to maintain breeding sites by habitat manipulation and wetland preservation. Additional management techniques (in addition to controlled burning, water level manipulation and mowing) should be explored to set back succession and maintain sedge meadows for prime nesting habitat (Bookhout 1995). Burkman (1993) suggests that further research is needed to test the hypothesis that flooding after burning reduces the regeneration of woody species more efficiently than the isolated application of prescribed fire. Very little is known about yellow rails on their wintering range and whether current available habitat is sufficient. Research is needed to determine the impact that loss of coastal marshes may have on this species and whether management is needed to enhance their wintering habitat (Bookhout 1995).

Related abstracts: northern harrier, short-eared owl.

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Rallus elegans Audubon — king rail

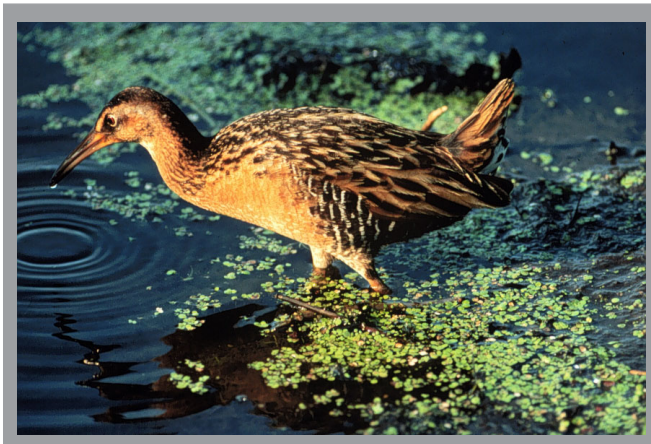
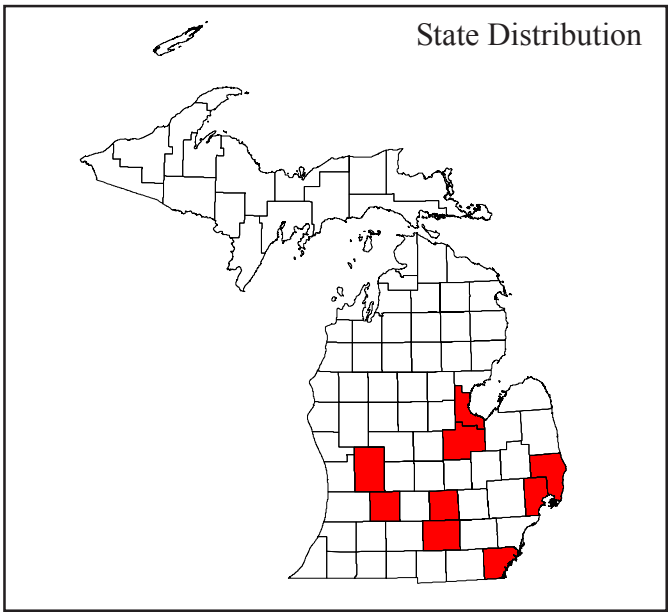
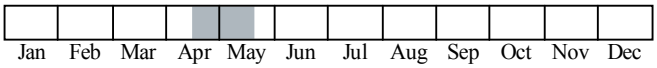


Photo by Lawrence Wales - C.L.O.



Best Survey Period



Status: State endangered

Global and state rank: G4G5/S1

Family: Rallidae (Rails, Gallinules, Coots)

Taxonomy: The clapper rail (*Rallus longirostrus*), which inhabits saltwater marshes along ocean coasts, and the king rail are considered by some to be the same species (Ripley 1977). Hybridizing populations of the two species exist in brackish marshes in Delaware and possibly in other areas along the Atlantic coast (Meanley and Wetherbee 1962). Mitrochondrial DNA studies have been inconclusive (Avise and Zink 1988).

Total Range: The king rail is widely distributed in the eastern U.S., but barely reaches southeastern Canada. The king rail breeds from the Great Plains through southern Ontario and New England's Atlantic Coast to the Gulf Coast and Cuba. It is absent throughout the Appalachian Mountains and is only a local breeder north of the marsh-rice belts of the southern states and tidal marshes of the Atlantic Coast. An isolated breeding population has been reported in central Mexico (Warner and Dickerman 1959). Wintering range includes tidewater areas from the Delaware Valley to southeastern Georgia, southward through interior Florida to the Everglades, westward through the Gulf Coast and rice belts of Louisiana and Texas, as well as north into the Arkansas rice belt.

State Distribution: In Michigan, the king rail is at the northern limit of its breeding range, and all breeding pairs are migratory. Nesting activity has been reported from the Saginaw Bay area west to Muskegon County and south to the state line, although there are several summer and nesting records in the northern Lower Peninsula and strays have been reported from the Upper Peninsula (Ilnicky 1969). King rails were reported from 9 counties during the 1980's and 1990's (see distribution map). In addition, Michigan Breeding Bird Atlas data for 1983 to 1988 notes possible breeding birds for three more counties (Menominee, Lake and Ottawa)(Brewer et al. 1991). Observations prior to 1980 exist for 16 additional counties, although only Lapeer, Calhoun and Washtenaw are represented by more than a single observation at a single site (Michigan Natural Features Inventory 2001).

Recognition: The king rail is a **large, slender**, rust-colored marsh bird with a **long bill** and long toes; it is the largest North American rail. Upper body parts are olive brown, the **breast is reddish-brown**, **flanks are barred with black and white**; the tail is short and often uplifted. Males appear similar to females. Meanley (1992) presents detailed information on the appearance

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and plumage of chicks and adults. Average length and wingspan of adult birds are 15 - 19 inches and 21 - 25 inches, respectively. Males weigh about 12 ounces and females weigh 11 - 13 ounces (Ripley 1977). Although seldom flushed, flight is usually short, skimming the top of emergent vegetation; flight begins with legs dangling. The similar Virginia rail (*Rallus limicola*) occurs in the same habitats, but is a gray-cheeked, smaller version of its larger relative and lacks the king rail's extensive barring on the sides and undertail coverts. The clapper rail, while similar in appearance, does not breed in Michigan.

Best Survey Time: Because of their secretive behavior, rails are more often heard than seen. Birds are quite vocal at night during courtship and most of the incubation period (generally mid April to mid May), and readily respond to taped recordings of their loud and diagnostic calls. Rabe (1986) noted that king rails responded more consistently to taped calls played within 300 feet and during evening hours (2100 - 2400 hr). The call most commonly used is grunt-like, and may be described as *jupe-jupe-jupe*. The first several notes in this series are louder than succeeding ones and tempo increases toward the end of the call when the notes seem to run together. This call can be answered by other nearby king rails including a mate; it sometimes is used when a bird is startled (Meanley 1992). The courtship or mating call is basically a series of staccato notes (e.g., *kik-kik-kik*-). As the nesting period approaches this call all but ceases and a number of other calls, mostly soft and subdued, are used. Meanley (1992) presents detailed information on vocalizations of chicks and adults. Calls of the Virginia rail can sound similar, and they should be carefully compared before field surveys are initiated. In general, king rail calls are deeper, louder and slower. Individual birds and females with chicks can be seen sporadically throughout the breeding season. Mowed areas next to good nesting habitat are often used for feeding, so birds have been observed on dikes, edges of parking lots, and lawns. Rails have been located by traversing, on foot or by boat, all potential habitat; dogs can be used as an aid in flushing rails (Andrews 1973). Once rails have been located by calls or searches, drive traps and walk-in traps can be used for capture (Andrews 1973).

Habitat: The king rail prefers permanent freshwater marshes in the Midwest, although it uses brackish wetlands elsewhere. Grasses (Poaceae), sedges (Cyperaceae) and rushes (Juncaceae) are important cover types; cattail (*Typha* spp.) is a key plant throughout the range (Meanley 1992). Studies in Michigan have found king rails in monotypic cattail stands, cattail-sedge-shrub mixtures, and tussock-forming sedge-grass wetlands (Evers 1984, Rabe 1986). Although expansive stands of marshy herbaceous vegetation are typically considered preferred habitats, Rabe (1986) found king rails occupying marsh habitats interspersed with willow (*Salix* spp.) and dogwood (*Cornus* spp.) when Great Lakes water levels are high. Meanley (1969) believes this species uses a wider variety of habitats than any other rail.

Biology: King rails arrive at Michigan marshes in mid April, with pairs often returning to the same marsh in consecutive years. Territories are aggressively defended against rival king rails as well as soras (*Porzana carolina*) and Virginia rails. During courtship, the male attracts a female by strutting with its tail held vertically, exposing the white undertail coverts (Meanley 1957). The nest site is generally chosen by the male, which also assumes most of the nest building responsibilities. The presence of tussocks or clumps of vegetation in a rail territory is a key determinant of nest site location. Nest sites are usually in shallow water with depths of less than 10 inches (Meanley 1969). The nest is placed in a clump or tussock above water level and generally has a canopy and an entrance ramp. In uniform stands of vegetation, this canopy, which is formed by bending over the nearby plant stalks, may be very noticeable. Several brood nests, usually without canopies, are constructed near the egg nest. The clutch consists of 10 - 11 eggs. Both parents incubate the eggs for 21 - 23 days. After hatching, the downy black, semiprecocial young quickly vacate the nest. Day-old chicks can follow their parents for a considerable distance. Adults feed chicks 1 - 3 weeks of age almost exclusively; at 4 - 6 weeks of age, chicks pick up at least 60% of their own food; by 7 - 9 weeks, adults rarely feed chicks (Reid 1989). Most young broods (1 - 3 weeks of age) associate with two foraging adults, but older broods with only one (Reid 1989). Meanley (1969) estimated a 50% survival rate of young until two weeks of age. By the ninth or tenth week of age (mid-August), most young have fledged. Breeders depart by late September, although December records exist for Roscommon and Jackson counties for individuals caught in muskrat traps. Little is known about

migratory behavior, but birds appear to migrate alone and at night (Meanley 1992). Raccoons (*Procyon lotor*), mink (*Mustela vison*) and red fox (*Vulpes vulpina*) are know to prey on king rails, especially their nests. Adults also fall prey to northern harriers (*Circus cyaneus*) (Errington and Breckenridge 1936) and great horned owls (*Bubo virginianus*) (Errington 1932). King rails are diurnal feeders typically foraging in dense vegetation and shallow water approximately 2 to 3 inches in depth. Occasionally, individuals forage in open water and cultivated fields adjacent to suitable wetland habitats. Their diet consists of small crustaceans, especially crayfish, and aquatic insects. Fish, frogs, terrestrial insects (e.g., grasshoppers), and aquatic plant seeds also are eaten when available. Exoskeleton fragments are regurgitated; as many as 14 pellets (adult pellets average 0.8 inches long by 0.5 inches wide) have been counted on the top of one muskrat lodge (Meanley 1992).

Conservation/Management: Despite the king rail's broad geographic range, its populations have declined alarmingly in the past 30 years throughout major portions of its range, owing mostly to loss of wetlands. While severe declines have been reported in the northern part of the range, populations appear somewhat stable in most of the southern U.S., especially in Louisiana and Florida. The king rail's Midwest breeding population is declining due to wetland destruction and degradation as well as high pesticide residues. The king rail's decline in Michigan is not fully understood, but these factors further stress a population already constrained by its peripheral status. Migratory northern king rail populations may be geographically isolated from the more abundant and sedentary southern populations. Therefore, even though self-sustaining rail populations are present in the southern United States, northern populations cannot rely on recruitment from southern populations. In the early 1900's, king rails were frequently reported during the breeding season along Saginaw Bay and in the southern four-county tier of the Lower Peninsula. Since the mid-1900's, king rail populations have not recovered in Michigan and are currently confined to large marshes along Lake Erie, Lake St. Clair and Saginaw Bay with only sporadic occurrences reported from interior wetland complexes.

As nocturnal migrants, individuals strike various illuminated structures such as television towers, tall buildings, and lighthouses. They also are struck and killed by automobiles. The king rail is considered a game bird in Gulf and Atlantic coast states (Meanley 1969), and there are annual harvests of king rails on their wintering grounds (Eddleman et al. 1988). Lead poisoning also may be a significant factor in declining rail populations. Soras have been found with ingested lead in their gizzards, indicating lead as a major contaminant among rails (Artman and Martin 1975).

Since the availability of suitable habitat is a major limiting factor, protection of occupied habitats is needed as well as artificial manipulation to enhance areas for migrating and nesting rails. Hummocky topography and natural swales should be maintained for nesting and foraging. Artificial land leveling should be discouraged. Beds of perennial vegetation should be encouraged where water depths are moist to 10 inches. In a continuum of preferred water depths for inland-breeding rallids, king rails nest in the most shallow water areas. These shallow, seasonally flooded sites are most easily drained and impacted by agriculture, especially in the Great Lakes Region when water levels are low. Row crops, other than rice (Meanley 1969) have little value for any rallid species. Suitable rail habitat can be created by flooding impoundments in spring to permit shallow water depths (less than 10 inches), followed by drawdowns in late summer to maintain vegetation density and coverage. Water depth and vegetation structure are probably more important than plant species composition. Brood foraging sites with open mud flats adjacent to dense vegetation are also crucial.

Improved nest success when nests were located in the interior of marshes suggests that beds of desired vegetation should be encouraged within the interior, not the periphery, of managed wetland units. Borrow areas along the edges of units may serve as travel lanes for mammalian predators. Nests located along ditches may be susceptible to increased predation and flooding (Meanley 1969). Borrow areas may, however, be the only remaining habitat available in intensively farmed regions (Meanley 1969), and roadside mowing of borrow areas should be discouraged during the nesting and brood-rearing periods. On intensively managed refuges, a complex of wetland units should include marsh habitats that naturally dry during the summer and may include extensive perennial vegetation. Floating nesting platforms are a potential management tool and

have increased breeding success of clapper rails in areas with limited nesting sties (Wiley and Zembal 1989).

Research Needs: More research needs to be completed to evaluate the relationship between chemical use and the levels ingested by king rails foraging on aquatic insects. The amount of hybridization with sympatric clapper rails needs further study. Evaluate timing and consistency of King rail use of interior wetland systems. Knowledge of the relative use of interior and coastal wetlands would assist recovery efforts.

Related Abstracts: Great Lakes marsh, lakeplain wet prairie, lakeplain wet-mesic prairie, prairie Indian-plantain, Sullivant's milkweed, eastern prairie fringed orchid, northern harrier, black tern, Forester's tern, American bittern, least bittern, Blanding's turtle, eastern fox snake, lake sturgeon

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Abstract citation:

Rabe, M.L. 2001. Special animal abstract for *Rallus elegans* (king rail). Michigan Natural Features Inventory. Lansing, MI. 4 pp.

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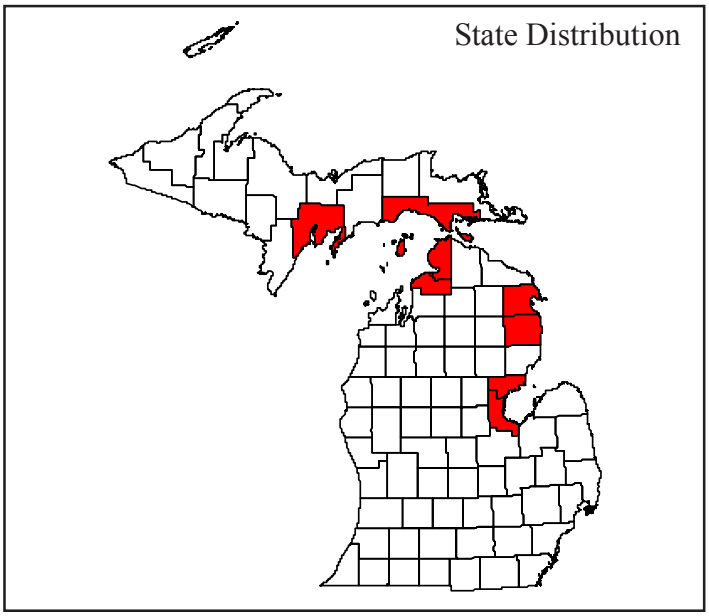
Sterna caspia Pallas — Caspian tern

Photo by O.S. Pettingill,
Cornell Laboratory of Ornithology



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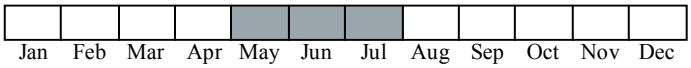

Status: State threatened

Global and state rank: G5/S2

Family: Laridae (gull and tern family)

Total range: The Caspian Tern is found throughout the world. In North America, six distinct populations breed on coastal and inland waters. On the Pacific coast, the species breeds locally in Washington and California, and south to Baja California. On the Atlantic coast, breeding occurs locally in Newfoundland and Quebec, and from Virginia to northern Florida. Nesting colonies also occur from Florida to Mexico along the Gulf coast. Inland populations reside in the Great Lakes northwest to central Manitoba, and locally in the Great Salt Lake region (Spendelow and Patton 1988). Wintering grounds include the southern coast of the United States, the West Indies, and northern South America (Ludwig 1942; Ludwig 1965).

State distribution: Caspian terns currently nest in eight counties within the State. Colonies are recorded from islands and coastal areas in Alpena, Alcona, Arenac, Bay, Charlevoix, Delta, Emmet, and Mackinac counties. Some of these nesting sites have been established since the early 1980s, including one on an artificial disposal dike in Saginaw Bay. Nesting is possible but not confirmed in Antrim, Cheboygan, Chippewa, Huron, Leelanau, Manistee, Presque Isle, and Tuscola Counties.

Recognition: The Caspian tern is the largest of the terns, with a **wingspan averaging 4.5 feet**. Its size, **stout red bill**, and **lack of a deeply forked tail** distinguishes it from other white terns found in the state. Its **black cap, large red bill**, and tern-like habit of flying slowly with its bill pointed downward separates it from the gulls. The **low harsh call** of the Caspian tern sounds similar to *karrr* or *kraa-ah* and is given frequently while in flight. The orange feet of immature birds distinguish them from fall-plumaged adults which have black feet (Evers 1994).

Best survey time: Although Caspian terns can be seen in Michigan from mid-April through September, the optimal time to survey for Caspian terns is during May, June and July.

Habitat: Nesting habitat of the Caspian tern is open sandy or pebble beaches, usually on islands in large bodies of water. The nest consists of a shallow depression near the water line. Water levels, competition from other species in the Laridae family, and vegetative succession are factors that influence the selection of sites for a nesting colony. Artificial nesting sites, such as the disposal dike in the Saginaw Bay, have proven to be acceptable nesting habitat (Scharf and Shugart 1983). A problem identified with this, and similar artificial sites is the possibility of toxins entering the surrounding ecosystem and negatively impacting the population. Foraging habitat can consist of almost any large body of water where their prey of alewife (*Alosa pseudoharengus*), American smelt (*Osmerus mordax*), or yellow perch (*Perca flavescens*) is common (Ludwig 1991).

Biology: Caspian terns are a migratory species. They arrive at their breeding grounds from mid-April to mid-May. Almost all individuals return to the same general breeding area for more than one season (Cuthbert 1988). Caspian terns nest in colonies, often within several feet of

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each other and other species of the Laridae family. (Ludwig 1965). Clutches with an average of two or three eggs each appear from mid-May to mid-July. Both males and females incubate the eggs for approximately 26 days until hatching in July and August. The young fledge 36-56 days after hatching. After migrating to their wintering grounds, first year birds remain through the first summer, and don't return to their breeding grounds until the second summer after their fledging (Ludwig 1968, Cuthbert 1988)

The rapid expansion of the alewife into the upper Great Lakes in the 1950s provided Caspian terns with a plentiful food source. The population size in Michigan grew in response, from approximately 525 nesting pairs in 1962 (Ludwig 1962), to an average of 1,800 nesting pairs between 1975 and 1982 (Evers 1994).

Conservation/management: Offspring tend to return to the region of their natal colony to breed and adults tend to return to the same colony to breed if nesting the previous year was successful. (Ludwig 1968, Cuthbert 1988). Combined with the geographic separation of colonies, this suggests there is little mixing between populations of different regions. This being the case, the Great Lakes population maintains itself primarily through reproduction with little immigration of individuals from other regions. Therefore, local perturbations could cause a dramatic decline in a region's population (Shugart et al. 1978). The Caspian tern is listed as threatened in Michigan because of the possibility of a local decline under these circumstances. The Caspian tern has never been common or widespread in the Great Lakes region. Current factors believed to be negatively affecting the population are interspecific competition, human disturbance, environmental contaminants, and a lack of isolated island habitat (Evers 1994). Washouts caused by high waves can destroy entire nesting colonies. Studies in the region attributed over half of nest failures in Caspian tern colonies to washouts (Shugart et al. 1978, Cuthbert 1988). Although nest counts for the species have been relatively high in recent times, there is still concern for the viability of the Great Lakes population. The mean fledging rate of 1.46 chicks per nest in the 1962-1967 period (Ludwig 1965, Ludwig 1968) declined to .61 in the 1986-1989 period (Ludwig et al. 1990). Evidence has been presented that PCB's have put Great Lakes populations under severe stress. High levels of this toxin in eggs correlate with rising rates of deformities, embryonic abnormalities, and depressed hatching rates (Ludwig and Kurita 1988, Tillit et al. 1988). Conservation efforts should concentrate on the protection of nest sites from human disturbance. Terns using contaminated sites for nesting should be provided with alternative breeding sites with uncontaminated substrate. Colonies should be monitored on a regular basis to document changes in numbers of breeding pairs, reproductive success, and impacts of toxins (Evers 1994).

Research needs: A better understanding of the effects of toxins on the Caspian Tern and related species is needed. In particular, how floods, dredging, and other physical events can mobilize toxicants from contaminated sediments into the aquatic food web needs to be researched.

Related abstracts: open dunes, common tern

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Abstract citation

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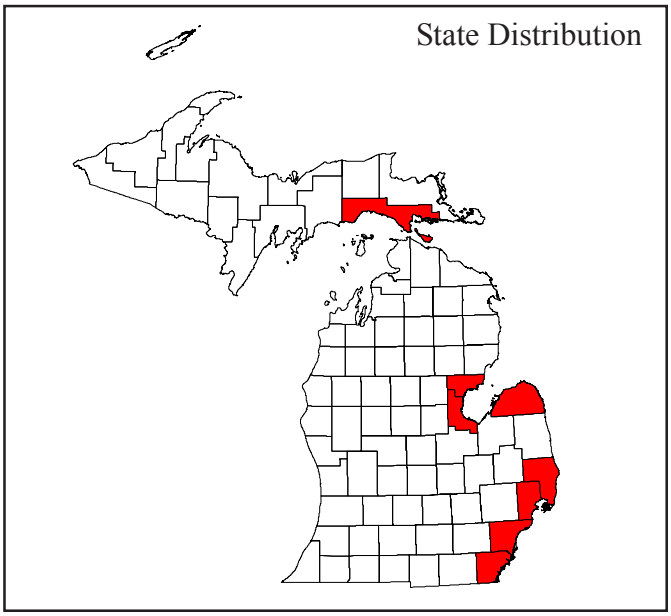
Sterna forsteri Nuttall — Forster's tern

Photo by Paul Kivlin



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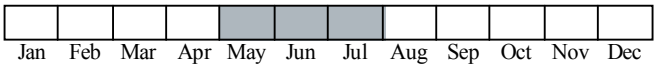

Status: State special concern

Global and state ranks: G5/S2

Family: Laridae- Gulls and Terns

Total range: The Forster's tern is confined to the Western hemisphere and nests along the Atlantic, Gulf and Pacific coasts of the U.S. as well as the prairie and Great Lakes region of the U.S. and Canada. It winters from central California and Virginia south to Mexico and Guatemala with small numbers found in the Bahamas and Greater Antilles (AOU 1983).

State distribution: The Forster's tern is considered to be a common transient and local summer resident on the shores of the southern Lower peninsula with abundance decreasing northward. It is an uncommon migrant at inland locations (Chu 1994). The Michigan breeding population is currently limited to Saginaw Bay and Lake St. Clair, although there have been confirmed nesting records of Forster's terns on Lake Erie and on an inland lake on Bois Blanc Island (Mackinac Co.) in the past. Forster's tern nesting sites have been recorded for eight counties in Michigan including Arenac, Bay, Huron, Mackinac, Macomb, Monroe, St. Clair, and Wayne counties. Reports of possible or probable nesting have occurred in Chippewa, Emmet and Muskegon counties (Michigan Natural Features Inventory 2001, Scharf 1991).

Recognition: Forster's terns are medium-sized terns, 14 in. long (36 cm) with slender bodies, long pointed wings and deeply forked tails. Their typical call is a low nasal "*ky-yarr*" and a harsh, nasal, buzzy "*za-a-ap*". Their 31-inch (79-cm) average wingspan distinguishes them from the Caspian tern whose wingspan averages 54 inches (137 cm). In the breeding season adults are **snow white below** and **pale gray above** with **silvery white wing tips** and **a long deeply forked gray tail.** They have **an orange bill with a black tip**, **a black forehead, crown and nape, and orange legs and feet**. Although it is easily confused with the Common tern, the Forster's tern has a white breast and belly (Common has gray breast). The Forster's tern has a gray tail with white outer edges and dark inner edges (opposite pattern on white tail of Common), primaries that are lighter than the rest of wing (darker in Common) and a shorter, lower pitched call. Because Forster's terns have a pale gray back there is not much contrast between the rump and back while the Common tern's white rump contrasts with its darker gray back. Wintering adults and juvenile birds lack the black cap but are distinguished by a black eye patch and dark bill.

Best survey time: Forster's terns can be seen in Michigan from late March though December, although mid-April to mid-September is a more typical timeframe. The best time to survey for breeding birds is in May, June and July. Because Forster's terns nests are well hidden inside an interior screen of emergent vegetation, the best way to

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acquire accurate locations of colonies in order to make nest counts is through the use of aerial surveys (Scharf and Shugart 1998). Once a colony is located, most often the only way to survey the nests is by using a boat to access the site and then wading out to the nests since they are frequently in shallow spots in open water away from the shoreline (Scharf 1991).

Habitat: Forster's terns nest in colonies on floating vegetation in the interior of marshes and on shallow lakes (Forbush and May 1939, Scharf 1991). In the Great Lakes, Forster's terns inhabit the embayments and connecting channels that support coastal stands of emergent vegetation. They are usually associated with the inaccessible deepwater portions of large freshwater marshes, containing cattails (*Typha* sp.) and bulrushes (*Scirpus* sp.). Colony sizes range from just a few pairs to well over 100 pairs (Best 1998, Environment Canada 2001). Nests are placed on floating rootstocks, leaves and muskrat houses as well as on mud flats and floating wracks of dead reeds pushed up by the ice in the previous winter. (Best 1998, Scharf 1991). Additionally, nests are found in the interior of flooded dredge material islands at the interface between the vegetation and standing water. Vegetation most common to these sites includes reedgrass (*Phragmites communis*) and cattail (Scharf and Shugart 1984). They also nest readily on artificial nest platforms (Environment Canada 2001). Water depths at nests range from 1.5 to 4.2 feet (0.5 to 1.3 m). Often the only way to reach nests in Michigan is by wading from a boat used to get to the site (Scharf 1991). Forster' terns and black terns often nest in the same marshes although Forster's terns nests are larger, higher and drier, and placed closer together than those of black terns (Bergman et al. 1970). The location of nests in marshes with deeper water and more open expanses give them greater protection from mammalian predators but make them more vulnerable to destruction by wind and waves (Environment Canada 2001). Nests become increasingly protected from wind and wave events with the "green up" of the emergent vegetation, which also makes the nests difficult to see. Often these breeding colonies exist as islands well removed from the shoreline and from terrestrial and semi-aquatic predators (Best 1998, Scharf 1991). The nest may be a fairly well built structure of dead grasses and bits of drift or merely a scantily lined hollow, (Baicich and Harrison 1997, Forbush and May 1939).

Biology: Forster's terns are short distance migrants and typically begin arriving in Michigan from their wintering grounds in the first half of April with numbers peaking between late April and mid-May. Forster's terns are monogamous and raise one brood per year. Nests are built by both sexes and although data on nest initiation is lacking, it is believed that the first eggs are laid during mid to late May. Clutches are usually completed between the second or third week of May and the second or third week in June (Chu 1994, Shugart 1991). Forster's terns lay two to five eggs (usually three) and both parents incubate the nest for 23-25 days. After hatching the young remain in the nest for a few days where they are tended by both parents. They then leave the nest and run or swim actively or hide in the vegetation if disturbed. It is not known precisely when the chicks fledge but their parents feed them until they are able to fly and shortly after this adults and juveniles disperse (Baicich and Harrison 1997, Environment Canada 2001). Despite the fact that Forster's terns will readily renest following nest failure, they have variable and often low reproductive success (Best 1998, Environment Canada 2001). The Forster's tern is very aggressive towards other bird species but sociable to its own kind (except during the breeding season) and will defend their nest vigorously (Bent 1947, Ehrlich et. al 1988).

Because of its marsh habitat, the Forster's tern eats a more varied diet than other tern species. Although little research has been done on the diet of this tern, it is reported that they eat fish as their staple food. It primarily catches small fish, which live in shallow water or in the upper levels of a larger body of water (Salt and Willard 1971). Chicks are primarily fed minnows. Forster's terns also hawk insects in the air as well as hover over the water looking for tiny morsels of food on the surface. Sometimes they make a diving plunge into the water but more often they swoop gracefully along the surface, picking up their food without wetting their plumage. They eat a limited amount of carrion, especially in the spring when they scavenge dead fish and frogs that perished during the winter. They also eat live frogs and occasionally take the eggs of American coots (*Fulica americana*) and other conspecifics (Bent 1947, Ehrlich et. al. 1988, Environment Canada 2001).

At the completion of the nesting season, fledglings and adults begin their southward migration. In the southern Lower Peninsula, concentrations of Forster's terns begin to accumulate at shoreline locations away from nesting areas between late June and mid July. Numbers

are highest in August and early September, then decline into mid-November. Fall aggregations on western Lake Erie are higher than anywhere in the state, with a single-site reporting a maximum of 1,300 birds (Chu 1994, Scharf 1991).

Conservation/Management: The Forster's tern is protected by the Migratory Bird Treaty Act. It is listed as an endangered species in Wisconsin and Illinois. Although it has the smallest population of any short-legged colonial waterbird species in Michigan, it has not been given official recognition as a threatened or endangered species since it is unclear whether the population is increasing or decreasing. In 1991, Scharf and Shugart (1998) conducted a count of colonially nesting bird species of the U.S. portions of the Great Lakes. He found 2,260 Forster's tern nests at 29 colonies. The largest regional population (1,325 nests at 19 colonies) occurred in Lake St. Clair, accounting for 59% of the total. Colonies in Green Bay comprised 35% of the nesting population. The 145 nests at eight colonies in Saginaw Bay accounted for the remaining 6.5 % of Forster's tern nests. Because the search effort for this species was low during counts conducted in 1976 and 1977 and because of the probability of overlooked colonies, comparisons between years is not appropriate (Scharf and Shugart 1998).

The nesting and feeding habits of Forster's terns make them vulnerable to changing land and water uses, especially those due to development of industrial, residential and recreational resources (Scharf and Shugart 1998). The disappearance of large amounts of coastal marsh in Saginaw Bay, particularly cattail stands, has drastically reduced the breeding habitat of this species in this area. Remaining habitat is often small and fragmented as well as closer to shore and leaves nests more vulnerable to wash out by early season storms as well as predation by avian, terrestrial and semi-aquatic predators. Periodic cycles of high water in the Great Lakes further threaten breeding success by delaying the growth of cattails needed to adequately shelter the wrack mats from wind and waves (Best 1998). Forster's tern colonies formerly nesting on dredge material have disappeared or have been unsuccessful in the recent past due to the loss of interior ponds in dredge islands, caused by evaporation, addition of more dredge material and deliberate drainage (Scharf and Shugart 1998). Although the use of artificial islands may be helpful in the short term, restoration of emergent marsh in Saginaw Bay would benefit this species as well as other breeding birds in this area including the pied-billed grebe (*Podilymbus podiceps*), mallard (*Anas platyrhynchos*), American coot (*Fulica americana*), black tern (*Chilidonias niger*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), and marsh wren (*Cistothorus palustris*) (Best 1998).

Recreational boating wakes have had a detrimental effect on the floating aquatic vegetation that Forster's tern's use for nesting habitat. Disturbance from the noise of close personal watercraft has also caused desertion of nests and the exposure death of newly hatched chicks (Best 1998, Scharf and Shugart 1998). Best (1998) recommends the implementation of an educational outreach program directed towards recreational boaters to address this problem. The placement of signage at public access sites near breeding colonies suggesting the avoidance of cattail stands where birds exhibit aggressive and defensive behaviors could prove to be beneficial to Forster's terns. Regulation of boat numbers, boat speed and proximity of travel to the vegetation used by Forster's tern colonies may also be required (Scharf 1991).

Despite the fact that Forster's terns readily renest following early nest destruction or abandonment, renesting poses additional hazards to reproductive success. Even though Forster's tern young which hatch later are better protected from wind and waves by cattail growth, this later time period coincides with greater activity of avian predators, particularly by black-crowned night herons (*Nycticorax nycticorax*) which are actively feeding their own young during this time (Best 1998). Because colonial waterbirds are top predators in the aquatic food chain, the longer that adults reside in the Great Lakes after returning from their wintering areas, the higher the contaminant residues in the second clutch of eggs (Scharf and Shugart 1998, Yamashita et. al. 1993). Tillit et al. (1993) documented contaminant related reproductive problems in Forster's terns nesting in Green Bay. Saginaw Bay has a similar history of dioxin-like contamination as Green Bay and likely has resulted in similar reproductive impairments.

Research needs: Regular aerial searches of potential Forster's tern nesting areas in the Great Lakes are needed to acquire accurate locations of colonies, to make nest counts and to better understand the status and trends of the population. In addition, documenting

the sizes of the shifting populations of island and wetland dependent colonially nesting birds in the Great Lakes is important for establishing a baseline of ecological species diversity (Scharf and Shugart 1998). Little information is available on life expectancy, mortality rates, sex ratio and average lifespan in Forster's terns so it is difficult to calculate the level of reproductive success needed to sustain their population. Contaminant analysis in conjunction with an accurate census and reproductive data is needed to assess the impacts of toxic chemicals on reproduction in Forster's terns (Scharf 1991).

Related abstracts: Great Lakes marsh, black tern, Caspian tern, and common tern.

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Abstract Citation:

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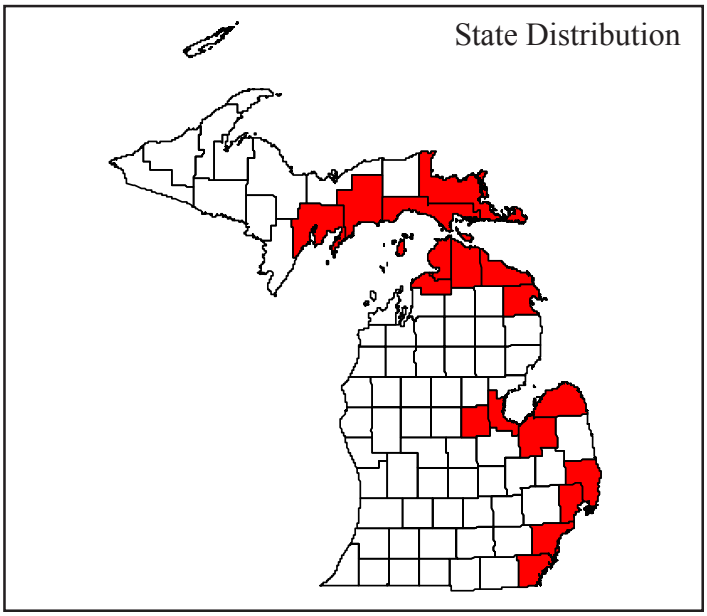
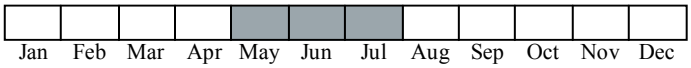
Sterna hirundo Linneaus — common tern



Best Survey Period



Status: State threatened

Global and state rank: G5/S2

Family: Laridae (gull and tern family)

Total range: The common tern breeds throughout much of the temperate zone of the Northern Hemisphere. Its primary breeding range in North America is from the south central Northwest Territories to southern Quebec and Newfoundland, the Atlantic Coast (from Nova Scotia to North Carolina), the Great Lakes region and the northern Great Plains. Great Lakes common terns migrate along the Atlantic coast and winter primarily along the north and west coasts of South America, in the Caribbean, and less frequently along the U.S. Gulf coast and the southern Atlantic coast (Austin 1953, Haymes and Blokpoel 1978).

State distribution: Common tern nesting sites have been recorded for seventeen counties in Michigan. These are Alpena, Bay, Charlevoix, Cheboygan, Chippewa, Delta, Emmet, Huron, Mackinac, Macomb, Midland, Monroe, Presque Isle, St. Clair, Schoolcraft, Tuscola, and Wayne counties. No recent nest sites have been recorded from either the northern coast of the Upper Peninsula or the western coast of the Lower Peninsula, although the species was once abundant on all the Great Lakes (Barrows 1912).

Recognition: The **slender body**, **long pointed wings** and **deeply forked tail** are key characteristics of the common tern. Their typical call is a drawled *kee-arr*. Their 31 inch average wingspan distinguishes them from the Caspian tern whose wingspan averages 54 inches. Wintering adults and immature birds have a black nape and dark bill. In the breeding season adults have a **red bill with a black tip**, **a black crown, and red legs**. Although it is easily confused with the Forster's tern, the common tern has darker wing tips, a higher pitched call, and a redder bill.

Best survey time: Common terns can be seen in Michigan from mid-April though October, although the best time to survey for them is in May, June and July.

Habitat: Common tern colonies occur on sparsely vegetated sand and gravel beaches of islands and peninsulas. Artificially created islands currently provide the most favorable nesting habitat. Colonies utilize sites formed from dredged material in Chippewa, Saginaw, and Monroe Counties. They also have been known to use abandoned wooden piers (Harris and Matteson 1975). Ocean shoreline habitats are used for roosting and foraging during the winter.

Biology: Common terns return to their Michigan breeding grounds beginning in mid-April and depart to their wintering grounds from late August through October. Nesting begins the second week of May in southern counties and in late May in northern counties. Both adults incubate a clutch, averaging two or three eggs, for a 22 to 25-day period. Initial nest loss is common and is often compensated by a second nesting. Although typically single-brooded, common tern pairs occasionally attempt to raise a second brood (Hay 1984). Both adults share in feeding the young (Wagner and Safina 1989) which begin flying four weeks after hatching. Reproductive maturity is reached at three years of age.

Common terns prefer to nest in relatively large colonies

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where they cooperate to defend against competitors and predators. The pair cooperates in building a nest that can be as simple as excavating a slight hollow in the sand and gravel, to construction of a slightly raised mound with a lining of fine grass and other material. Nests are usually associated with low, herbaceous vegetation and driftwood (Blokpoel et al. 1987). Common terns are opportunistic feeders, foraging on the small fish species that are most available (Courtney and Blokpeol 1980). They feed primarily on fish that are between 1 to 3 inches long by hovering over the water and then diving and capturing them with their bill. Insects are also caught while flying and can play a significant role in the common tern's diet in certain locales (Vermeer 1973).

Conservation/management: Common terns were once the most abundant tern in Michigan waters, frequenting the shores and islands of the Great Lakes as well as all the principal streams and interior lakes (Barrows 1912). The market for plumes and feathers nearly caused their extinction until they were given protection under the Migratory Bird Treaty of 1916. During the mid 1970's through 1984, an average of 1,800 nesting pairs were recorded in the state. Recent reductions in the Michigan population to 1,500 pairs in 1985 have been attributed to the declining quality of their nesting habitat.

A combination of natural and human-related factors are severely impacting common tern populations. Regularly fluctuating water levels of the Great Lakes, vegetation succession, and erosion continually reduce or eliminate suitable nesting sites. Competition and predation from increasing populations of ring-billed gulls (*Larus delawarensis*) and herring gulls (*L. argentatus*), are a significant limiting factor, especially due to competition for limited suitable nesting sites. (Scharf 1981). Other predators which impact reproductive success include: Norway rats, red fox, garter snakes, great horned owls, black-crowned night herons, and Canada geese (Cuthbert 1980, Evers 1994).

Human factors that limit common tern populations include island and beach development, use of off-road vehicles on beaches, and the release of chemical contaminants into the environment. Recent evidence suggests that PCB's have put Great Lakes populations under severe stress. High levels of this toxin in eggs correlate with rising rates of deformities, embryonic abnormalities, and depressed hatching rates (Ludwig and Kurita 1988).

Using fire to expose the ground surface, in areas succeeding to closed vegetation, has been demonstrated to be very helpful to common terns (Sharf 1986). Control of competitors and predators may be crucial in maintaining common tern populations, although restricting one competitor or predator is usually not adequate to increase fledgling success. Intensive programs to control all predators impacting a population as well as reducing disturbances by humans may be needed (Cuthbert 1980).

Research needs: More research is needed to understand the population dynamics of common terns and to insure the long-term preservation of nesting colonies in Michigan. Habitat availability, relationships with gulls and other competitors, and food requirements are key areas that need further study. Immediate measures such as habitat manipulations are needed to insure that populations in the Great Lakes ecosystem are maintained at healthy levels (Evers 1994).

Related abstracts: open dunes, Caspian tern

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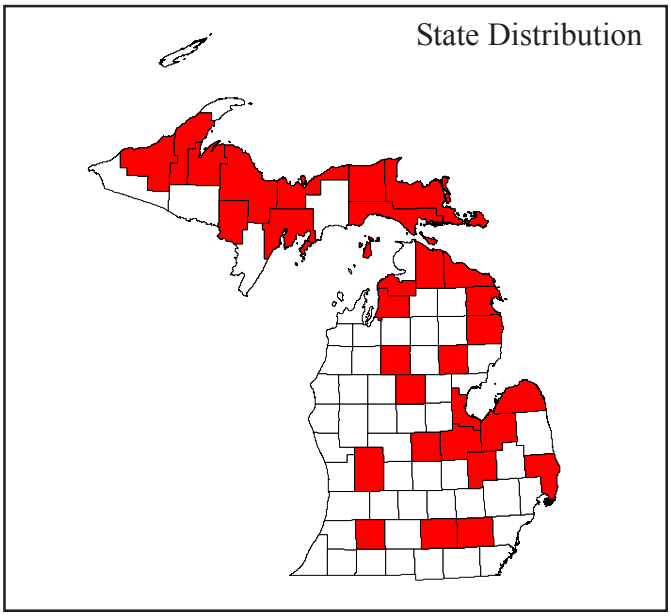
Botaurus lentiginosus (Rackett) American Bittern



Best Survey Period

Status: State special concern

Global and state ranks: G4/S3S4

Family: Ardeidae – Herons, Egrets, and Bitterns

Total Range: The American bittern breeds from the mid – U.S. to northern Canada (AOU 1983). Its breeding range runs from British Columbia east to southern Quebec and Newfoundland. Breeding in the U.S. is discontinuous south of Pennsylvania, Ohio, Indiana, Illinois, Missouri, Kansas, Colorado, Utah, Nevada, and California (AOU 1983). Only local breeding is found in Wyoming and surrounding states (Findholt 1984) and in Texas, Louisiana, Florida, and Mexico (Hancock and Kushlan 1984). The winter range includes the west coast from southern British Columbia south through California, the southern U.S. to the east coast, south through Mexico and the Caribbean, and rarely to Central America (AOU 1983). Wintering concentrations occur along the southern Atlantic coast, Gulf Coast, and southern California (Root 1988).

State Distribution: Barrows (1912) commented that the American bittern was one of the most abundant of our waders, and the species was listed as a common summer resident by Wood (1951). Currently, the American bittern breeds throughout the state but is more common in the Upper Peninsula (UP) and northern Lower Peninsula (LP) (Adams 1991). In recent years, breeding has been confirmed or suspected in 30 counties in the state (Adams 1991, Michigan Natural Features Inventory 2003). Michigan Breeding Bird Atlas (Atlas) records of American bitterns were widely scattered, but did reveal concentrations of observations in the northeastern LP and in Jackson, Barry, Van Buren, Oakland, and Tuscola Counties and near Saginaw Bay in the southern LP (Adams 1991). Intensive bird surveys at coastal wetland sites on Saginaw Bay upgraded American bittern breeding status to probable in one township and added a possible breeding record in a second township from what was observed during Atlas surveys (Whitt and Prince 1998). Distribution in the UP was generally more uniform with fewer birds recorded near the lakeshores and in some central counties (Adams 1991). Monfils and Prince (2003) confirmed nesting in coastal wetlands on Munuscong Bay (Chippewa County). Ewert (1999) identified several important bird sites for the American bittern: Houghton Lake marshes (Roscommon and Missaukee Cos.), Lower Manistee River wetlands (Manistee Co.), Seney National Wildlife Refuge (Schoolcraft Co.), Munuscong Bay wetlands, Lake Stella (Alger Co.), and Scott's Marsh (Schoolcraft Co.). The figure above indicates counties with confirmed

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breeding during Atlas surveys or known occurrences from the Michigan Natural Features Inventory database at the time of writing.

Recognition: This **brown, medium sized heron** is 23 – 33 inches (60 – 85 cm) in length with a **stout body and neck and relatively short legs** (Cramp and Simmons 1977, Hancock and Kushlan 1984). Gibbs et al. (1992) described adults as dark brown above, **heavily streaked brown and white below**, having a rusty crown and white throat, and possessing a **long, black patch extending from below the eye down the side of the neck**, which is a character unique among the herons. American bitterns are sometimes confused with immature black-crowned night-herons (*Nycticorax nycticorax*), which are darker brown, lack the contrast between the dark wingtips and paler coverts and body, and have no black neck patch (Gibbs et al. 1992). Males and females are similar, with the males slightly larger, and juveniles lack the black neck patches. Vernacular names such as "stake-driver" and "thunder-pumper" allude to the resounding call of the American bittern (Gibbs et al. 1992). Previous authors have best described the American bittern's **low, resounding song** as a deep, gulping, pounding **"*BLOONK-Adoonk*"**, which is repeated one to 10 times in succession (Gibbs et al. 1992, Sibley 2000). This species **assumes the "bittern" stance when alarmed** by larger animals: **bill pointed skyward, body stretched vertically, contour feathers compressed, and body swayed with the breeze** (Gibbs et al. 1992).

Best survey time: Because the American bittern is most often concealed in dense herbaceous wetlands, the best time to survey for this species is during the breeding season when it is more apt to call to mark its territory or advertise for a mate. Singing is most often crepuscular and nocturnal, but American bitterns can be heard throughout the day and night early in the breeding season (Gibbs et al. 1992). The best survey period is between their arrival on the breeding grounds and egg laying, which Gibbs et al. (1992) noted is the time when males are most territorial and actively solicit copulations from females. In Michigan, this period ranges from late April to early July depending on latitude. Conspecific call-response techniques have been used successfully to improve the effectiveness of surveys for American bitterns and other waterbirds (Lor and Malecki 2002, Gibbs and Melvin 1993, 1997). Huschle et al. (2002) evaluated a variety of techniques for capturing adult American bitterns, and found mirror traps to be the most efficient method for trapping males and mist nets to be a versatile means of capturing both males and females.

Habitat: American bitterns most often breed in shallow wetlands dominated by tall emergent vegetation, including cattail (*Typha* spp.) marshes, wet meadows, bogs, and shrubby marshes, and occasionally hayfields (Adams 1991). In Maine, American bitterns were observed to use all wetland sizes, but were more abundant on larger wetlands, and preferred impounded and beaver-created wetlands to those of glacial origin (Gibbs et al. 1992). Brown and Dinsmore (1986) only found the species on wetlands > 10 ha, indicating that American bittern may be a wetland area-dependent species. In a study of wet meadows along the northern Lake Huron shoreline, Riffle et al. (2001) found the American bittern to be area-sensitive, with abundance positively related to wet meadow area. When compared to the sympatric least bittern (*Ixobrychus exilis*), the American bittern uses a wider variety of wetland types, less densely vegetated sites, shallower water depths, and exclusively freshwater habitats (Gibbs et al. 1992).

During spring and fall migration, Reid (1989) observed the species using wetlands dominated by river bulrush (*Schoenoplectus fluviatilis*), burreed (*Sparganium eurycarpum*), cattail, and water smartweed (*Polygonum coccineum*) in Missouri. American bitterns winter in areas where temperatures stay above freezing and waters remain open, especially in coastal regions where oceans moderate the climate (Root 1988). Gibbs et al. (1992) noted that although a wider range is used, wintering habitat is similar to breeding habitat. Managed wetlands, such as impoundments at wildlife refuges, are also important to American bitterns (Root 1988). This species will occasionally use brackish coastal marshes (Hancock and Kushlan 1984), and sometimes forage in large numbers in terrestrial habitats such as dry grasslands (Gibbs et al. 1992).

Biology: American bitterns return to southern Michigan during the first two weeks of April and rarely in late March (Wood 1951, Kelley 1978, Walkinshaw 1978), and by late April and early May occur throughout the state (Adams 1991). Adams (1991)

stated that nests are placed on elevated platforms constructed of emergent vegetation, such as cattails, sedges (*Carex* spp.), and grasses (Poaceae), above shallow water or sometimes on land in tall grass. Nests are placed singly, however, males may be polygamous, with several females nesting within a single territory (Baicich and Harrison 1997). Egg dates ranged from May 6 (Wood 1951) to July 11 (Pettingill 1974) and clutch size ranged from 2 to 7, but is typically 3 to 5 (Gibbs et al. 1992). Baicich and Harrison (1997) described the eggs as unmarked and plain buffy brown to deep olive-buff. Incubation is done by the female alone, beginning with the first egg and lasting 24 – 29 days. Although renesting by American bitterns has been suspected, Azure et al. (2000) recently documented renesting for the first time. The young hatch over several days, differ in size, and are semi-altricial with yellowish-olive down at hatching (Baicich and Harrison 1997). Brood rearing and feeding is apparently done by the female alone, and chicks are given partially digested, regurgitated food (Gibbs et al. 1992). Gibbs et al. (1992) stated that the young leave the nest after one to two weeks, but remain near the nest to receive supplemental feedings until two to four weeks of age. Age at fledging is unknown, but occurs at 50 to 55 days in the similar Eurasian bittern (*Botaurus stellaris*) (Gibbs et al. 1992). Little information is available on departure dates, but fall migration is thought to begin in September and continue well into October (Wood 1951, Kelley 1978, Adams 1979). This bittern is a solitary feeder that is most active during dim light and relies on stealth to capture its prey (Gibbs et al. 1992). Kushlan (1978) noted that only four of the recognized heron feeding behaviors are used by this species: standing in place, neck swaying, walking slowly, and walking quickly. Analysis of American bittern specimens collected throughout North America revealed an array of food items, including insects (23%), fish (21%), crayfish (19%), frogs and salamanders (21%), small mammals (10%), and snakes (5%) (Cottam and Uhler 1945).

Conservation/Management: Although North American Breeding Bird Survey (BBS) data should be viewed with caution, they can be useful in elucidating trends in bird populations. Recent analyses of BBS data indicate significant ($P<0.01$) declines in American bittern observations of 14.3 and 5.7 percent/year in the Great Lakes Plain (includes southern Michigan) and Great Lakes Transition (includes northern Lower Michigan) physiographic regions, respectively (Sauer et al. 2003). Adams (1991) noted that the results of Atlas surveys confirmed that American bittern had declined in the State, especially in the southern Lower Peninsula. Habitat loss is cited most often as the likely cause of American bittern declines. Dahl (2000) estimated that less than half of the original wetlands present in the conterminous U.S. at the time of European settlement remain today. Approximately 50% of Michigan's original wetlands have been destroyed since European settlement, which includes about 70% of the State's coastal wetlands (Cwikiel 1998). Many of our remaining wetlands have been severely degraded from their original condition. Gibbs et al. (1992) noted that eutrophication, siltation, chemical contamination, and human disturbance can reduce habitat quality by impacting the prey base. The spread of exotic and nuisance species, such as purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and common reed (*Phragmites australis*), has also degraded wetlands used by this species, but the overall impact of these changes has not been evaluated. Acid precipitation has been listed as a potential threat to American bitterns due to their dependence on wetlands vulnerable to acidification, the importance of amphibians to their diet, and the large proportion of their breeding range that receives acid rain; however, the emergent wetlands used by this species tend to be circumneutral in pH and chemically buffered against strong shifts in acidity (Gibbs et al. 1992). Although the effects of contamination on American bitterns are largely unknown, Gibbs et al. (1992) believe that agricultural chemicals could have significant indirect effects on the species by entering wetlands through runoff. Should prey items that are vulnerable to pesticides, such as aquatic insects, crayfish, and amphibians, be impacted by contamination, American bittern populations could in turn suffer (Gibbs et al. 1992).

Gibbs et al. (1992) stated that preservation of freshwater wetlands, especially large shallow wetlands with dense growth of robust emergent vegetation, is the most urgent management need for this species. Programs that provide funds for wetland restoration and protection on private and public lands can effectively conserve habitat for this species and need to continue. Such initiatives include Farm Bill programs like the

Wetlands Reserve Program and Conservation Reserve Program, and the North American Waterfowl Management Plan, which uses funding appropriated through the North American Wetlands Conservation Act. Existing wetlands also need to be protected from chemical contamination, siltation, eutrophication, and other forms of pollution that could harm the birds or their prey (Gibbs et al. 1992). Encouraging best management practices, such as filter strips, no-till farming, and conservation tillage, in surrounding watersheds would help protect priority habitats from pollution. Gibbs et al. (1992) also noted that concentrations of nesting and wintering birds on protected and managed wetlands, such as state and federal wildlife areas and refuges, indicate the need to develop and implement management plans that benefit American bitterns.

Research needs: Previous authors have noted that much about the basic biology and ecology of this species remains unknown (Gibbs et al. 1992, Hands et al. 1989). Although survey methodologies have been developed to monitor populations of American bittern and other waterbirds (Lor and Malecki 2002, Gibbs and Melvin 1993, 1997), no large scale surveys or monitoring programs have been implemented. Such surveys are needed to assess the status and trends of this species in North America. Gibbs et al. (1992) indicated that detailed studies of American bittern breeding biology have been lacking, including investigations of diet, home range, habitat requirements, mating systems, ability to renest, sources and rates of mortality in adults, juveniles, nestlings, and eggs, and juvenile dispersal patterns and philopatry. Little work has been done during the migration and wintering periods of this species' life cycle. Research is needed to identify migration routes, major stopover and wintering sites, food habits, and habitat needs (Gibbs et al. 1992, Hands et al. 1989). Several authors have highlighted the need to develop effective strategies for wetland and associated upland management that will conserve habitat for this species during breeding, migration, and wintering (Gibbs et al. 1992, Adams 1991, Hands et al. 1989). A variety of other topics should be explored, including the examination of factors that regulate populations, impact of weather on populations, and the effects of chemical contamination (Gibbs et al. 1992, Adams 1991, Hands et al. 1989).

Related abstracts: least bittern, king rail, black tern, Great Lakes marsh.

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Funding provided by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center via the Great Lakes Commission.

Great Blue Heron Rookery

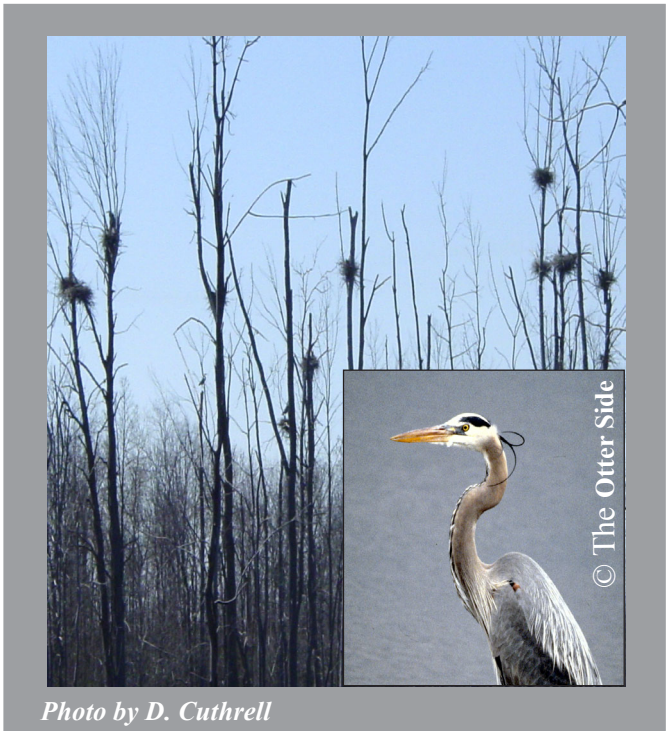
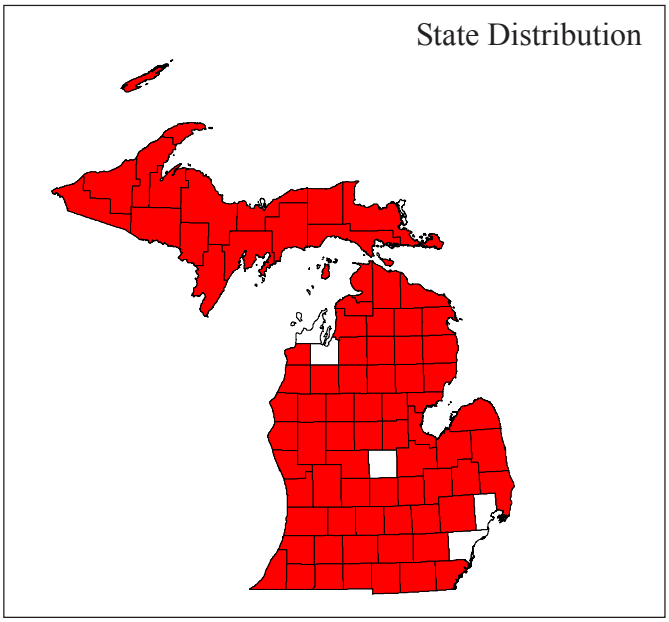
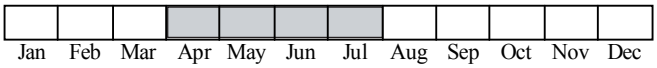


Photo by D. Cuthrell



Best Survey Period



Status: The species is not on T & E list, however, MNFI does record and monitor locations of rookeries throughout the state.

Global and State Rank: -

Family: Aredidae (herons, egrets, and bitterns)

Total Range: The great blue heron can be found throughout much of North America and into Central and South America as well.

State Distribution: In Michigan great blue heron is classified as a common permanent resident. It occurs scattered throughout most of Michigan but is much more likely to be encountered in the southern half of the state or in the Upper Peninsula. The great blue heron is vulnerable because of their colonial nesting behavior and the availability of suitable nesting habitat is declining. Construction of vacation homes, boating, sport fishing, camping, or hunting either within or in very close proximity to active heronries may be impacting the birds (Scharf 1991). These activities in many cases lead to abandonment of breeding colonies or reduced reproductive success. During the first Breeding Bird Atlas Project (1983-1988) 196 blocks contained confirmed breeding records and 960 blocks reported either probable or possible breeding records (Brewer et al. 1991). Southern Lower Michigan counties had the greatest concentration of occurrences. There were 35 active Great Lakes coastal heronries recorded in 1987 representing a 62% increase compared to 10 years previously (Scharf 1989). The figure above indicates counties with confirmed breeding during Michigan Breeding Bird Atlas surveys, other recent breeding confirmations, or known occurrences from the Michigan Natural Features Inventory database.

Nest Recognition: The great blue heron is mostly a colonial nester, occasionally they nest in single pairs. Colonies are typically found in lowland swamps, islands, upland hardwoods and forests adjacent to lakes, ponds and rivers. Nests are usually in trees and may be as high as 98 ft. (30 m) or more from the ground. The platform like nests are constructed out of medium-sized sticks and materials may be added throughout the nesting cycle. Nests are usually lined with finer twigs, leaves, grass, pine needles, moss, reeds, or dry grass (Cottrille and Cottrille 1958, Palmer 1962, Mock 1976, and Baicich and Harrison 1997). The same nests are refurbished and used year after year. Nest size varies; newer nests may be 1.5 ft. (0.5 m) in diameter with older nests reaching up to 4 ft (1.2 m) in diameter (Andrle 1988). Nests can also be used by Canada geese (*Branta canadensis*), house sparrows (*Passer domesticus*), and great-horned owls (*Bubo virginianus*) (Vermeer 1969, Butler 1992).

Species Recognition: The great blue heron as described by Butler (1992) is the largest North American heron standing 2 ft. (60 cm.) tall and 3 - 4.5 ft. (97-137 cm) long, weighing up to 5.5 pounds (2.5 kg). It has a 6 ft. (1.8m) wingspan and while **in flight tucks its neck in a characteristic S-shape**, with its long legs trailing

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along the body axis. It has a slow deep wing beat and frequently calls a deep croaking *fraaahnk*. Distinctive field marks include a **large, grayish body** and **white face and crown with wide black bands terminating in usually two plumes**, and yellowish bill, long and tapered. Juveniles are brownish, with gray crowns and no body plumes.

Best Survey Time/Phenology: The great blue herons in Michigan are largely migratory, with almost all leaving the state during the winter months. Most leave by end of October and return in early to mid-March. No data exists where Michigan birds over-winter but large numbers of great blue herons are recorded each year during Christmas bird surveys in the Gulf Coast States. In Michigan nest building and courtship begins in early April in the south and not until mid-May at heronries off Isle Royale (Scharf 1991). In one Michigan study to determine the number of active coastal heronries, float plane surveys were initiated during mid-April and commenced around mid-July (Scharf 1989). The first survey corresponded to the peak of egg-laying to incubation, which occurs usually before leaf-on, with the second visit occurring during late chick or the pre-fledging period.

Habitat: In Michigan, and elsewhere in eastern North America, great blue herons are found in a variety of wetland habitat types. Herons usually feed in calm, slow waters including lakes, rivers, ponds, marshes and swamps. They are occasionally seen foraging in fields and wet meadows. In Michigan nesting usually occurs in trees, although in other parts of their range they may be found nesting in low shrubs, man-made structures, artificial nest structures and even on the ground (Butler 1992, Scharf 1991). The ideal nesting habitat occurs in wooded swamps or on islands dominated by mature hardwoods; isolated locations that discourage predation by such things as snakes and mammals (Butler 1992). A wide variety of tree species have been utilized for nest placement in Michigan, including ash (*Fraxinus* spp.), aspen (*Populus* spp.), birch (*Betula* spp.), elms (*Ulmus* spp.), hickory (*Carya* spp.), various oaks (*Quercus* spp.), maples (*Acer* spp.) and white cedar (*Thuja occidentalis*). Deciduous hardwood trees are utilized more frequently in southern Michigan with softwood deciduous trees (such as aspen and birch) more commonly used in the northern part of the state (Scharf 1991). Wetland foraging areas in close proximity to nests are an important habitat component.

Biology: Most great blue herons return to southern Michigan heronries in mid-March (Scharf 1991) although a few may remain through the winter if there are areas of open water. Courtship and nest building commences from early April in southern Michigan to early May in the extreme northern portions of the state (Isle Royale) (Cottrille and Cottrille 1958, Scharf 1989). Both sexes are involved in the nest building process with males primarily gathering sticks from the ground, nearby trees, or ungarded nearby nests. Males pass sticks to females who then place them on the nests (Cottrille and Cottrille 1958, Palmer 1962, Mock 1976). Between 3 and 7 (usually 4) greenish blue eggs are laid in April and May in Michigan. Both sexes take a turn at incubation with females incubating mostly at night and males during the day (Butler 1992). The incubation period lasts from 25-29 days (Baicich and Harrison 1997). In Michigan hatching occurs in the first week of May in the south while parents are still incubating nests in the far northern part of the state (Scharf 1989). For the first 3-4 weeks post hatching, one parent remains on the nest with the young (Baichich and Harrison 1997). The young are semi-altricial and downy, and for the first month eat regurgitated food dropped by parents into the nest (Mock 1987). Adults feed the older chicks by standing on the edge of the nest and place food items directly into the open bill of chicks (Cottrille and Cottrille 1958). Young great blue herons first fly around 60 days and leave the nest between 64-90 days (Baicich and Harrison 1997). Fall migration begins in September and October with a few birds lingering much later (Barrows 1912). Main food items include fish, crayfish, and frogs but many other animals are taken including snakes, salamanders, insects, small mammals, and birds (Barrows 1912, Butler 1992). Great blue herons hunt individually or with other great blue herons or other ciconiiforms (Kushlan 1978). They hunt mostly by standing in wait of prey in shallow water, or by slowing wading in search of food (Kushlan 1976, 1978, Hom 1983). They will occasionally hunt from floating objects (Godin 1977). Prey are located visually and caught by rapid forward thrust of head and neck, and then held between the mandibles (Butler 1992).

Conservation/Management: The first step towards heron conservation is continued monitoring of population size (Scharf 1991). Used and abandoned colony sites should be surveyed regularly, mapped by local and state agencies, and reproductive success should be monitored (Quinn and Milner 2004). Quinn and Milner (2004) suggest that the most effect way to conserve great blue herons is through comprehensive land-use planning that considers the needs of all species. Colony site-specific management plans would be the best alternative in lieu of comprehensive land use planning (Quinn and Milner 2004). If sites have to be prioritized, larger colonies should receive priority over small colonies, since there is some evidence suggesting the former have more stability and higher productivity (number of fledglings/nesting herons) (Butler 1995). Disturbances to the nesting colony (i.e., human visits, road building, logging activity) can cause abandonment

especially in the early season before eggs are laid (Vos et al. 1985). Habitat manipulation directly impacts the species by alteration of suitable structure around the heronry. Outright removal of woodlots for highway construction, home building, and other developments (such as shopping malls and golf courses) have eliminated suitable nesting habitat. To protect nesting colonies from human disturbance, most studies reviewed by Butler (1992) recommend a buffer of 300 m in which no activity occurs during the season of 15 February to 31 July. Many of the authors of these studies made recommendations in the absence of data (Quinn and Milner 2004). However, work in Canada (Vos et al. 1985) recommended a 300 meter no activity buffer to minimize disturbances to nesting great blue herons (Quinn and Milner 2004). This distance is based on their experimental work, with 200 meters being their greatest flushing distance plus an additional 50 meters as a safeguard. Hoover and Willis (1987) recommend that important foraging areas within 4 km (2.5 mi.) be protected from development if possible. Quinn and Milner (2004) suggest that these colony buffer zones (300 m) and foraging areas (within 4 km of colonies) should also be free of pesticides. Historically shooting adults at nests was extremely damaging to populations and while now considered less of a threat, some limited amount still occurs(Scharf 1989).

Research Needs: There are many research needs concerning this species, a few of which are listed below. In the last decade very limited systematic inventory has been completed throughout the state. Regular aerial searches of nesting areas in Michigan are needed to acquire accurate locations of heronries, to make nest counts, and to better understand the status and trends of the population. Information is lacking on the productivity and reproductive success of the great blue heron in Michigan and the differences between coastal and interior populations. Also, little research has been conducted on the impacts of urbanization and suburbanization on habitat use and nest productivity. More quantitative research is needed to assess the impacts of human disturbance on great blue heron abundance and productivity. Additional research needs include the impacts of predation, contaminants, and competitors on nesting success, and landscape-level analysis of habitat. Most productivity studies have documented only the number of fledged young per successful nest and show little annual variation (Butler 1992). Butler (1992) suggests that future productivity studies should determine number of fledglings raised per nesting attempt. Little information is available on the timing and routes of migration throughout the state as well as the U.S. (Butler 1992). While some regional datasets exists on arrival and departure dates, Butler (1992) suggests more data is needed to establish a better migration chronology.

Related Abstracts: Wooded Dune and Swale Complex, Great Lakes Marsh, Mesic Northern Forest, Mesic Southern Forest, black-crowned night-heron.

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Abstract Citation:

Cuthrell, D.L. 2004. Michigan Natural Features Inventory. Special animal abstract for *Ardea herodias* (great blue heron rookery). Lansing, MI. 4 pp.

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Ixobrychus exilis (Gmelin) Least Bittern

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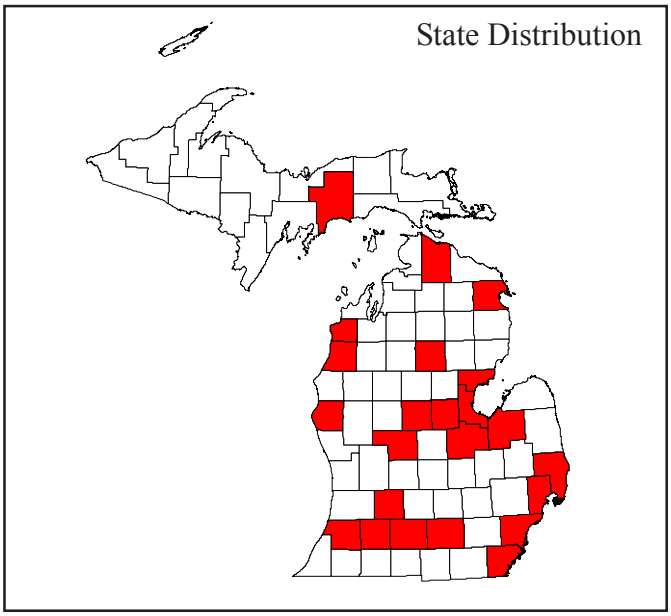
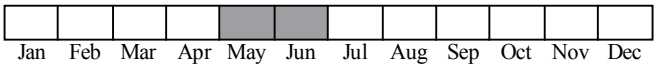


Best Survey Period



Status: State threatened

Global and state rank: G5/S2

Family: Ardeidae – Herons, Egrets, and Bitterns

Total range: Five subspecies of least bittern are found throughout much of North, Central, and South America (Gibbs et al. 1992). In North America, this species is primarily restricted to the eastern U.S., ranging from the Great Plains states eastward to the Atlantic Coast and north to the Great Lakes region and the New England states (Evers 1994). Western populations are concentrated in low-lying areas of the Central Valley and Modoc Plateau of California, the Klamath and Malheur basins of Oregon, and along the Colorado River in southwest Arizona and southeast California (Gibbs et al. 1992). U.S. populations are migratory and overwinter along the Atlantic coastal plain and U.S. Gulf Coast south through Mexico and the Caribbean islands into northern South America (Gibbs et al. 1992, Evers 1994). The northern limit of overwintering least bitterns is considerably farther south than that of the hardier American bittern (*Botaurus lentiginosus*) (Gibbs et al. 1992).

State distribution: Barrows (1912) listed the least bittern as "an abundant bird in all suitable places in the state." Wood (1951) identified the species as a summer resident and common in southern tiers of counties and Cheboygan County, but rare and local in the Upper Peninsula. Least bittern was later described by Payne (1983) as an uncommon transient and summer resident, with nesting confirmed in 27 counties. Michigan Breeding Bird Atlas (Atlas) surveys conducted in the 1980s confirmed breeding in 20 survey blocks in 17 counties (Adams 1991). All of these observations occurred in the Lower Peninsula, with the number of blocks and counties with confirmed breeding nearly split between the northern (9 blocks in 8 counties) and southern (11 blocks in 9 counties) Lower Peninsula (Adams 1991). Researchers confirmed nesting at several sites on Saginaw Bay and observed possible breeding in Munuscong Bay wetlands (Chippewa County) during avian studies conducted in the mid-1990's (Whitt and Prince 1998, Monfils and Prince 2003). Evers (1994) noted that least bittern has declined dramatically in all of its former strongholds in Michigan. The figure above indicates the counties with confirmed breeding during Atlas surveys or known occurrences from the Michigan Natural Features Inventory database at the time of writing.

Recognition: Least bitterns average 11 – 14 inches (28 – 36 cm) in length and have a wingspan of 16 – 18 inches (41 – 46 cm) (Evers 1994). Gibbs et al. (1992)

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noted that the **crown, back, and tail** are a **vivid greenish black**, while the neck, sides, and underparts are brown and white. Diagnostic characters include **chestnut wings with contrasting pale patches** and **white lines bordering the scapular feathers** (Gibbs et al. 1992, Evers 1994). Sexes are similar in size but have **dimorphic plumage**, with the **crown and back of the female being purple-chestnut** compared to **black in the male** (Gibbs et al. 1992). The female also has a darkly streaked neck. Gibbs et al. (1992) described juveniles as similar to females, but having a paler and browner crown and heavier streaking in the neck and breast. In the rare dark color morph known as Cory's Bittern, the pale areas of the typical plumage are chestnut colored (Gibbs et al. 1992). Least bitterns can be confused with green herons (*Butorides virescens*); however, according to Gibbs et al. (1992) the green heron is easily separated by its larger size and dark wings and scapular feathers. Because of the secretive nature and dense cover used by this species, it is often easier to identify by its **low dovelike call**. Males give a fast series of **three to five "*coo*" notes**, reminiscent of the black-billed cuckoo (*Coccyzus erythropthalmus*). Females have been reported to respond with ticking calls, and the species will utter various cackles and "*tut-tut-tut*" calls when agitated or alarmed (Gibbs et al. 1992, Evers 1994). Similar to the much larger American bittern, this species will assume a frozen position with its bill pointed upward, feathers compressed, and eyes directed forward when threatened (Gibbs et al. 1992).

Best survey time: Surveys are most successful when conducted during the early breeding season prior to incubation, which generally occurs from early to mid May through the end of June. Whitt and Prince (1998) suggested that the most effective method to determine presence and breeding status for this species is to search emergent breeding habitat for nests and adults between mid-June and late July. As with many secretive marsh bird species, broadcasting conspecific calls can increase the effectiveness of surveys (Lor and Malecki 2002, Gibbs and Melvin 1993, 1997). In New York, least bitterns were most responsive to call-response surveys conducted between mid May and mid June (Swift et al. 1988). Bogner and Baldassarre (2002) found that responsiveness was higher near nest initiation when compared to incubation and hatching stages. Least bitterns can be heard during the early morning and evening hours; however, Swift et al. (1988) indicated that responsiveness to call-response surveys may be higher in the morning. The species is usually silent during midday and afternoon (Gibbs et al. 1992).

Habitat: Range-wide this species uses a variety of freshwater and brackish marshes with dense, tall growths of aquatic or semiaquatic vegetation, especially cattail (*Typha* spp.), sedge (*Carex* spp.), bulrush (*Schoenoplectus* spp.), and arrow-head (*Sagittaria* spp.), interspersed with clumps of woody vegetation and open water (Gibbs et al. 1992). Weller (1961) found least bittern nests in the north-central states most often associated with marshes dominated by cattail and/or bulrush. When compared to the American bittern, the least bittern is more prevalent in deeper water marshes (Weller 1961, Weller and Spatcher 1965). In their study of Iowa marshes, Weller and Spatcher (1965) recorded the species in the greatest abundance during years when ratios of emergent vegetation to open water were approximately equal (the hemi-marsh stage), and the species was not observed in areas of dense vegetation until opened up by muskrats. Brown and Dinsmore (1986) found that least bitterns were observed more often on Iowa wetlands larger than 12 acres (5 ha), suggesting that the species may be area sensitive. While Bogner and Baldassarre (2002) observed a mean home range size of 9.7 ha (11.4 ha for females, 8.1 for males) in their study in western New York, they suggested that vegetation type and cover ratios are likely more important than marsh size to least bittern populations.

Biology: Spring arrival usually occurs in late April and early May in the southern Lower Peninsula and shortly thereafter in northern Michigan (Evers 1994). Males give their low calls frequently during the breeding season, presumably to advertise their presence to females, and are known to defend their territories (Gibbs et al. 1992, Weller 1961). Weller (1961) indicated that nests are almost always placed above standing water and are constructed primarily by the male. The nest consists of a platform located 0.15 to 0.75 m above the water in clumps of dense emergent vegetation (Adams 1991), and is formed by bending down live and dead stalks and adding short stems and sticks on top (Weller 1961). Usually a clutch of 4 – 5, and rarely up to 7, pale bluish to pale greenish eggs are laid at one day intervals (Baicich and Harrison 1997).

Photo by Brad Yocum

Least bittern young remain at the nest for about a week after hatching, where they are brooded by both parents.

Weller (1961) found that incubation begins with either the first or second egg and lasts for 17 – 20 days. While both sexes participate in incubation, Weller (1961) felt the female may incubate more than the male. Renesting and double brooding has been observed; however, Bogner and Baldassarre (2002) indicated that more information is needed to determine the proportion of birds that renest or have second broods. Young are semi-altricial and downy and are brooded by both parents until they leave the nest as early as the 6th day, but usually leave permanently by the 13th – 15th day (Gibbs et al. 1992, Nero 1950). The young are fed minnows and frog legs by regurgitation (Nero 1950, Weller 1961). Young are typically able to begin foraging on their own within 1 – 2 weeks after hatching; however, the parents may continue providing food for up to 30 days (Nero 1950, Palmer 1962). First flight is usually attained by about 25 days after hatching (Baicich and Harrison 1997), although Bogner and Baldassarre (2002) observed a mean age of 29 days at first flight (n = 4) in western New York. Adams (1991) stated that little is known about the timing of the southward migration in Michigan, but it probably begins in August and continues well into September. Gibbs et al. (1992) noted that least bitterns use only four of the 28 known feeding behaviors used by herons: standing in place, walking slowly, neck swaying, and wing-flicking. Foraging occurs almost exclusively in emergent wetlands, most often at the edges of open water and emergent vegetation (Evers 1994). The least bittern's small size and compressed trunk allow it to easily move through dense emergent vegetation (Gibbs et al. 1992). Weller (1961) found that least bitterns stalk along branches or reeds when feeding, or by clinging to clumps of vegetation above the water level, aided by its short outer toes and long curved claws. Prey consists primarily of aquatic species, such as small fish, large insects, tadpoles and other amphibians, and crayfish, with small mammals and birds taken occasionally (Evers 1994). Foraging platforms of bent vegetation are frequently constructed at productive feeding sites, which are used during the late-incubation and brood-rearing periods (Weller 1961, Evers 1994).

Conservation/Management: Analysis of North American Breeding Bird Survey data did not reveal significant population trends for the least bittern; however, these and other large-scale surveys are known to not adequately survey secretive marsh birds (Adams 1991, Gibbs et al. 1992). While listed as abundant to common in Michigan through the late 1950s (Barrows 1912, Wood 1951, Zimmerman and Van Tyne 1959), Adams et al. (1981) indicated least bitterns apparently declined in the state between the late 1950s and early 1980s. Habitat destruction and degradation are likely the most important threats facing this species. Dahl (2000) estimates that less than half of the original wetlands estimated to be present in the conterminous U.S. at the time of European settlement remain today. An estimated 50% of Michigan's original wetlands have been destroyed overall since European settlement, including about 70% of the State's coastal wetlands (Cwikiel 1998). Many of our remaining wetlands have been severely degraded from their original condition by sedimentation, eutrophication, and chemical contamination. Gibbs et al. (1992) noted that changes in water quality could adversely affect the least bittern's prey base and increase the potential impacts from a nematode parasite (*Eustrongilides* spp.), which can devastate wading bird populations. Acid precipitation could be a potential threat due to possible affects to their food supply; however, the emergent wetlands used by this species tend to be circumneutral in pH and may provide chemical buffering against acidification (Gibbs et al. 1992). Invasive species such as purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*) have degraded many wetlands and have the

potential to impact the availability of suitable nesting habitat. Alterations to the hydrology of wetlands, such as drainage or channelization, can reduce breeding success by drying or flooding potential nest sites (Evers 1994). Collisions with motor vehicles, barbed-wire fences, transmission lines, and airboats can be a significant mortality factor due to least bitterns flying low to the ground (various sources cf. Gibbs et al. 1992). Although least bitterns are generally less vulnerable to land predators because they tend to nest over water and away from shore, there are many potential predators of young and eggs, including American crows (*Corvus brachyrhynchos*), raptors, blackbirds, blue jays (*Cyanocitta cristata*), snakes, turtles, mink (*Mustela vison*), and raccoons (*Procyon lotor*) (Bent 1926, Weller 1961, Bogner and Baldassarre 2002). Bogner and Baldassarre (2002) suspected marsh wrens (*Cistothorus palustris*) of predating least bittern eggs.

The protection, management, and improvement of large shallow wetlands with robust growth of emergent vegetation is seen as the most urgent conservation need of this species (Gibbs et al. 1992, Evers 1994). Several authors have indicated that marshes with a 50:50 ratio of open water to emergent vegetation, often termed hemi-marshes, attract the highest densities and diversities of wetland birds (Weller and Spatcher 1965, Kaminski and Prince 1984, Gibbs et al. 1991). Managing wetlands for the hemimarsh stage would improve conditions for least bittern and other wetland birds. Gibbs et al. (1992) suggested that wetlands also be protected from chemical contamination, siltation, eutrophication, and other forms of pollution. Best management practices, such as filter strips, no-till farming, and conservation tillage, are valuable tools in protecting wetlands from pollution. Initiatives that encourage wetland restoration and protection on private and public lands have been effective at conserving habitat for this and other wetland-dependent birds. Federal programs funded by the Farm Bill, such as the Wetlands Reserve Program and Conservation Reserve Program, and the North American Wetlands Conservation Act are good examples of efforts that have had positive benefits for an array of wetland species.

Research needs: Although call-response surveys are useful assessing the status and trends of this and other waterbird species in North America (Hands et al. 1989, Adams 1991, Gibbs et al. 1992), no large-scale monitoring programs have been implemented. Such a monitoring program is needed to track the populations of this and other secretive wetland bird species, and would allow agencies and organizations to work more effectively for their conservation. More study of least bittern breeding biology is needed, including investigations of movements, causes, and rates of juvenile and adult mortality, causes of nest failure, renesting, juvenile dispersal patterns, mating systems and philopatry, and diet (Gibbs et al. 1992). Gibbs et al. (1992) also suggested examining the species' habitat associations in the nesting, migration, and overwintering periods. Major habitats used as least bittern migration stopovers and for overwintering need to be identified, and techniques for wetland enhancement and restoration need to be developed (Gibbs et al. 1992). Other topics that should be explored include determining the factors that regulate populations, investigating the effects of chemical contamination, identifying the effects of disease and parasites, and determining the impacts of weather on populations (Gibbs et al. 1992, Hands et al. 1989).

Related abstracts: American bittern, Forster's tern, yellow-headed blackbird, Great Lakes marsh.

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Nycticorax nycticorax (Linnaeus) Black-crowned Night-Heron

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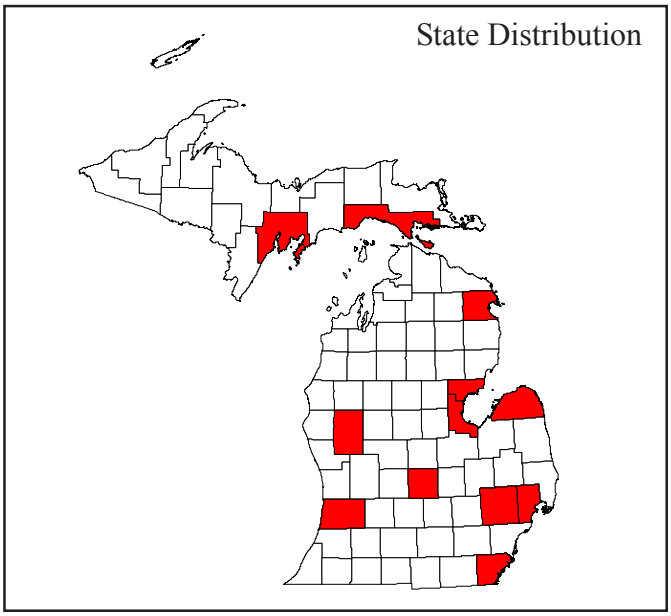

Best Survey Period

Status: State special concern

Global and state rank: G5/S2S3

Family: Ardeidae – Herons, Egrets, and Bitterns

Total range: Black-crowned night-herons breed on every continent except Australia and Antarctica (Davis 1993). In North America the species breeds throughout most of the United States extending north into southern Alberta, Saskatchewan, and Manitoba and south into coastal Mexico. Black-crowned night-herons are year-round residents in many coastal areas, the lower Mississippi and Ohio River valleys, and parts of the lower Great Lakes (Davis 1993). Wintering black-crowned night-herons can be found in southwestern Texas and throughout much of Mexico and Central America (Davis 1993).

State distribution: Barrows (1912) noted that the black-crowned night-heron did not appear to be common anywhere in Michigan, while Wood (1951) called the species a summer resident and common locally in southeastern Lower Michigan. Payne (1983) listed the black-crowned night-heron as an uncommon transient and summer resident and noted that the breeding population was 310 pairs at eight sites from Saginaw Bay to Big Bay de Noc. Most nesting in Michigan now occurs along the shores of Lakes Huron and Erie (Scharf 1991). According to Scharf and Shugart (1985), nesting habitat in Michigan extends from the Erie marshes near the Ohio border northward to Saginaw Bay, Thunder Bay, Big Bay de Noc, and its furthest northward limit near the Straits of Mackinac. Multiple observations of flightless juveniles in Oakland County indicated successful breeding in 1997 (Appelbaum 1998). Black-crowned Night-Herons have also been flushed from nesting colonies of other species in northern Michigan, including Bellows Island in Grand Traverse Bay and Gem and Rock Islands in Lake George of the St. Mary's River system, but evidence of nesting was not found (Scharf 1991). Scharf (1991) stated that the current distribution in Michigan shows a marked preference for islands. The figure above reflects counties with confirmed breeding during Michigan Breeding Bird Atlas surveys, other recent breeding confirmations, or known occurrences from the Michigan Natural Features Inventory database.

Recognition: The black-crowned night-heron is a **medium-sized heron**, measuring 23 – 26 in (58 – 66 cm), with a **stocky build**, relatively **short neck and legs**, and **sexually monomorphic plumage** (Davis 1993). Gross (1923) found that males (1.7 – 2.2 lbs, 785 – 1014g) are slightly heavier than females (1.6 – 2.0 lbs, 727 – 884 g), although their weights overlap.

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Adults are easily identified by their **black cap, upper back, and scapulars**, gray wings, rump, and tail, and **white to pale gray underparts** (Davis 1993). The **bill is stout and black**, **eyes are red**, and legs are yellow-green for most of the year, but pink during the height of the breeding season (Davis 1993). Davis (1993) described juveniles and first winter birds as brown above with large pale spots on the back, scapulars, and coverts, with underparts paler and heavily striped with brown, while older immatures up to about 2 years old are still mostly brown but more solidly dark above and light below, gradually approaching the adult pattern. Immature birds are sometimes confused with American bittern (*Botaurus lentiginosus*); however, that species has a long dark mark on the side of the neck and lacks large pale spots on the underparts (Davis 1993). Juvenile yellow-crowned night-heron are more similar; however, Davis (1993) noted that they have smaller pale spots above, longer legs, and a heavier, all-black bill. Payne (1983) considered the Yellow-crowned Night-Heron an occasional summer resident in Michigan, and Carpenter (1991) indicated that the species is probably a rare breeder across the southern Lower Peninsula. The best known black-crowned night-heron vocalization is its **"*Quawk*" call**, most often given at night while in flight or from a perch (Scharf 1991, Davis 1993). Hancock and Kushlan (1984) described its advertising call as a hissing "*Plup*", threat call as "*Rok-rok*", disturbance call as "*Wok-wok*", and landing call as "*Kak-kak*".

Best survey time: Although black-crowned night-herons are known to occasionally winter in Michigan, the best time to survey for this species is during the breeding season. Surveys for breeding colonial waterbirds are typically conducted when birds are actively nesting. Since black-crowned night-herons feed primarily at night, the species is most likely to be at or near the nest site during daytime hours; however, the demands of young can sometimes keep black-crowned night-herons foraging during daylight hours (Davis 1993). Black-crowned night-herons typically arrive in southeastern Michigan in April (Wood 1951); however, Scharf (1991) notes that nesting can span from early May into July. A number of techniques have been used to survey nesting colonial waterbirds, including ground surveys on foot or by boat and aerial surveys using fixed-wing aircraft or helicopters (Steinkamp et al. 2003).

Habitat: The habitats used by the black-crowned night-heron throughout its breeding range are extremely varied and include swamps, streams, rivers, margins of pools, ponds, lakes, lagoons, tidal mudflats, salt marsh, man-made ditches, canals, ponds, reservoirs, and wet agricultural fields (Davis 1993). During their study of Iowa prairie marshes, Brown and Dinsmore (1986) listed the species as possibly area-dependent. The distribution of black-crowned night-herons appeared to be dependent upon marsh size, with the only observations occurring on wetlands larger than 50 acres (20 ha); however, this relationship was not statistically significant (Brown and Dinsmore 1986). Davis (1993) states that migrating birds concentrate in wetlands associated with coasts and the Mississippi River drainage, while wetlands used for wintering are as varied as those used for breeding (Hancock and Kushlan 1984). Black-crowned night-herons breeding in Michigan primarily use habitats associated with the shores of Lakes Huron and Erie and prefer to nest in shrubs and small trees from 6 to 18 feet in height (2 to 6 m) (Scharf 1991). Davis (1993) noted that most nesting colonies are located on islands, in swamps, or over water, suggesting that site selection may be related to predator avoidance. Shallow, weedy pond margins, creeks, and marshes are preferred foraging habitats (Davis 1993).

Biology: Wood (1951) noted that the arrival of black-crowned night-herons at Erie marsh in extreme southeastern Lower Michigan occurred between April 7 and 21. The species is presumed to be monogamous, and pair formation and nest initiation are essentially contiguous events, especially when old nests are used (Davis 1986, 1993). Breeding usually occurs at 2 yrs of age (Davis 1993); however, Custer and Davis (1982) reported a successful pair of 1 yr old birds and a 1 yr old paired with a 2 yr old. Males choose nest sites and advertise for females and begin nest building or refurbishing of old nests; later the male brings material to the female, which she uses to continue nest building (Davis 1993, Baicich and Harrison 1997). Davis (1986) observed 86% of the birds at a Massachusetts colony study plot reusing old nests. The nest site can occur from the ground level up to 150 feet above ground and generally consists of a platform with a shallow hollow made of twigs, reeds, and similar material (Baicich and Harrison 1997). Nest material is highly variable and dependent upon the vegetation immediately available,

and nests can occur in trees, shrubs, and emergent vegetation. Hoffman and Prince (1975) found 93% of the nests of one Michigan colony in box elders (*Acer negundo*). Nests can be near tree trunks or distal forks of branches and in the open or deep in foliage (Davis 1993). In Michigan eggs can be found in early May, but the egg-laying season may extend into July, with colonies showing great asynchrony in nesting (Scharf et al. 1978). Scharf (1991) indicated that such a long breeding season is an adaptation that allows the black-crowned night-heron to exploit habitats over much of its range. Females lay eggs at two-day intervals and both parents incubate beginning with the first egg; hatching occurs in 23 – 26 days for North American birds (Hancock and Kushlan 1984, Custer et al. 1992). This heron has only one brood per season, but will renest if the first nest fails (Nickell 1966). Clutch size is 3 – 4 and sometimes 5 and the eggs are pale greenish-blue, sometimes more green or wholly blue, smooth and non-glossy, and elliptical to subelliptical (Baicich and Harrison 1997). Baicich and Harrison (1997) described the nestlings as semi-altricial and downy, rufous-brown above with pale tips forming a crest on the head, and white on the thighs. Young are tended by both parents and are brooded nearly constantly for the first 10 days after hatching (Davis 1993, Baicich and Harrison 1997). The parents deliver regurgitated food directly to young chicks, but later dump into the nest when chicks are older (Davis 1993). Davis (1993) states that young can leave the nest after two weeks, by three weeks can often be found at the top of trees when disturbed, and by six to seven weeks can fly and depart for feeding grounds. Although most individuals in the northern part of the range migrate south (Davis 1993), Payne (1983) listed the black-crowned night-heron as an occasional species during winter in Michigan. Wood (1951) stated that southward migration in Michigan occurs in September and October. Black-crowned night-herons feed primarily from evening to early morning, but will also forage during the day during periods of high food demand, such as when brooding prefledged young (Bent 1926). This heron is opportunistic and feeds on a wide variety of foods across its range, including leeches, earthworms, aquatic and terrestrial insects, prawns and crayfish, mussels, squid, freshwater and marine fish, amphibians, lizards, snakes, rodents, birds, eggs, carrion, plant material, and garbage from landfills (Kushlan 1978). Scharf (1991) noted that fish and amphibians are important food sources in Michigan, as well as gull and tern chicks from colonies that are often in proximity to black-crowned night-heron nesting sites. Generally this species is a solitary forager that will defend a feeding territory and is known to use eight feeding behaviors: standing, bill vibrating, standing fly-catching, walking slowly, hovering, plunging, feetfirst diving, and swimming feeding (Kushlan 1978, Davis 1993). Riehl (2001) documented black-crowned night-herons manipulating bread in water to catch fish attracted to the bait.

Conservation/Management: Scharf (1991) stated that black-crowned night-herons are present in large numbers in parts of their range, but when comparisons are made to historical nesting abundance, declines are noted nearly everywhere. Habitat destruction continues to be a problem for this species, with habitat alteration and food availability being the major factors regulating population numbers (Davis 1993). However, Davis (1993) indicated that because early census data is lacking, population trends are difficult to assess and most populations appear to be stabilized or increasing. The black-crowned night-heron is a species of special concern in Michigan and Wisconsin, listed as threatened in Ohio, and designated as endangered in Indiana and Illinois. Because this species is high on the food chain, it is vulnerable to pesticides and other contaminants (Davis 1993). Declines in black-crowned night-heron populations during the 1950's and 1960's were probably related to eggshell thinning caused by DDT application (Davis 1993, Anderson and Hickey 1972). Hoffman et al. (1986) linked PCB contamination to decreased growth of black-crowned night-heron embryos. Some studies conducted after the 1972 DDT ban have indicated that the impact of DDE and PCB contamination on reproductive success of black-crowned night-herons has lessened (Custer et al. 1983, Blus et al. 1997). Researchers have also implicated organochlorines and heavy metals in the death or impairment of some birds (Ohlendorf et al. 1979, Custer and Mulhern 1983). As of the mid-1980's, there were still contamination problems in southern and western U.S. birds, with the likely source of western bird contamination being Mexican wintering grounds (Fleming et al. 1984, Henny and Blus 1986).

Man-made islands, most of which are created by the U.S. Army Corps of Engineers (USACE), are widely

used by nesting wading birds (Davis 1993). Scharf (1991) stated that the development of confined disposal facilities at Pointe Mouillee and Saginaw Bay by the USACE has not only created nesting sites for black-crowned night-herons and other waterbirds, but provided a significant food source in the form of aquatic organisms and gull and tern chicks. Calls for the control of ring-billed gulls in these areas could impact an important food source (Scharf 1991). Scharf (1991) also cautioned that the policy of the USACE to turn over ownership of artificial islands to other organizations, which may convert these areas to uses incompatible with nesting birds, could lower the suitability of these habitats. The reliance of Michigan's birds on shrubs and small trees for nesting means that vegetative succession could cause existing heronries to become unsuitable unless new habitat develops. The vegetation at some colony sites is constantly renewed by ice and wind action, and vegetation at other sites could be controlled through appropriate management (Scharf 1991). Periodic selective cutting of mature trees near existing colonies could ensure the presence of the mid-successional habitat preferred by nesting black-crowned night-herons. Tremblay and Ellison (1979) found that frequent disturbance of nests by researchers just before or during egg laying caused some nest abandonment and predation, so disturbance of known nesting colonies should be avoided during this period. Scharf (1991) stated that the survival of Michigan's black-crowned night-herons depends on conserving natural diversity in coastal marshes and keeping both the mainland and island nesting sites free of human disturbance. Although nesting and foraging habitats in Michigan are at least partially protected through public ownership and wetland protection statutes, the rapid expansion of coastal development and recreation requires continued monitoring to assess threats to black-crowned night-herons (Scharf 1991).

Research needs: While the black-crowned night-heron is presumed to be monogamous, Davis (1993) noted that information from studies of marked birds is needed to better understand the species' mating system and the duration and maintenance of the pair bond. Continued monitoring of Michigan's nesting colonies is crucial to the conservation of this species. Detailed information regarding the location, size, productivity, and expected long-term viability of nesting colonies is needed. Because the black-crowned night-heron is a predator that forages in aquatic systems, periodic monitoring of contamination levels in these and other waterbirds would be prudent. The recovery of double-crested cormorants (*Phalacrocorax auritus*) in the Great Lakes region has prompted concern about possible impacts to other colonial waterbirds, which Cuthbert et al. (2002) believe could be caused through competition for limited habitat or the destruction of vegetation used for nesting. While preliminary investigations have not indicated a decline of black-crowned night-heron at the regional level due to the presence of double-crested cormorants, cormorants have caused total or partial loss of forest cover at some sites and initial soil chemistry suggests that normal plant growth and survival will be affected (Cuthbert et al. 2002). Clearly, further work is needed to understand how black-crowned night-herons and other waterbirds interact with this now ubiquitous species at nesting sites.

Related abstracts: Great Lakes marsh, American bittern, great blue heron rookery.

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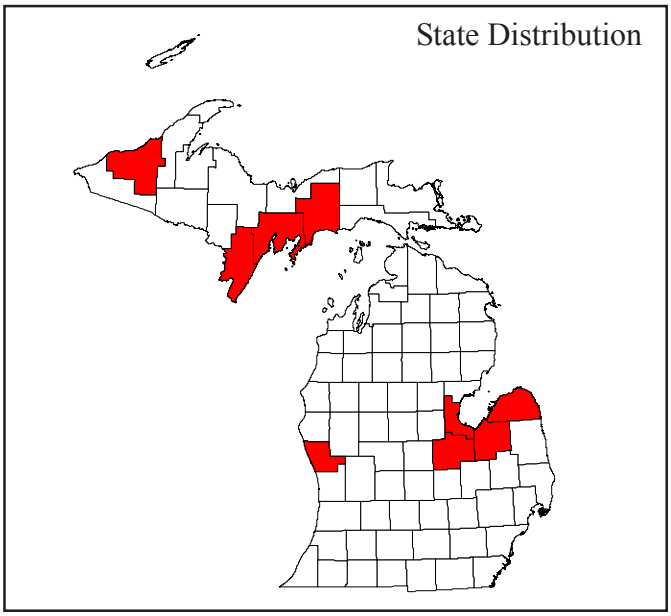
Xanthocephalus xanthocephalus (Bonaparte) Yellow-headed Black-bird



Best Survey Period

Status: State special concern

Global and state rank: G5/S2

Family: Icteridae – Meadowlarks, Cowbirds, Blackbirds, Grackles, and Orioles

Total range: The breeding range of the yellow-headed blackbird occurs in the prairie and mountain meadow wetlands of the western and central U.S. and Canada (Twedt and Crawford 1995). The species breeds from central British Columbia, northern Alberta, central Saskatchewan, southern Manitoba, and extreme southwest Ontario south through Minnesota and Wisconsin to extreme northwest Indiana, northern Illinois, southern Iowa, extreme northwestern Missouri, central and western Kansas, western Oklahoma, northwestern Texas, northern New Mexico, and Arizona, west to southern California, and in Oregon and Washington largely east of the Cascade Mountains (Twedt and Crawford 1995). The yellow-headed blackbird has been extending its range eastward and breeds in small numbers in scattered locations in Michigan, northwestern Ohio, and southeastern Ontario (Granlund 1991). Wintering primarily occurs from western and southern Arizona, southern New Mexico, and western and extreme southern Texas south through Mexico to northern Veracruz on the Atlantic slope, Oaxaca and Guerrero in the interior and adjacent slope, and Nayarit on the Pacific slope (Twedt and Crawford 1995).

State distribution: Granlund (1991) noted that the yellow-headed blackbird appears to be a relatively new breeding species for Michigan. Barrows (1912) and Wood (1951) listed the yellow-headed blackbird as a rare straggler and described records from Dickinson and Ontonagon Counties in the Upper Peninsula (UP) and Huron, Manistee, Missaukee, and Monroe Counties in the Lower Peninsula (LP). Zimmerman and Van Tyne (1959) listed the species as a rare visitor with a nesting occurrence for Gogebic County, records for the above counties, and additional observations for Menominee, Muskegon, Saginaw, and Washtenaw Counties. Additional nesting records were later confirmed for Cheboygan, Chippewa, Delta, Gratiot, Macomb, and Ottawa Counties and Saginaw Bay, and Payne (1983) considered yellow-headed blackbird an uncommon transient and local summer resident. During Michigan Breeding Bird Atlas (MBBA) surveys, yellow-headed blackbirds were confirmed breeding in Ontonagon, Menominee, Delta, and Schoolcraft Counties in the UP, and Muskegon, Bay, Saginaw, and Huron Counties in the LP (Granlund 1991). The figure above indicates counties with confirmed breeding during Atlas surveys or known occurrences from the Michigan

Michigan Natural Features Inventory
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Natural Features Inventory database. Granlund (1991) noted that Muskegon County and the coastal marshes of Saginaw Bay and Delta County appear to historic breeding locations for Michigan.

Recognition: Twedt and Crawford (1995) described the yellow-headed blackbird as a large bodied passerine with males weighing 100 g and measuring 26.5 cm in length, which is nearly twice the mass of females (<60 g) and about 0.5 cm longer. The species is sexually dimorphic, with the male being unmistakable with its **yellow head, neck, and breast**, **black body plumage, lore, and eye-stripe**, and **white wing patches** visible in flight (Twedt and Crawford 1995). Females and immature males have muted plumages with **dull black and brown bodies**, **pale yellow** primarily on the **breast and throat**, but also on the neck and eyestripe, and **white streaking merging the yellow breast with a brown abdomen** (Twedt and Crawford 1995). Other female or immature male icterids lack yellow on the head (Twedt and Crawford 1995). Twedt and Crawford (1995) described two songs exhibited by males: the musical accenting song directed toward birds at long distances, and the buzzing song usually directed toward birds very close to the singer. The **accenting song** consists of several fluid introductory notes that may or may not be followed by a highly variable trill (Twedt and Crawford 1995). Bent (1958) described the introductory notes phonetically as **"*oka wee wee, oka wee wee, oka wee wee*."** The **buzzing song** has been represented as **"*kuk – koh-kohkoh – – waaaaaaaa*"** (Twedt and Crawford 1995).

Best survey time: The best time to survey for yellow-headed blackbirds is during the breeding season when the males are territorial and conspicuous. Little information is available for typical arrival dates in Michigan, but the timing is likely similar to that of Wisconsin, which begins between 11 and 23 April for males and between 4 and 7 May for females (Twedt and Crawford 1995). Generally, breeding activity is greatest between late April and late June. Young (1996) conducted surveys for singing males between early April and late June, while nest searches covered the same period and continued until about mid July. Twedt and Crawford (1995) noted that during the breeding season males sing most often during morning and evening, with delivery rates in the early morning similar to those in the late afternoon. A variety of techniques can be used to successfully survey yellow-headed blackbirds, including transects traversed by foot, boat, or canoe, and point counts conducted in suitable breeding habitat.

Habitat: In the core of its breeding range, the yellow-headed blackbird is primarily found in prairie wetlands, but is also common in wetlands associated with the prairie parklands, mountain meadows, and arid regions (Twedt and Crawford 1995). Typically the species nests in deeper-water palustrine wetlands dominated by cattail (*Typha* spp.), bulrush (*Schoenoplectus* spp.), or reed (*Phragmites* spp.) (Twedt and Crawford 1995). The need for deeper water appears to be a limiting factor as yellow-headed blackbirds are often not found in similar vegetation where water levels fluctuate (Granlund 1991). Young (1996) found nests distributed in the outer zones of cattail along Saginaw Bay; however, Whitt et al. (1999) found no nests in cattail zones located inland. Nests are only located over water and are fixed either to dead emergent vegetation from the previous season or robust growing vegetation (Twedt and Crawford 1995). Foraging occurs both within wetlands and in surrounding grasslands, croplands, or savanna (Twedt and Crawford 1995).

Biology: Yellow-headed blackbirds likely arrive on Michigan breeding grounds between early to mid April and early May. Adult males arrive about one to two weeks before adult females and begin forming territories shortly thereafter (Twedt and Crawford 1995). Twedt and Crawford (1995) describe breeding as being in grouped territories when the majority of food resources are obtained within the territory, or as loosely colonial when most food resources are obtained outside the territory. Males are polygynous and generally have 1 – 6 females in a harem, and females select breeding sites within the male's defended territory (Twedt and Crawford 1995). The overwater nests are built entirely by the female, usually in water between 2 and 4 ft (0.6 and 1.2 m) deep, and rarely deeper (Bent 1958). Nests are constructed of water-soaked aquatic vegetation interwoven with standing dead or growing emergent vegetation (Granlund 1991). Baicich and Harrison (1997) characterize the nest as a deep cup built of long stems and blades of wet partly decayed grasses woven around supporting stems to form a tight cup, lined with dead leaves of plants, coarse grasses, roots, and decayed plant material, and firmly packed with an inner

lining of narrow leaves, leaf strips, or fine grasses. Little information is available for egg laying dates in Michigan, but it is likely similar to those of Minnesota, which occurs from about mid May through mid June (Bent 1958). Young (1996) found similar laying dates in her study of yellow-headed blackbirds in coastal wetlands on Saginaw Bay. Clutch size is typically 3 – 5, but most often 4 eggs and rarely 5 (Twedt and Crawford 1995). Baicich and Harrison (1997) describe the eggs as long subelliptical to long oval, smooth and glossy, very pale bluish-white, and finely speckled and mottled with brown, purplish-brown, or reddish-brown, usually with denser markings at the lower end. Incubation is by the female alone and usually lasts 10 – 13 days (Baicich and Harrison 1997). The young are altricial and brooded by the female exclusively (Twedt and Crawford 1995). Females feed young at the nest, while males will assist in feeding after the young are about four days old (Twedt and Crawford 1995). The young are fed invertebrates, primarily emergent aquatic insects (Twedt and Crawford 1995). Young leave the nest unable to fly at 9 – 12 days and remain among the emergent vegetation until flight is attained by about 20 days (Twedt and Crawford 1995, Baicich and Harrison 1997). Adults specialize in aquatic invertebrate food during the breeding season, but consume primarily cultivated grains and weed seeds during the postbreeding period (Twedt and Crawford 1995). Little information is available on fall departure dates for Michigan; however, Robbins (1991) lists early August to mid October for Wisconsin and Roberts (1936) has fall dates from mid September through October for Minnesota.

Conservation/Management: Twedt and Crawford (1995) stated that continental populations of yellow-headed blackbird appear to be secure provided wetlands remain intact. Because this species typically nests in deeper water marshes, it is more immune to habitat destruction caused by human drainage or filling. Michigan's location at the eastern edge of the yellow-headed blackbird's range explains the species rareness in the state (Granlund 1991). During MBBA surveys, yellow-headed blackbirds showed increases in some locations and withdrew from others (Granlund 1991); Young (1996) noted the ephemeral nature of breeding colonies. Granlund (1991) noted that expansion of yellow-headed blackbirds in Michigan has been slow despite apparently ample habitat. Short and long-term water level fluctuations are likely an important factor limiting the expansion of the species in Great Lakes coastal marshes. In Young's (1996) study of yellow-headed blackbirds in the Saginaw Bay, seiches or storm surges increased marsh water levels and destroyed most nests in 1994. Twedt and Crawford (1995) noted that yellow-headed blackbirds have likely benefited from human conversion of grasslands to small grain, corn, and sunflower fields, which provide a substantial postbreeding food supply that may result in increased fledging. Lethal control of crop depredation is common in the heart of the yellow-headed blackbird's breeding range and is not expected to cause long-term detrimental impacts to regional populations if applied at the depredation site (Twedt and Crawford 1995). However, if lethal methods are directed at breeding or roosting populations, local populations could be devastated due to the colonial breeding habits of this species (Twedt and Crawford 1995). Twedt and Crawford (1995) also stated that isolated populations at the periphery of the breeding range are at particular risk of extirpation.

Previous research has indicated that marshes with a 50:50 ratio of open water and emergent vegetation, often termed hemi-marshes, attract the highest densities and diversities of wetland birds, including yellow-headed blackbirds (Weller and Spatcher 1965). Orians (1980) found that the value of emergent vegetation patches to breeding yellow-headed blackbirds decreased with increased stem densities. Increased stem density may reduce aquatic insect production and yellow-headed blackbird encounter rates with prey (Orians 1980). Wildlife biologists should manage wetlands, especially those with water level control, for the hemi-marsh state. Best management practices, such as filter strips, no-till farming, and conservation tillage, should be encouraged in watersheds containing suitable wetlands to help protect valuable habitats from pollution.

Research needs: Twedt and Crawford (1995) listed several topics as priorities for yellow-headed blackbird research: examining the different metabolic rates of this and other Icterids, in order to provide insight into differential timing of migration; studying habitat use, range, and behavior during winter; exploring the underlying mechanism that allows yellow-headed blackbirds to avoid nest parasitism, which could be useful in managing parasitism in other species; and

investigating breeding site fidelity of females and fidelity to the natal site. Since yellow-headed blackbirds are typically found in large coastal marshes in Michigan, further investigation into the potential factors that limit these populations in what appears to be suitable habitat would be prudent. Potential factors could include available food resources and water level fluctuations (long- and short-term) and the associated changes to vegetation composition and structure and vegetation to open water ratios (Young 1996).

Related abstracts: least bittern, Forster's tern, Great Lakes marsh.

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