Conservation Assessment
for
Black Tern (Chlidonias niger) *Linnaeus*

Photo credit: B.D. Cotterille, Cornell Lab of Ornithology

USDA Forest Service, Eastern Region

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Janet Kudell-Ekstrum
USDA Forest Service, Hiawatha National Forest

Tony Rinaldi
Wisconsin Department of Natural Resources

This Conservation Assessment was prepared to compile the published and unpublished information on Black Tern and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving Black Tern, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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Executive Summary

This is a Conservation Assessment providing a summary of readily available information on the distribution, status, ecology, habitat, management, and population biology of Black Terns (*Chlidonias niger)*. Four key summary reference documents, which compiled research findings from several sources, were used extensively in this Assessment. These references are: The Nature Conservancy Species Management Abstract - Black Tern (Novak et al. 1999); Black Tern *In* The Birds of North America, No. 147 (Dunn and Argo 1995); the Status Assessment and Conservation Plan for the Black Tern in North America - U.S. Fish & Wildlife Service (Shuford 1999), and Michigan's Natural Features Inventory Abstract on Black Tern (Currier 2000). This document was also compiled to assist in the writing of the Conservation Assessment for the Beach Dune Community.

Black Tern populations have decreased markedly since the mid 1960s. One-third as many Black Terns were in North America in the early 1990s as in the late 1960s (Dunn and Agro 1995). From 1966-1996, population declines throughout the North American breeding range were 3.1 % annually (Currier 2000).

The Black Tern is listed by the US Fish and Wildlife Service as a species of Management Concern in the northeastern states due to declines in breeding numbers (Scharf 1999). The Black Tern has lost much of its breeding habitat due to wetland drainage and was a Category 2 candidate for review for possible addition to the Federal endangered or threatened species list (USFWS 1991) until use of the Category 2 list was discontinued (USFWS 1996). The states of Illinois, Indiana, New York and Pennsylvania list the Black Tern as state endangered, and Michigan lists it as a species of special concern. Prominent researchers in Wisconsin have recommended that Black Terns be added to the state's threatened list (Matteson and Mossman 2000). The species is listed as a Regional Forester's Sensitive Species on the national forests of Minnesota, Wisconsin and Michigan.

Black Terns require aquatic habitats with extensive stands of emergent vegetation and large areas of open water. In the Great Lakes region, Black Terns use both marshes and inland and Great Lakes shoreline habitats for breeding. Threats to Black Tern populations include loss of freshwater marsh habitat, contaminants such as organochlorines (e.g. PCBs, DDT) (Scharf 1999, Novak et al. 1999, Currier 2000, Schieldcastle pers. comm. 2000) metals (Currier 2000), and acid rain (Brewer 1991), human disturbance, predation of eggs and nestlings (Scharf 1999; Brewer 1991) and disease and parasites. Successional processes, changes in water levels, invasion by exotic wetland plants (e.g. purple loosestrife, *Lythrum salicaria*), and degradation of water quality have the potential to render wetlands unsuitable for use by Black Terns (Novak et al. 1999). On a continent-wide scale competition for food with commercial fishing (Dunn and Argo 1995) in tropical wintering grounds may be a probable cause of decline (Zaret and Paine 1973). Brewer (1991) suggests that international reductions in airborne pollutants may be necessary for the long-term survival of the Black Tern and other marsh

species. However, no cases of direct mortality of Black Terns due to toxic chemicals have been reported in the literature (Zimmerman et al. 2002).

A number of conservation and management options exist for the Black Tern. Preservation of wetlands in sizes large enough to attract Black Terns and to allow adults to move to areas of suitable water depth as natural drought cycles recur is the most straightforward conservation option (Brewer 1991). Wetlands created for waterfowl are attractive if flooding/drawdown regimes preserve appropriate emergent vegetation, nesting substrate, and stable water levels through the nesting season (Hands et al. 1989). Muskrats help create Black Tern nesting habitat through the interspersion of vegetation and open water created by their feeding, and by providing Black Tern nesting structures. However, high muskrat numbers can remove too much vegetation resulting in unsuitable Black Tern habitat.

There are many research needs for Black Terns including determining the causes of nest failure and mortality at nesting colonies, evaluating the effectiveness of artificial nest platforms, determining site fidelity, determining the effects of human disturbance, evaluating factors affecting renesting after nest failure, determining foraging range and habitat use at breeding sites, determining movements and mortality rates in the nonbreeding season, determining feeding habits during the nonbreeding season (Novak et al. 1999), comparative studies across habitats and regions, and metapopulation dynamics and demography investigations (Nisbet 1997). In addition, Dunn and Agro (1995) recommend studies in population dynamics including changes in first-year and adult annual survival, age at first breeding, and the possibility that adults will skip a breeding season after their first attempt. More information is also needed on migration and wintering biology, including stopover times and locations, food sources and availability. Nothing is known about possible physiological changes accompanying the shift of this species between freshwater and marine habitats (Dunn and Agro 1995).

Acknowledgments

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Nomenclature and Taxonomy

Scientific name: *Chlidonias niger* (Linnaeus, 1758)
Subspecies: There are two subspecies recognized *Chlidonias niger surinamensis* found in North America and *C. niger niger*, in Eurasia.
Common name: Black Tern
Order: Charadriiformes
Family: Laridae (gull and terns)
Subfamily: Sterninae
Synonym(s): *Chilidonias niger*, *Chilidonias niger surinamensis.*

Description of Species

The Black Tern is one of four tern species that nest in the Great Lakes. The other three species are Caspian *(Sterna caspia)*, Common *(Sterna caspia)*, and Forster's *(Sterna fosteri)* (Canadian Wildlife Service 2003). The Black Tern is an easy tern to identify with its black head, black body and gray wings (USGS 2000). It is boldly marked during the breeding season with a black head and black underparts (Royal Ontario Museum and the Ontario Ministry of Natural Resources – hereafter cited as ROM 1999). The sexes are similar in coloration and size. Identification tips for the Black Tern are it's small size, very short dark legs, a short-notched tail, and it's distinctive feeding habit of swooping down and picking prey off the surface of the water or over land. A distinguishing characteristic of this species is a dark ear patch extending down from a black crown (Currier 2000). The **juvenile form** has a white face, foreneck, breast, and belly; an irregular black cap connected by a dark ear spot, a brownish back and upperwing and dark gray shoulder bar. **The first winter/first summer form** is similar to the adult basic form, but often with blackish mottling in first summer. Wintering adults and juveniles are white or patchy black, and white below with a gray tail (Currier 2000). The **adult alternate form** has dark legs, black head, neck, breast and belly. The dark gray back and upperwings have no apparent contrast. The underwing coverts are pale and the undertail coverts are white. The **adult basic form** has a white face, foreneck, breast and belly, an irregular black cap connected to a dark ear spot, a gray back and upperwing (paler than in alternate plumage) and a dark gray shoulder bar (Gough et al. 1998).

Vocalizations include a harsh metallic *kik*, often produced when alarmed, and a softer, more common call *kyew* or *kyew-dik* (Currier 2000).

Life History

The Black Tern primarily feed on insects (e.g. dragonflies, grasshoppers and beetles); often hovering while hunting (Novak et al. 1999) and foraging in flocks where food is concentrated (Dunn and Agro 1995). Additional prey includes aquatic and land invertebrates (e.g. small mollusks, crustaceans) small fish, worms, and grubs (Novak et al. 1999).

Most Black Terns in the northeastern U. S. and Canada return to breeding areas during the first two weeks of May (Laughlin and Kibbe 1985, Firstencel 1987, Gerson 1987 In Novak et al. 1999). Black Terns have two courtship aerial displays, the "high-flight" and "fish-flight" (Baggerman et al. 1956, Novak et al. 1999). Pairing may occur prior to arrival on the breeding grounds, with a short period of communal feeding and courtship behavior taking place before nest building begins. Black Terns are monogamous (Dunn and Agro 1995).

To our knowledge, Black Terns are gregarious year round (USGS 2000). They nest in loose or small colonies but occasionally will nest singly, and may form nesting associations with Forster's Terns (Hoffman 1990). Black Tern colonies typically have twenty nesting pairs (Novak et al. 1999), but a 200 nest colony was reported in Michigan (McPeek 1994). Cuthbert (1954) reported the Black Tern as only partly colonial, with nests forming both loose colonies within 100 feet of each other, and at scattered sites of various distances from the colony. Both parents build the nest, and egg laying begins soon after nest completion. Black Terns are considered a single-brooding species but if the nest fails they will attempt to re-nest. Robbins (1991) reported egg laying between May 23 and July 8 in Wisconsin, with many authors reporting the majority of egg-laying observations the first week of June (Dunn and Agro 1995). The eggs are an olive-brown color with a typical clutch of 3 eggs, although 1 to 5 is possible (Currier 2000). Dunn and Agro (1995) provide detailed information on egg shape, size and mass, eggshell thickness and tolerance to dampness. Incubation by both adults begins with the first egg and requires 20 to 24 days (Novak et al. 1999). In Wisconsin, Fevold (1998) reported a hatch rate of 48%. The young are precocial and able to leave the nest a few days after hatching. The age of fledging is difficult to determine. Currier (2000) lists the young fledging in 18-21 days and Gough et al. (1998) report 21-28 days. The young are vigorously protected by both parents (USGS 2000). It is the tendency of Black Terns to re-select their nesting sites each year rather than return to traditional sites (Bailey 1977).

Breeding habitat is freshwater marshes and wetlands with emergent vegetation found along lake margins and occasionally in rivers (Dunn and Argo 1995). Nests are usually constructed on floating substrates, matted marsh vegetation, detached root masses, boards (Dunn and Agro 1995) or other pieces of floating wood (USGS, 1998) or muskrat-built feeding platforms of fresh-cut vegetation (Dunn and Agro 1995). The size

of vegetation mats used as nest platforms vary widely among sites, with diameters ranging from 25 to 52 cm (Bergman et al. 1970, Dunn 1979). Occasionally, Black Terns will nest atop a muskrat house (USGS 2000) or use abandoned nests of other birds including grebes, Forster's Terns, and American Coots (*Fulica americana)* (USGS 1998). As reviewed by Dunn and Agro (1995), typical nest dimensions are 10 to 25 cm in diameter, 2 to 6 cm in height, and 2 to 5 cm above the water level. The diameter of the nest bowl (if any) is approximately 9 cm (Dunn and Agro 1995).

Black Terns are a neo-tropical migratory species. They normally depart from breeding grounds by mid-August with a few individuals staying until October (Brewer 1991). Juveniles will not return to the breeding grounds until their second summer after fledging, remaining further south along the Gulf Coast (Currier 2000). Novak et al. (1999) review a number of studies that found most nest losses occurring at the egg stage, but losses have also been attributed to egg inviability, predation, muskrat activity, intraspecific interactions, and nest flooding from heavy rain and wind (Brewer 1991).

The maximum age recorded for the subspecies *Chlidonias niger surinamensis* was just under 8.5 years (Currier 2000).

Habitat

Rangewide Habitat

Black Terns require aquatic habitats with extensive stands of emergent vegetation and large areas of open water. Shallow marshes, open water areas of deeper marshes, wet meadows, natural ponds, lakes and river oxbows, reed-bordered sloughs, shallow river impoundment, edges of streams, and swampy grasslands are inhabited by this species. Habitat requirements seem strict, because they will colonize and abandon marshes as water levels fluctuate between wet or dry conditions (Brewer 1991). In migration, both fresh and saltwater habitats are used along the coast, including marshes, rivers, lakes, and nearby cultivated fields (USGS 1998). Many studies have described the nonbreeding season habitats as marshy reservoirs in Mexico, coastal areas of the Netherland Antilles, brackish swamps and estuaries of large rivers in Surinam, and coastal areas and a large lake in Panama (Novak et al. 1999).

The area of a marsh is thought to be an important habitat requirement. In Iowa, Black Terns were found to avoid marshes < 5 ha altogether and to avoid medium sized (5 to 10 ha) marshes if no larger marshes occurred within 5km (Brown and Dinsmore 1986). Naugle (1997) reported small (6.5 ha) marshes, within a mixture of large and small wetlands, being used by Black Terns in high-density wetland landscapes in South Dakota. In a subsequent South Dakota study, the mean size of wetlands used was 18.9 ha (Naugle et al. 2000). Researchers report that nesting typically occurs in water depths ranging from 0.5 m to 1.2 m (Currier 2000), but several studies have found it to be less (Dunn and Agro 1995). In a St. Mary's River study, Scharf (1999) found water depths at

nest sites to vary between 5.5 and 68.1 inches (14 to 173 cm). Nests are usually located adjacent to or within 0.5 to 2 m of small to large expanses of open water (Dunn and Agro 1995).

Similarly, nest-site characteristics have been described as areas of still water, usually with 25 to 75% of the surface covered with emergent vegetation (Dunn and Agro 1995). Vegetative cover varies from dense to sparse (USGS 1998, USGS 2000), but normally is open enough to allow canoe travel, although some nests (and some colonies) are in denser vegetation (Dunn and Agro, 1995). Overall, Black Terns tend to nest at sites with a 50:50 ratio of vegetation and open water (Hickey and Malecki 1997). Bailey (1977) found Black Tern nests in all areas of the lake he studied, but never near shore (closest was 25m from shore).

Emergent vegetation is <0.25 to 0.50 m high when a nest site is selected, often growing to > 1 m before hatching (Dunn and Agro 1995). Several studies report the predominant emergent vegetation as cattail (*Typha* spp.), bulrush (*Scirpus* spp.), or less often, burreed (*Sparganium* spp.) (Dunn and Agro 1995). Scharf (1999) found that both cattails and bulrushes were important although more nests were constructed in bulrushes. Dunn and Argo (1995) review several studies where Black Terns nested in association with trisquare (*Sciprus americanus*), *Eleocharis* spp., sedge (*Carex* spp.), reed canary grass (*Phalaris arundinacea*), marsh horsetail (*Equisetum fluviatile*), rushes (*Juncus* spp.), hairgrass (*Deschampsia* spp), spatterdock (*Nuphar* spp.) and cultivated rice. Occasionally in the far north they have nested in flooded willow (*Salix* spp.) or heath bogs (Peck and James 1983). Vegetation structure rather than species composition dictated suitability of nest substrates in eastern South Dakota (Naugle et al. 2000).

Lake States Habitat

In northwestern Minnesota, Brewer (1992) found breeding Black Terns where open water was interspersed with low open emergent vegetation primarily dominated by cattail and bulrush habitats with horsetails, wild rice, reed-canary grass, and sedges also being used. In Wisconsin, dominant plants around Black Tern nests include bulrushes, cattails, sedges, arrowhead (*Sagittaria* sp.), waterlilies (*Nymphaea* sp.), burreed, and wild rice (Hoffman 1954, Faanes 1979, Tilghman 1980, Mossman 1981). Mossman (1981) found nests mostly in semi-open stands of emergent vegetation, in openings or edges of dense vegetation, or on floating bog islands. He noted that water depths at nests were usually 40 to 80 cm, and that most nests in deeper water were on floating mud islands. A more detailed account of Black Tern habitat characteristics throughout its breeding range is summarized in Zimmerman et al. (2002) and reproduced in part for the western Lake States in Appendix 1.

Distribution

Rangewide Distribution

In North America Black Terns breed across most of southern Canada and the northern United States (Fig. 1). They breed in all provinces of Canada except Prince Edward Island and Newfoundland. They are most common from central British Columbia across the prairie provinces to central Ontario and southern Quebec. Black Terns breed from southwestern and east-central British Columbia and south-central Mackenzie to southern Quebec and southern New Brunswick, south locally to south-central California and northern Utah, Wyoming, Nebraska, Kansas, south-central Illinois, Indiana, Ohio, Pennsylvania to northern New York, northern New England, and Maine (Currier 2000). In summer, nonbreeding birds are found along the southern Pacific Coast to Panama, and in eastern North America to the Gulf Coast. Black Terns mainly winter in marine and coastal areas south of the Gulf Coast through Central America to northern South America (Currier 2000, USGS 1998).

Figure 1. Distribution of Black Tern in North, Central, and northern South America (reproduced from Dunn and Argo, 1995)

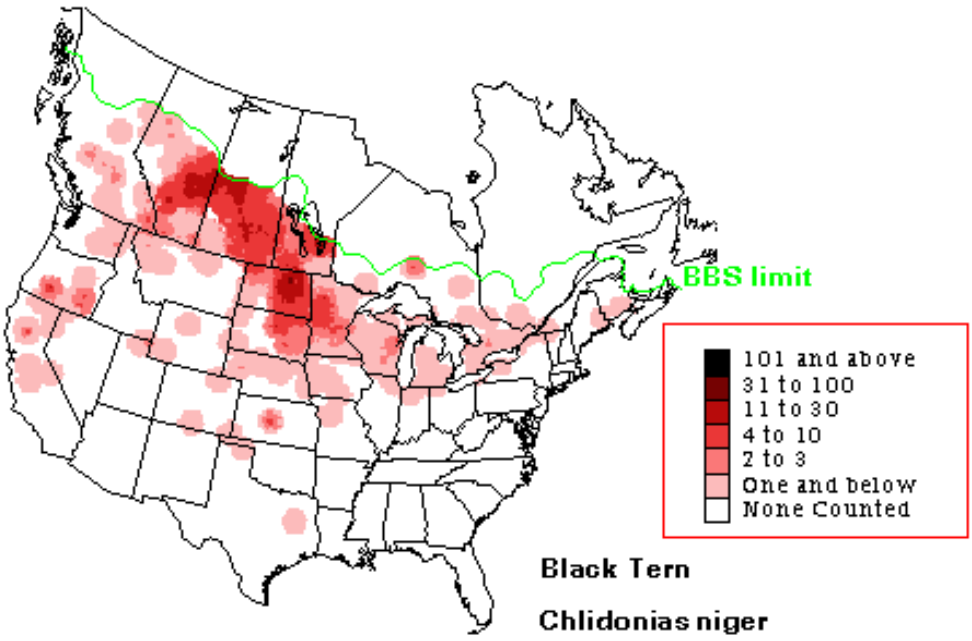

Figure 2. Breeding Range of Black Tern
(source: North American Breeding Bird Survey)

Lake States Distribution

Appendix 2 summarizes Black Tern occurrences by county for all the states bordering the Great Lakes and Ontario. Although the data is likely incomplete, the available information shows that the states of Michigan, Ohio, and Wisconsin have the broadest distribution. Black Tern breeding distribution for Minnesota, Wisconsin, and Michigan are shown in Figures 3- 5.

Minnesota's major Black Tern concentrations occur in the west-central and north-central counties where there is an abundance of lakes and wetlands (Baker and Hines 1996). In Wisconsin a statewide survey conducted in 1979 showed the highest populations occurring along the shore of Green Bay, Collins Marsh, Crex Meadows, Horicon Marsh, Killsnake and Manitowoc Rivers, and Crescent Lake in Oneida County (Tilghman 1980). More recent surveys have shown that Black Tern populations are small but stable or increasing in the southeastern part of Wisconsin, having disappeared from many small of the small isolated wetlands and concentrated into a few suitable wetlands (Matteson and Mossman 2000, Shealer 2003). In Michigan, the most important Black Tern breeding concentrations are the marshes located near Higgins and Houghton Lakes, Lake St. Clair; Saginaw Bay, the Straits region, and marshes in Muskegon, Ottawa, Roscommon and Allegan counties (Chu 1994).

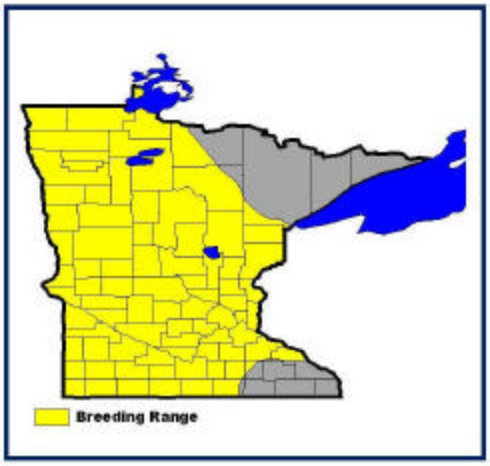

Figure 3. Breeding Range of Black Tern in Minnesota (source: Minnesota Ornithologist Union).

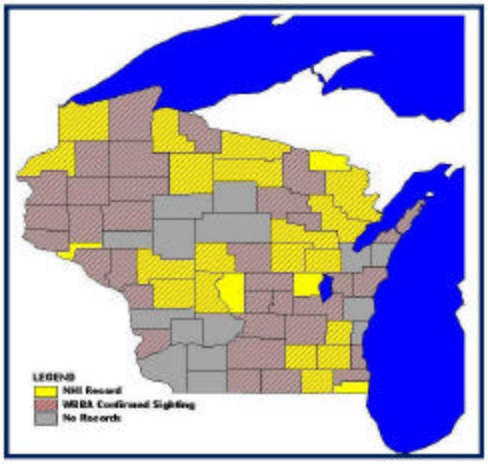

Figure 4. Breeding range of Black Tern in Wisconsin (source: Wisconsin Natural Heritage Inventory, and Wisconsin Breeding Bird Atlas [WBBA]).

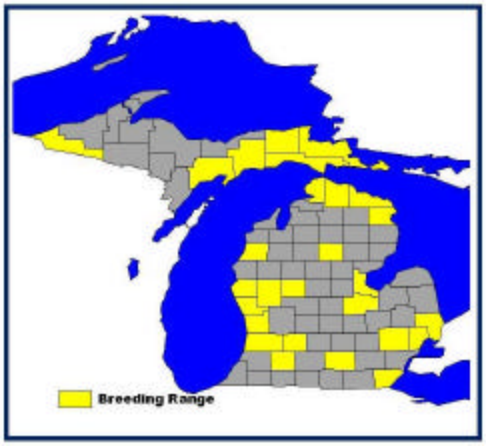

Figure 5. Breeding Range of Black Tern in Michigan (source: Michigan Natural Heritage Inventory).

National Forest Distribution

Appendix 3 provides a summary of the number of Black Tern occurrences reported for the Minnesota, Wisconsin, and Michigan National Forests. A possible explanation for the Chequamegon-Nicolet having the greatest number of occurrence records (37) is because of the specific surveys and monitoring conducted for Black Terns from 1991-1998. Black Terns are also recorded during the annual Nicolet National Forest Breeding Bird Survey, which surveys a variety of upland and wetland habitats. From 1988 to 1998, a total of 62 adult Black Terns were counted in this survey. (Note: there is some duplication between Appendix 3 records and the Nicolet Breeding Bird Survey records.) There are 13 Black Tern occurrence records for the Hiawatha National Forest. The Michigan Natural Heritage lists three Black Tern element occurrences from the Hiawatha National Forest, which were last observed between 1993 and 1996. Michigan's Breeding Bird Atlas confirmed breeding records for four townships, probable for six townships, and possible for three townships that are located within the Hiawatha National Forest (USDA Forest Service 2003). Records from the remaining national forests include seven on the Chippewa, four on the Huron-Manistee, three on the Superior, and two on the Ottawa.

Rangewide Status

Overall, the status of the Black Tern is declining. During the period 1966 to1989 the breeding population declined at an annual rate of 5.6% per year, which results in an overall population decline of 71.8% (Novak et al. 1999). A query of the North America Breeding Bird Survey between 1966 to 1998 shows a non-significant increasing trend for the "United States region" but a significant declining trend for the "Eastern Breeding Bird region" and Region 3 of the US Fish and Wildlife Service (FWS R3), and a non-significant declining trend for the "Survey-wide region" (Sauer et al. 2000). The data for

all these regions is assigned the intermediate category of credibility as defined by the North American Breeding Bird Survey. This category could reflect low relative abundance on survey routes, small sample sizes, imprecise trends or inconsistency in trend over time (Sauer et al. 2000). Although there may be deficiencies in the data from the North American Breeding Bird Survey, this is the best available source of breeding trends for this species. The decreasing trend in the Eastern Breeding Bird and FWS R3 areas are in agreement with population declines reported by Currier (2000), Mortensen (pers. comm. 2001), and others. Figure 6 presents the Black Tern population change (%) per year from 1966 to 1996 for North America.

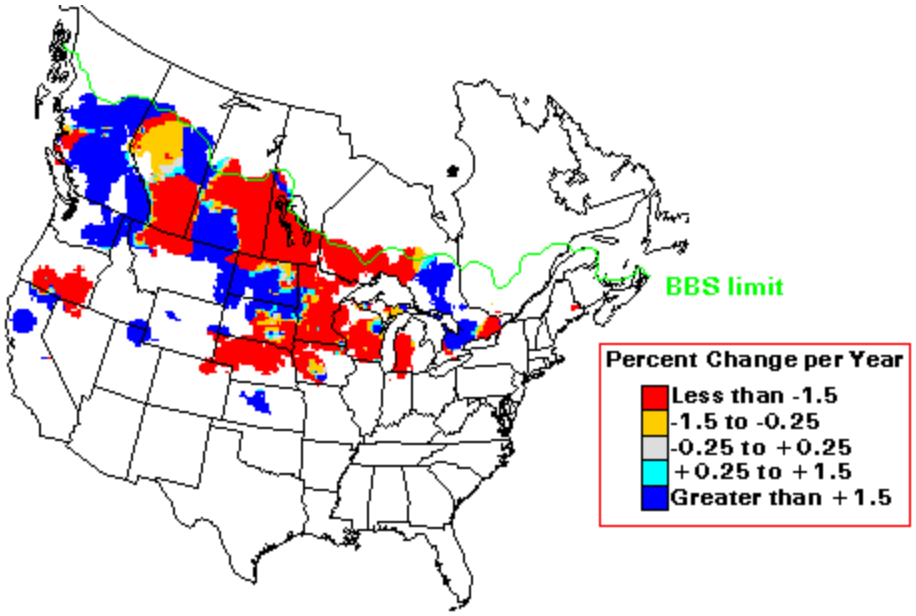

Figure 6. Annual population trend of Black Terns from Breeding Bird Survey routes in the United States and southern Canada, 1966 to 1996; data is summarized as the percent change per year for each route (Sauer et al. 1997).

The Black Tern was given a Global Rank of G4 on November 27, 1996 (NatureServe 2001). The definition for a G4 ranking is widespread, abundance apparently secure globally, though it may be quite rare in parts of its range, especially the periphery (typically 101+ occurrences and 10,000 individuals); some cause for long-term concern exists. The rationale for the G4 ranking is Black Tern has a widespread distribution and is relatively abundant, although habitat alteration and degradation may threaten the species (NatureServe 2001). Figure 7 provides the status ranking for Black Terns by individual state and province.

Black Terns are listed as endangered in Maine, New York, Pennsylvania, Indiana, and Illinois; threatened in Vermont; a species of special concern in California, Idaho, Iowa, Montana, Utah, and Wyoming; a species in need of conservation in Kansas and a state monitor species in Washington. The provinces of Alberta and British Columbia have placed the Black Tern on their yellow list. The remaining states and provinces in North

America do not have a government status for the Black Tern (Shuford 1999).

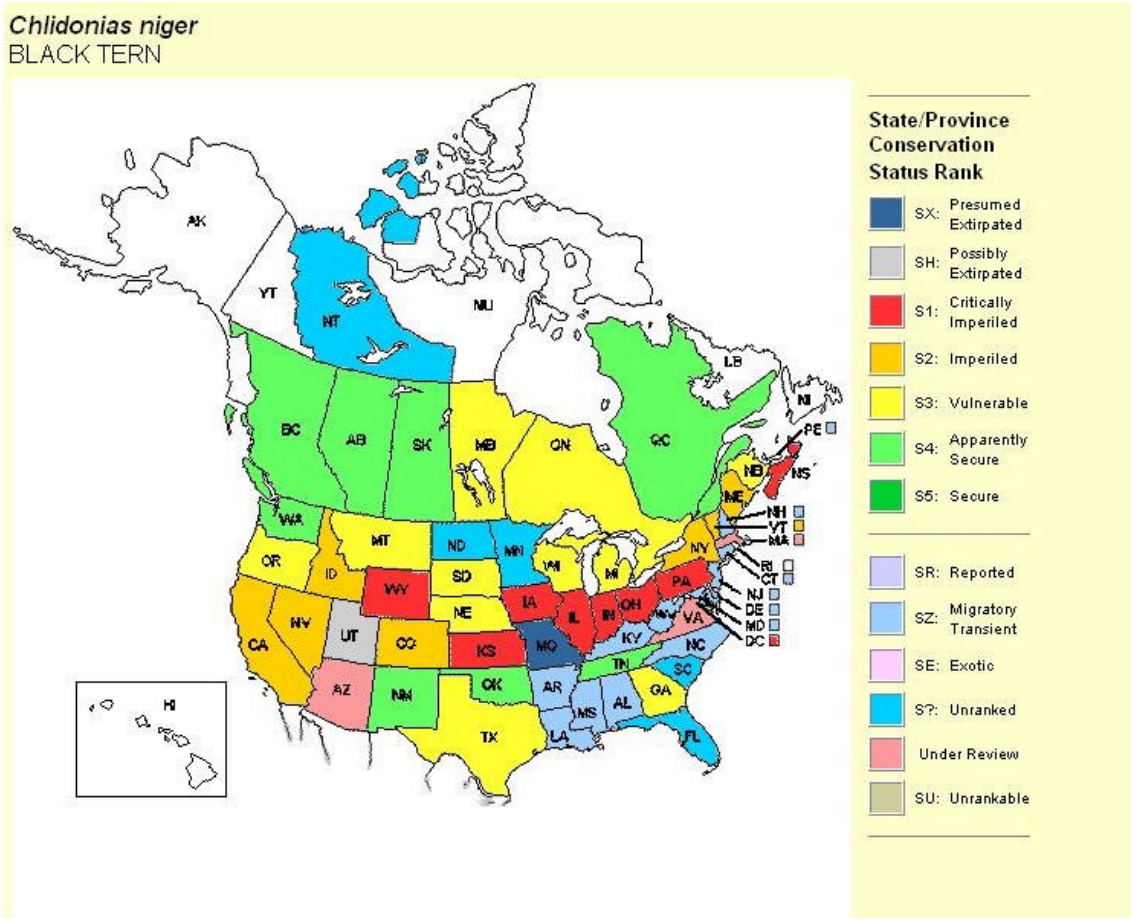

Figure 7. State/Province Conservation Status Rank for Black Terns (NatureServe 2003)*

Lake States and Provincial Status

A colonial waterbird census conducted from 1997 to 1999 for the Great Lakes, Lake St. Clair, Lake Champlain, Lake Winnebago, and the Saint Mary's River, reported 1106 Black Tern nests compared to1664 nests for the previous 10-year census, eventhough Lake Champlain was not included in the previous census (Cuthbert 2003).

Shuford (1999) cites several sources that describe the Black Tern as common to abundant, and widely distributed in Minnesota as late as 1995. Baker and Hines (1996) suggest that Minnesota's breeding Black Tern population may be the largest in northcentral United States, and perhaps in the entire United States. This seems to contradict the Breeding Bird Survey trend of –2.4% for 1966 to 1996 in Minnesota (Peterjohn, B.G., and Sauer, J.R. 1997). However, Robbins (1991) cautions that the Breeding Bird Survey may not accurately gauge population changes in marsh-dwelling species.

In Wisconsin, Robbins (1991) reports the Black Tern as a common migrant, a common summer resident in the south and east, and a fairly common resident in the west and north. Part of the reason for this common to fairly common statewide status was the presence of some sizable colonies along the Lake Superior marshes, but all of these colonies disappeared after 1995. For example, one Black Tern colony on Lake Superior's Kakagon Slough within the Bad River Indian Reservation numbered approximately 65 pairs in 1995, and none in 1996 (T. Doolittle pers. comm. 2003). A 2.3% decline over a 30-year period (1966 to 1996) in Wisconsin was reported by the Breeding Bird Survey (Peterjohn and Sauer 1997). Although none of these Breeding Bird Survey trends were significant for Black Terns, Shuford (1999) cited several studies where a similar downward trend was noted. Matteson and Mossman (2000) report a decreasing breeding population in Wisconsin during the period 1980 to 1997, with the clearest evidence from roadside surveys conducted between 1980 to 1982 and 1995 to 1997 where a 60% decline was noted. The Checklist Project (summary for 1984 to 2000) shows a variable but significant decline for the species (Wisconsin Society for Ornithology 2000). In southeastern Wisconsin, Black Tern breeding populations have actually increased or remained stable in recent years, but this is suspected to be the result of a high rate of immigration (Shealer 2003).

In Michigan, the species is considered a common migrant and local summer resident along the shores of the Great Lakes, and fairly common inland. However, it is declining as a breeder in Michigan (Chu 1994). Shuford (1999) cites conflicting reports showing examples of both increasing and decreasing Black Tern populations.

Table 1 provides the state and provincial listings and heritage rankings for the Lake States, Pennsylvania and Ontario.

Table 1. Selected State and Provincial Rankings for Black Tern

State	State Threatened/Endangered or Special Concern Listing	State/Province Heritage Status Ranks
Illinois	Endangered	S1
Indiana	Endangered	S1B, SZN
Michigan	State special concern (SC)	S3
Minnesota	Not listed as T, E, or SC	No status (Unranked)
New York	Endangered	S2B

Ohio	Not listed as T, E, or SC	S1
Ontario*	COSEWIC rating Not at risk OMNR rating Vulnerable	S3B, SZN
Pennsylvania	Endangered	S1B
Wisconsin	Not listed as T, E, or SC	S3B, SZN

*COSEWIC = Committee on the Status of Endangered Wildlife in Canada, OMNR = Ontario Ministry of Natural Resources.

State Ranks: S1 species are critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state. S1B species have the same designation as S1 during the breeding season. S2B species are imperiled in a state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state during the breeding season. S3 species are rare or uncommon in a state (on the order of 21 to 100 occurrences). S3B species have the same designation as S3 during the breeding season. SZB species are not of significant concern in the state during breeding season or (SZN) non-breeding season. These taxa often are not encountered in the same locations from year to year.

National Forest Status

The following national forests in the eastern region list the Black Tern as a Regional Forester's Sensitive Species: Huron-Manistee, Hiawatha, and Ottawa in Michigan, Chequamegon-Nicolet in Wisconsin, and the Superior and Chippewa in Minnesota. The Midewin Grassland in Illinois lists the Black Tern as "present but not determined to be at risk", since they have very little suitable breeding habitat and the species is seen infrequently during migration (B. Glass pers. comm. 2003). The Black Tern is reported as not occurring on the remaining national forests in the eastern region.

Very little historical information on Black Terns is available for the Lake States National Forests. In Minnesota, the Superior National Forest is at the edge of the Black Tern's historic range. On both the Superior and Chippewa National Forests, the Black Tern is considered a rare species. The Chequamegon-Nicolet National Forest is located in the forested part of the state where Black Terns have been far less common than in other regions. They are currently listed as rare on this Forest. For the Michigan national forests, Black Terns were likely common in large coastal marshes along the Lake Michigan and Lake Huron shorelines. They are listed as rare on these Forests as well (USDA Forest Service 2000, 2003).

Population Biology and Viability

Reproductive success in Black Terns is highly variable. Like many other long-lived species they are naturally adapted to withstand high levels of chick and egg loss, even <

1 chick fledged per nesting attempt (Novak 1992, Dunn and Agro 1995). Adaptations to marsh nesting include frequent renesting, low site tenacity, and eggshell morphology suited to damp conditions (Dunn and Agro 1995). Low site tenacity was observed in a southeastern Wisconsin study where only 4% of the 281 banded adults were recaptured three years after banding (Shealer 2002). Black Terns do not breed before their second summer when some, but not all, first attain black plumage. Some may delay breeding beyond age two or even skip an occasional year of breeding (Howell 1964, Voous 1983). Cramp (1985) reports that many two to three year old Black Terns may visit a breeding range without breeding. Shealer (2002) found a negative relationship between colony size and reproductive productivity, where large colonies suffered near complete failure primarily due to predation.

Although the primary habitat for Black Terns is located in the prairie regions, many biologists feel that there is enough habitat existing on the national forests in Minnesota and Wisconsin to sustain a viable population. A cumulative effects analysis completed for the Chequamegon-Nicolet National Forest concluded that the likelihood of ecological conditions that contribute to the long-term abundance and distribution of Black Terns is expected to remain at its present level for all planning alternatives (USDA Forest Service 2003b). For Michigan's national forests, there is no speculation as to their ability to sustain a Black Tern population. It is believed that colonies with > six pairs are needed to maintain a viable population (T. Doolittle pers. comm., USDA Forest Service 2000, 2003).

Potential Threats

Present or Threatened Risks to Habitat or Range

Threats to Black Tern habitat include loss of freshwater marshes, contaminants (e.g. PCBs, DDT) (Scharf 1999, Novak et al. 1999, Currier 2000), metals (Currier 2000), and acid rain (Brewer 1991). Successional processes include changes in water levels, invasion by exotic wetland plants (e.g. purple loosestrife), and degradation of water quality (Novak et al. 1999, Ennis pers. comm. 2000) and have the potential to render wetlands unsuitable for use by Black Terns. Changes to wintering grounds and migration area habitats may also be responsible for Black Tern population declines (Matteson and Mossman 2000). Brewer (1991) suggests that the long-term survival of the Black Tern and other marsh species may require international reductions of airborne pollutants.

Commercial, Recreational, Scientific, or Educational Over-utilization

Human activities such as fishing, swimming, and boating, may disturb Black Tern colonies and prevent adults from incubating eggs or feeding offspring. In addition, boat wakes could disturb the floating nests either submerging eggs or drowning chicks (Currier 2000). Normally, Black Tern adults actively defend their nest sites from human intruders. However, in one study neither hatching or fledging success of Black Terns was negatively affected by investigator disturbance (Shealer and Haverland 2000).

Disease or Predation

Ectoparasites collected from Black Terns include feather mites, lice and the apparently host-specific filarioid nematode (*Eulimdana andersoni*)(Barlett 1992). No trematodes have been reported in Black Terns from the United States, however, one tremetode was recorded from Black Terns in Russia (Mirzoeva 1980 In Novak et al. 1999). The effects of parasites on survival of the Black Tern have not been studied. Black Terns are susceptible to avian botulism, but no major die-offs have been reported (Novak et al. 1999). The Centers for Disease Control has not reported a positive sample for West Nile Virus in a Black Tern (as of 9/03), but the future impact is unknown.

Studies have presented evidence of predation on eggs or chicks by great horned owl (*Bubo virginianus)*, great blue heron (*Ardea herodias)*, black-crowned night heron *(Nycticorax nycticorax)*, muskrat (*Ondatra zibethicus)*, mink (*Mustela vison)*, and Norway rats (*Rattus norvegicus)*. Other predators that are suspected of preying on Black Tern eggs or chicks include raccoon (*Procyon lotor)*, long tailed weasel (*Mustela freneta)*, otter (*Lutra canadensis*), northern harrier (*Cirus cyaneus)*, American bittern (*Botaurus lentiginosus)*, ring-billed gull (*Larus delawarensis)*, American crow (*Corvus brachyrhynchos)*, common raven (*Corvus corax)*, marsh wren (*Cistothorus palustris)*, water snake (*Natrix sipedon)*, painted turtle (Chrysemys picta), and snapping turtle (*Chelydra serpentina)* (Dunn and Agro 1995, Scharf 1999). There are accounts of adult Black Terns being attacked by a common raven, northern harrier, and large fish (Dunn and Argo 1995). A four-year study of Black Terns in Wisconsin's Horicon Marsh provided strong evidence that predation, not habitat, is the leading cause of nest failure. During this study, at least 48%, and possibly as much as 85%, of all nest failures were attributed to predation (Shealer 2002).

Inadequacy of Existing Regulatory Mechanisms

Section 404 of the Clean Water Act and the Swampbuster provision of the Food Security Act of 1985 provide some protection for Black Tern breeding habitats, although these are not adequate to prevent all wetland losses. Section 404 prohibits the discharge of dredged or fill materials into U.S. waters, including wetlands. Despite permit requirements for any activity that involves placement of dredge or fill material in a wetland, net annual wetland loss in the U.S. averaged 47,370 ha (117,000 acres) between 1985 and 1995. Incentive programs such as the Wetland Reserve Program offer some breeding habitat protection with wetland easements in perpetuity (Shuford 1999).

Current regulatory mechanisms are inadequate to protect the species and its habitats on the winter range. Most countries in these areas have no legal mechanisms in place for protecting the Black Tern or its winter habitats. In Mexico, no regulations exist to protect the habitat of the Black Tern, and current regulations protecting the species may not be adequately enforced (Shuford 1999).

Other Natural or Human Factors Affecting Continued Existence of Black Terns

Human caused disturbance at nesting colonies, particularly boat traffic, can swamp or destroy floating nests (ROM 1999). Wakes from large shipping vessels cause disturbance to Black Tern nesting along the St. Mary's River, and can influence the location of aquatic vegetation and nesting colonies (Scharf 1999). A single early June storm resulted in the loss of the largest number of nests in a 1977 study in Wisconsin (Bailey 1977).

Although no cases of direct mortality of Black Terns due to toxic exposure have been reported in the literature (Zimmerman et al. 2002), contaminants must be considered as having possible biological impacts on the declines of Black Terns (Heinz et al. 1985). In one study, some of the highest mercury levels in eggs from a group of inland aquatic birds (but not Black Terns) was detected in the Chequamegon and Nicolet National Forests, and the Seney National Wildlife Refuge (Faber and Hickley 1973). In that same study, mercury values in eggs from Black Terns collected from Green Bay were somewhat higher than in most eggs from other areas. In a study conducted in Ontario and Quebec (Weseloh et al. 1997), the levels of contaminants found in Black Tern eggs were low compared to other colonial nesting waterbirds. Although studies conclude that direct chemical toxicity is generally not considered a problem for Black Terns, pesticides may reduce their insect foods (Shuford 1999). Table 2 lists threats to Black Terns as determined by managers at each of the Lake States national forests.

Table 2. Threats or Risks to Black Terns and their Habitat by National Forest

Forest	Risk or Threat
Chequamegon-Nicolet	Jet skis and motorboat use on a Price County lake may threaten a colony. Shoreline development of private land within the national forest boundary and specific to the annual weed removal at one location on the Lakewood District. Fluctuating water levels, especially on flowages. Loss of habitat due to reduced muskrat numbers, and acid rain (pers. comm., USDA Forest Service 2000).
Chippewa	On the Chippewa, habitat is not considered

	threatened at this time. However, habitat loss could occur if muskrat numbers decline. Other threats include acid rain, mammalian predators at island sites, pesticide contamination, exotic plants and invertebrates, and boat traffic near nesting sites. (pers. comm., USDA Forest Service 2000)
Hiawatha	Threats include wetland loss and degradation, pollution from organochlorides and heavy metals, exotic species (e.g. purple loosestrive), and human-caused disturbance (boating, fishing, swimming, etc.). Exposure to West Nile virus is a possible treat. (pers. comm., USDA Forest Service 2003)
Huron-Manistee	Identified threats include wetland loss and degradation, pollution from organochlorides and heavy metals, exotic species (e.g. purple loosestrive), and human-caused disturbance (boating, fishing, swimming, etc.). West Nile Virus is a possible treat. (pers. comm., USDA Forest Service 2003)
Ottawa	Identified threats include wetland loss and degradation, pollution from organochlorides and heavy metals, exotic species (e.g. purple loosestrive), and human-caused disturbance (boating, fishing, swimming, etc.). West Nile Virus is a possible treat. Draw down of the Presque Isle flowage if conducted during the nesting season may negatively affect this species. (pers. comm., USDA Forest Service 2003)
Superior	Threats include acid rain, pesticide contamination, exotic plants and invertebrates, boat traffic near nesting areas, and loss of habitat due to muskrat declines. (pers. comm., USDA Forest Service 2000)

Summary of Land Ownership and Existing Habitat Protection

Shuford (1999) summarized current regulations and believes that they provide the Black Tern adequate protection throughout its breeding range. Currently the species is protected under the Migratory Bird Treaty Act (1918) in the United States, the Migratory Bird

Convention Act (1916) in Canada, and the Convention for the Protection of Migratory Birds and Game Mammals (1936) in Mexico. The Endangered Species Act in the U.S. and the Committee on the Status of Endangered Wildlife in Canada will provide further protection for the Black Tern if it becomes threatened with extinction. Further, the Black Tern is a U.S. Fish and Wildlife Service Migratory Nongame Bird of Management Concern in the United States (USFWS 1995). Recently the Black Tern was listed as a Category 2 candidate for review for possible addition to the Federal endangered or threatened species list (USFWS 1991), however use of the Category 2 listing was discontinued (USFWS 1996).

There are a number of wetland protection initiatives that are currently protecting the habitat of Black Terns and other wetland species. These include the North American Waterfowl Plan, No-Net-Loss of Wetlands policy, and the "Swampbuster" provision of the Food Security Act of 1985 (P.L. 99-198, commonly known as the 1985 Farm Bill). The Swampbuster provision prevents farmers who drain wetlands from receiving agricultural subsidies and other economic benefits of the bill, which has helped to curtail the destruction of wetland habitats essential for Black Terns (Novak et al. 1999). Enforcement of state and federal wetland regulations and a greater public recognition of wetland values also would help in the effort to preserve wetland habitat and Black Terns (Novak et al. 1999).

A number of authors (reviewed in Novak et al. 1999) state that relative to overall state populations, large numbers of Black Terns breed on government managed wetlands in Wisconsin, Michigan, New York, Vermont, Minnesota and perhaps elsewhere. Appendix 4 provides a list of the number of occurrences and land ownership by national forest in the western Great Lake States.

Summary of Existing Conservation and Management Activities

Conservation and management options necessary to ensure population stabilization or increase listed by Currier (2000) include habitat preservation through land acquisition and conservation easements. Viable options also include wetland creation, water level regulation of managed inland marsh complexes, education efforts, and restricting access (Novak et al. 1999). Preservation of wetlands in sizes large enough to attract Black Terns and to allow adults to move to areas of suitable water depth as natural drought cycles recur is the most straightforward conservation option (Brewer 1991). Wetlands managed for waterfowl are attractive if flooding/drawdown regimes preserve appropriate emergent vegetation, nesting substrate, and stable water levels through the nesting season (Hands et al. 1989).

Several researchers in western New York have outlined a wetland impoundment management plan for Black Terns. The marshes are drawn down in May, disked in July or August, and then reflooded. It is recommended that the marshes be placed on a four to six year drawdown followed by flooding in years two and five. Additionally, it is

recommended that in the first year of flooding, water levels be kept higher than normal to inhibit the growth of undesirable vegetation such as purple loosestrife, and promote the increase of the muskrat population. Again, the goal is to maintain or create emergent marshes with an approximate 50:50 vegetation to open water ratio with good interspersion of each. Black Terns almost always colonize impoundments the year following reflooding, with peak numbers usually occurring in the second or third year after reflooding (Shuford 1999).

In the northern Great Plains, cattails have overgrown many wetlands, which has contributed to the decline of Black Terns. In 1991 a cattail control program using herbicides was initiated on selected wetlands in North Dakota to increase duck habitat and reduce crop-depredating blackbirds. Black Tern numbers, and certain duck species, were positively correlated with the resulting increase in open water (Linz and Blixt 1997). In Wisconsin, Mossman et al. (1988) also noted that Black Terns avoided thick cattail stands and nested in marshes with a mixture of emergent vegetation, mud flats, and shallow open water. Muskrats help create the interspersion of vegetation and open water through their feeding, and provide Black Tern nesting structures. However, high muskrat numbers can remove too much vegetation resulting in unsuitable Black Tern habitat. Beule (1979) describes several methods to control cattails, including covering with black tarps, mechanical crushing, and cutting mature stems below the surface of the water.

Artificial nesting platforms may assist in luring Black Terns to more protected locations and may be less prone to nest failure from wave action (Novak et al. 1999). However, the research results are mixed as to how they actually influence Black Tern reproductive success. Where water levels fluctuate, artifical nesting platforms can lead to higher productivity. Both timing (before nest initiation) and location of placement (suitable vegetation habitat and water depths) are two factors to consider when using platforms (Shuford 1999, Laurent 1993). Also, Shealer (2003) warns that nest platforms may serve as predator attractors where predators and not habitat is the limiting factor. Adult occupancy of artificial nesting platforms is increased when decayed vegetation is placed on the structure and when the platform is the correct size (Faber 1992). (See section under Life History for nest dimensions.)

In Minnesota, the Objibwe Tribe manages Leech Lake and has an active management program for colonial nesting species (Superior National Forest). Black Tern use of newly constructed wetland impoundments is well documented in many studies. One example is the Chippewa National Forest, where 9 of 12 impoundments studied had breeding Black Terns (Probst et al. 1983).

The National Forest Management Plans for Wisconsin, Minnesota, and Michigan contain the following direction for Black Terns:

Chequamegon-Nicolet National Forest (2003 Revised Forest Plan Draft Management Guidelines):

- Maintain impoundment and flowage water levels and avoid disturbance within

one mile of active Black Tern nests between May 1 and July 15.
    - Conduct surveys within potential Black Tern nest habitat, and where water levels could possibly be manipulated during the breeding season (May 1 to July 15). Monitor and document nest disturbance, especially from boat and jet ski traffic.
- Protect Black Tern colonies by coordinating with local town governments to restrict recreation activities or reduce activity impacts during the nesting season.
- Emphasize purple loosestrife eradication on water bodies with active Black Tern colonies.
- Maintain muskrat habitat within Black Tern habitat.

Chippewa and Superior National Forests (2003 Revised Forest Plan Draft Management Objective):

- In all known breeding locations maintain or restore high quality nesting habitat: marshes or shallow rivers or lakes with suitable balance of open water and emergent vegetation.
- Management activities, especially prescribed fire, that may adversely impact nesting habitat in the short term in order to restore future suitable habitat, should maintain adequate undisturbed nesting habitat.

Hiawatha National Forest (2003 Draft Species Viability Evaluation Conservation Measures [for Common Loon, Trumpeter Swan, and Black Tern])

- Limit/restrict motorized use on quality lakes by access control.
- Seasonal closures and or signing during nesting.
- Monitor lakes.
- Establish artificial nesting islands.
- Manage quantity of recreation use-carrying capacity of recreation relative to species.

Huron-Manistee National Forest (2003 Draft Species Viability Evaluation Conservation Measures [for marsh species group: Northern Harrier, King Rail, Black-crowned Night Heron, Black Tern, Blanding's Turtle, Spotted Turtle, Eastern Massasauga Rattlesnake)

- Shallow water emergent marshes are lacking on the Forest.
- Maintain and enhance emergent marshes on the Forest. They need to be >25 acres with associated vegetation composition.
- Create additional future habitats.

All national forests abide by state watershed Best Management Practices (BMPs) and have standards and guidelines within Forest Plans (Management Area direction) to protect wetland areas.

To date, most Black Tern management in North America has been piecemeal. The need for experimental testing of management techniques and publication of these results for wetland habitats on both breeding and migration areas (Dunn and Agro 1995).

Research and Monitoring

Existing Surveys, Monitoring, and Research

The North American Breeding Bird Survey (BBS) is useful in following population trends. The surveys are conducted during the peak of the nesting season, primarily in June, and some national forests participate in yearly survey routes. The BBS was designed to provide a continent-wide view of population change for most species, but may not be a good measure of Black Tern population changes (Robbins 1991).

The U.S. Fish and Wildlife Service conducts a colonial waterbird survey for the Great Lakes region every ten years. The last survey period was 1997 to 1999 (Cuthbert 2003), with the next one scheduled to begin in 2007.

In Wisconsin, Tilghman (1980) initiated a Black Tern survey in 1979. This statewide survey was repeated annually through 1982, and then again during 1995-1997 (Matteson and Mossman 2000). Currently, no formal statewide surveys are being done.

The Chequamegon-Nicolet National Forest began a Black Tern survey in 1991, and continued to collect observations through 2000. At this time no national forests are currently surveying for Black Terns on a yearly basis. The majority of the national forests rely on monitoring of known colonies by district biologists while they are traveling to other projects. Additional observations are reported by the public or by fisheries crews working in areas near a nest or colony.

The Black Tern conservation plan (Shuford 1999) commissioned by the U.S. Fish and Wildlife Service listed the need to refine monitoring techinques to better detect population trends, and conduct research to determine limiting factors and evaluate management techniques as top priorities. The conservation plan also included a survey protocol outline and research priorities citing suggestions from several sources.

Survey Protocol

Surveys of Black Tern breeding colonies should be completed two to three weeks after the adults begin arriving on the breeding grounds (late May – late June in the northern states and Canada) (Novak et al. 1999). The BBS uses a point count method. Surveying specific areas where terns are expected to occur is another possible method. Erwin and Hoover (undated) suggest ground estimates of large colonies (>200) and direct nest counts for smaller colonies using the total adult count as the estimated number of breeding pairs. The rationale is that most attempts to correlate numbers of nests and adults converge at about 1.0, although there may be variation by time of day, season, or colony (Erwin and Hoover undated). Stewart and Kantrud (1972) believe that Black

Terns readily change colony sites, and thus detailed site studies are not useful for regional population monitoring. They suggest appropriate regional survey techniques should include stratified random sampling or standardized surveys of all suitable sites. The stratified random sampling is best for areas with extensive breeding habitat (Stewart and Kantrud 1972), and standardized surveys are best for areas with limited habitat (Mossman 1980, 1981, Tilgman 1979). Shealer (2003) believes that the absolute reliance on census data alone may supply false or misleading information for the highly nomadic Black Tern. Because the Black Tern changes breeding sites as water levels change, it is an extremely difficult species to monitor (F.Cuthbert pers. comm. 2004).

Black Tern surveys conducted in Wisconsin utilized permanent roadside transects and nest census areas. Most surveys were completed by the same observers at approximately the same dates and times each year (Matteson and Mossman 2000).

Scharf (1999) located colonies by first locating windrows of dead plant material piled from wind and wave action called "wrack". Wrack can be identified from the air or from a boat. Important information to collect during nesting surveys includes the number of eggs, nest substrate, water depth, dominant plant species, height of eggs above water, distance to open water, and distance to other tern nests (Novak et al. 1999).

In order to establish a partial measure of reproductive success, a follow-up visit to count nestlings or fledglings is needed. These surveys would need to occur before young disperse from breeding areas (Novak et al. 1999).

Research Priorities

In Michigan, Nisbet (1997) identified the need for additional studies to properly assess Black Tern numbers and trends. Nisbet (1997) also believes that productivity measurements, foraging, diet, and nutrition studies will assist in conservation efforts, and that comparative studies across habitats and regions are necessary for insight into behavior and ecology. Nisbet (1997) suggests that the study of metapopulation dynamics and demography investigations are both essential components to understanding Black Tern population ecology. In addition, the effects of human-caused disturbance on Black Terns are not well studied (Currier 2000).

Novak et al. (1999) identified several research needs for the Black Tern. These included determining the causes of nest failure and mortality at nesting colonies, evaluating the effectiveness of artificial nest platforms, determining site fidelity, examining the effects of human disturbance, determining factors affecting renesting after nest failure, determining foraging range and habitat use at breeding sites, studies to measure movements and mortality rates in the nonbreeding season, and feeding habits during the nonbreeding season. In addition, Dunn and Agro (1995) listed changes in first-year and adult annual survival, age at first breeding, and possible skipping of breeding after first attempt as research needs. Also, more information is needed on stopover times, locations, and food sources used during migration and on wintering areas. Finally,

nothing is known about the physiological changes accompanying this species when it shifts between freshwater and marine habitats (Dunn and Agro 1995).

References

Baggerman, B., G.P. Baerends, H.S. Heikens, and J.H. Mook. 1956. Observations on the behavior of the Black Tern, *Chlidonias niger* (L.), in the breeding area. Ardea 44:2-71.

Bailey, P.F. 1977. The breeding biology of the Black Tern (*Chlidonias niger surinamensis).* M.S. thesis. University of Wisconsin, Oshkosh, Wisconsin. 67 pp.

Baker, R., and J. Hines. 1996. Black Tern sightings in Minnesota: 1990-1995. The Loon 68:137-140.

Bartlett, C.M. 1992. New, known and unidentified species of *Eulimadana* (Nematoda): additional information on biologically unusual filarioids of charadriiform birds. Syst. Parasitol. 23: 209-230.

Beule, J.D. 1979. Control and management of cattails in southeastern Wisconsin wetlands. Wisconsin Dept. of Nat. Res., Madison, WI. Technical Bulletin No. 112. 39pp.

Black Tern distribution map. Available at http://www.mbr-pwrc.usgs.gov/bbs/htm96/htmra/ra0770.html.

Brewer, R. 1991. Black tern *Chlidonias niger* pgs. 226-227 In: The Atlas of Breeding Birds in Michigan, Brewer, McPeek, and Adams, Michigan University Press. 594 pp.

Brown, M., and J.J. Dinsmore. 1986. Implications of marsh size and isolation for marsh bird management. J. Wildl. Manage. 50: 392-397.

Burger, J. 1985. Habitat selection in temperate marsh-nesting birds. Pages 253-281 *in* M.L. Cody, editor. Habitat selection in birds. Academic Press, Inc., Orlando, Florida

Canadian Wildlife Service-The Terns of the Canadian Great Lakes. 2003. Available at http://on.ec.gc.ca/wildlife/factsheets/fs_terns-e.html

Chu, P.C. 1994. Black Tern (*Chlidonias niger*). *In* J. Granlund, G.A. McPeek, R.J. Adams, P.C. Chu, J. Reinoehl, C.Nelson, R. Schinkel, M.Kielb, S. Allen, and A. Trautman 1994. The Birds of Michigan, pp. 132-133. Indiana Press, Bloomington and Indianapolis.

Cramp, S., ed. 1985. *Chlidonias niger* Black Tern. Pp. 143-155 *in* The birds of the western palearctic. Vol 4. Oxford Univ. Press, Osford.

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

Cuthbert, N.L. 1954. A nesting study of the Black Tern in Michigan. Auk 71:36-63.

Cuthbert, F.J. 2003. U.S. Great Lakes colonial waterbird survey, 1997-1999. Draft report to the U.S. Fish and Wildlife Service.

Delehanty, J.J., and W.D. Svedarsky. 1993. Black Tern colonization of a restored prairie wetland in northwestern Minnesota. Prairie Naturalist 25:213-218.

Doane, L.A. 1972. Behavior of Black Terns on their nesting grounds. Inland Bird Banding 44:136-144.

Dunn, E.H. 1979. Nesting biology and development of young Ontario Black Terns. Can. Field-Nat. 93:276-281.

Dunn, E. H. and D. J. Agro. 1995. Black Tern (Childonias niger). In The Birds of North America, No. 147 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C. 24 pp.

Eddy, J. 1961. Nesting habits of the Black Tern. Flicker 33:3-4.

Eichorst, B.A., and J.R. Reed. 1985. Re nesting of a Black Tern. North American Bird-Bander 10:8.

Einsweiler, S.S. 1988. Black Tern nesting biology in Cheboygan County, Michigan. M.S. thesis. Central Michigan University, Mount Pleasant, Michigan. 43 pp.

Erwin, R. M. and B. Hoover. Undated. Colonial Waterbird Inventory and Monitoring (Recommended Protocol for Regional/National Colonial Waterbird Inventory & Monitoring Program). 4 pp. Available at http://www.im.nbs.gov/cwb/cwb.html.

Faanes, C.A. 1979. Status of the Black Tern in western Wisconsin. Passenger Pigeon 41:124-128.

_____ 1981. Birds of the St. Croix River Valley: Minnesota and Wisconsin. U.S. Fish and Wildlife Service, Washington, D.C. North American Fauna 73. 196 pp.

Faber, R. A. 1990. Nesting ecology of the Black Tern on the Upper Mississippi River National Wildlife and Fish Refuge and the Trempealeau National Wildlife Refuge. Unpublished report to U.S. Fish and Wildlife Service, St. Mary's College, Winona, Minnesota. 13pp.

_____ 1992b. The Black Tern: effects of water level fluctuations on hatching success, and a census of nesting on pools 5 and 7. FWS grant agreement 14-16-003-91-984 final report. Unpublished report to U.S. Fish and Wildlife Service, St. Marty's College, Winona, Minnesota. 16 pp.

_____ 1996. Impacts of artificial nest platforms and water levels on hatching success in Black Terns. Colonial Waterbirds Society Bulletin 20:53.

Faber, R.A., and J.J. Hickley. 1973. Eggshell thinning, chlorinated hydrocarbons, and mercury in inland aquatic bird eggs, 1969 and 1970. Pestic. Monit. J. 7:27-36.

Fevold, B.M. 1998. The 1997 breeding population study of Forster's and Black Terns at Horicon National Wildlife Refuge. U.S. Fish and Wildl. Serv., Unpubl. report.

Firstencel, H. 1987. The Black Tern (*Chlidonias niger* Linn.): breeding ecology in upstate New York and results of pesticide residue analyses. Master's thesis, State Univ. of New York, Rockport.

Gerson, H. 1987. The status of the Black Tern (*Chlidonias niger*) in Canada. Committee on the status of endangered wildlife in Canada. Unpubl. rep. Comm. Status Endang. Wildl. Canada, Ottawa.

Gough, G.A., J.R. and Sauer, M. Iliff. 1998. Black tern Identification Tips, Patuxent Bird Identification Info. Center, Version 97.1. Patuxent Wildlife Research Center, Laurel, MD. Available at http://www.mbr-pwrc.usgs.gov/id/fram1st/Life History/lh0770.html.2pp.

Gough, G. 11/9/00. Life History Groupings Black Tern: USGS Patuxent Wildlife Research Center. Available at http://www.mbr-pwrc.usgs.gov/id/fram1st/Life History/lh0770.html.1pp.

Graetz. J.L., and S.W. Matteson. 1996. The status of Black Terns in Wisconsin, 1995. Passenger Pigeon 58:241-248.

Hands, H.M., R.D. Drobney, and M.R. Ryan. 1989. Status of the Black Tern in the north central United States. U.S. Dep. Interior, Fish and Wildl. Serv., Twin Cities, MN.

Heinz, G.H., T.C. Erdman, S.D. Haseltine, and C. Stafford. 1985. Contaminant levels in colonial waterbirds from Green Bay and Lake Michigan, 1975-1980. Environ. Monitor. Assess. 5:223-236.

Hickey, J.M., and Malecki, R.A. 1997. Nest site selection of the Black Tern in western New York. Colonial Waterbirds 20:582-595.

Howell, T.R. 1964. Birds collected in Nicaragua by Bernardo Ponsol. Condor 66: 151-158.

Hoffman, E. 1954. Black Terns at Big Muskego. Passenger Pigeon 16:3-8.

Hoffman, P.W. 1926. Nesting of the Black Tern in Wisconsin. Auk 43:86-87.

Hoffman, R.M. 1990. Birds of Wisconsin's deep marshes and shallow open-water communities. The Passenger Pigeon, Vol. 52, No. 3.

Indiana Natural Heritage Data Center, List of Endangered, Threatened and Rare Species by County. http://www.ai.org/dnr/naturpr/species/index.htm.

Integrated Taxonomic Information System, Black tern. 11/9/00 http://www.it is.usda.gov/is.usda.gov/plantproj…%5ftype=S&input=Chlidonias%20niger 1 pp.

Laughlin, S.B., and D.P. Kibbe, editors. 1985. The atlas of breeding birds of Vermont. Universtiy Press of New England, Hanover Vermont. 456 pp.

Laurent, S.M. 1993. Impact of water level on Black Tern (*Chlidonias niger)* hatching success. B.A. thesis, Saint Mary's College, Winona, Minn.

Life History Groupings, Black tern 11/9/00 http://www.mbr-pwrc.usgs.gov/id/fram1st/Lifehistory/1h0770.html. 1pp.

Linz, G.M. and D.C. Blixt. 1997. Black terns benefit from cattail management in the northern Great Plains. Colonial Waterbirds 20 (3): 617-621.

Manci, K.M., and D.H. Rusch. 1989. Waterbird use of wetland habitats identified by infrared aerial photography. Pages 1045-1058 *in* R.R. Sharitz and J.W. Gibbons, editors. Freshwater wetlands and wildlife. Proceedings of a symposium held at Charleston, South Carolina, March 24-27, 1986. U.S. Department of Energy Office of Scientific and Technical Information, Oak Ridge, Tennessee.

Matteson, S.W. and M. J. Mossman 2000. Changes in Wisconsin Black Tern populations, 1980-1997. Unpubl. report to U.S. Fish and Wildlife Service's Migratiory Nongame Bird Program and Wis. Dept. of Nat. Resourc. 14 pp.

McPeek, G.A. and R.J. Adams (eds.) 1994. Black Tern. Pgs. 226-227. The Birds of Michigan. Indiana University Press.

Michigan Natural Features Inventory. Michigan County Element List, September 1999. http://www.dnr.state.mi.us/wildlife/heritage/mnfi/lists/1999_county_lists.pdf. 98 pp.

Mirzoeva, S.S. 1980. Trematodes of birds of the Divichinsk Bay of central Caspia. Izvestiya Akad. Navk Azerb. SSR 1980:88-93.

Mossman, M. 1980. The second year of Wisconsin's Black Tern survey, 1980. Unpubl. rep. Wis. Dept. Nat. Resour., Madison. 23 pp.

_____. 1981. The 1981 Wisconsin Black Tern survey. Unpubl. rep. Off. Endang. and Nongame species. Wis. Dept. Nat. Resour., Madison. 9+ pp.

_____. 1983. The 1983 Black Tern survey. Unpubl. rep. Bur. Endang. Resour. Wis. Dept. Nat. Resour., Madison. 5pp.

Mossman, M.J., A.F. Techlow III, T.J. Ziebell, S.W. Matteson, and K.J. Fruth. 1988. Nesting gulls and terns of Winnebago Pool and Rush Lake, Wisconsin. Passenger Pigeon 50:107-117.

NatureServe 2003. An online encyclopedia of life [web application]. Version1.8. NatureServe, Arlington, Virginia. Available at http://www.natureserve.org/explorer

Naugle, D.E. 1997. Habitat area requirements of prairie wetlands birds in eastern South Dakota. Ph.D. thesis, South Dakota State Univ., Brookings.

Naugle, D.E., R.R. Johnson, M.E. Estey, K.F. Higgins, and S. Nusser. 2000. Local and landscape-level factors influencing Black Tern habitat suitability. J. Wildl. Mgmt. 64 (1): 253-260.

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

Novak, P.G., J.Soule, and R.Jennings; rev. by G. Hammerson and D.W. Mehlman. 1999. Black Tern (*Chlidonias niger*). Wings Info Resources/Species Information and Management Abstracts, The Nature Conserv. 19pp.

Peck, G.K., and R.D. James. 1983. Breeding birds of Ontario: nidiology and distribution. Vol. I: Nonpasserines. Life Sci. Misc. Publ., Royal Ontario Museum, Toronto.

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

Powell, A.N. 1991. Monitoring Black Tern populations in Minnesota in association with the USFWS waterfowl productivity survey. Report submitted to: Minnesota Department of Natural Resources, Nongame Program, St. Paul, Minnesota. 24pp.

Probst, J.R., D.Rakstad, and K. Brosdahl. 1983. Diversity of vertebrates in wildlife water-impoundments on the Chippewa National Forest. USDA Forest Ser., North Central Forest Exp. Sta., Res. Paper NC-235.

Robbins, S.D., Jr. 1991. Wisconsin Birdlife: Population and Distribution, Past and Present. Univ. Wisconsin Press, Madison.

Royal Ontario Museum and the Ontario Ministry of Natural Resources 1999. Ontario's Biodiversity: Fast Facts, Black tern. March. http://www.rom.on.ca/cgi-bin/cdcd/fastfact.pr/speciesID 1 pp.

Sauer, J.R., J.E. Hines, G. Gough, I. Thomas, and B.G. Peterjohn. 1997. The North American Breeding Bird Survey results and analysis. Version 96.4 Patuxent Wildlife Research Center, Laurel, MD. http://www.mbr.nbs.gov/bbs/bbs.html

Sauer, J. R., J. E. Hines, I. Thomas , J. Fallon, and G. Gough. 2000. The North American Breeding Bird Survey, Results and Analysis 1966-1999. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD. Updated August 22, 00, ran query 12/27/00.

Scharf, W. C. 1999. Black Tern Nesting Colonies and Habitats in Marshes of the St. Mary's River, Michigan. Michigan Birds and Natural History. Vol. 6 No. 2. pp. 65-73.

Shealer, D. A. 2002. Population dynamics of Black Terns nesting in southeastern Wisconsin: 2002 field season report. Unpubl. report to U.S. Fish & Wildlife Service, Horicon NWR, Mayville, WI.

Shealer, D.A. 2003. Annual survival, breeding site fidelity, and natal recruitment of Black Terns breeding in southeastern Wisconsin, 1999-2003. Unpubl. report to U.S. Fish & Wildlife Service, Horicon NWR, Mayville, WI.

Shealer, D.A., and J.A. Haverland. 2000. Effects of investigator disturbance on the reproductive behavior and success of Black Terns. Waterbirds 23: 15-23.

Shuford, W.D. 1999. Status assessment and conservation plan for the black tern (*Chlidonias niger surinamensis)* in North America. U.S. Department of Interior, Fish and Wildlife Service, Denver, CO. Available at http://www.r6.fws.gov/blacktern/sacp.htm

Stewart, R.E., and H.A. Kantrud. 1972. Population estimates of breeding birds in North Dakota. Auk 89: 766-788.

Svedarsky, W.D. 1992. Biological inventory of a multi-purpose flood control impoundment in northwestern Minnesota and potentials for nongame and game bird management. Final Report. Northwest Agricultural Experiment Station, University of Minnesota, Crookston, Minnesota. 115pp.

Tilghman, N.G. 1980. The Black Tern Survey, 1997. Passenger Pigeon 42:1-8.

USDA Forest Service. 2000. Population Viability Assessment-National Forests in Minnesota and Wisconsin. Unpubl. report.

USDA Forest Service. 2003. Population Viability Assessment-National Forests in Michigan. Unpubl. report.

USDA Forest Service. 2003a. Chequamegon-Nicolet NF Draft Forest Plan

U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants; animal condidate review for listing as endangered or threatened species, proposed rule. Federal Register 56:58804-58836.

U.S. Fish and Wildlife Service. 1995. Migratory nongame birds of management concern in the United States: The 1995 list. Office of Migratory Bird Mgmt., U.S. Fish and Wildl. Serv., Washington, D.C.

U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates for listing as endangered or threatened. Federal Register 61: 7596-7693.

USGS 1998. Forest and Rangeland Birds of the United States Natural History and Habitat Use, Black Tern-*Chlidonias niger*. 1998. http://www.npwrc.usgs.gov/resource/1998/forest/species/chlinige.html 1 pp.

USGS 2000. Marshbirds and Shorebirds of North Dakota, Black tern. 11/9/00 available at http://www.npwrc.usgs.gov/resource/othrdata/marshbrd/blktern.html. 1 pp.

Voous, K.H. 1983. Birds of the Netherlands Antilles. De Walburg Pers., Utrecht.

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 20:604-616.

Wisconsin Breeding Bird Atlas. 2001. Black Tern Breeding Status. 1 pp. Last edit June 5, 2001. Available at http://wso.uwbg.edu.wbba/.

Wisconsin Natural Heritage Program. Rare Species and Natural Communities, NHI Working List by County. http://www.dnr.state.wi.us/org/land/er/workinglists/countylist/.

Wisconsin Society for Ornithology Checklist Project. Available at http://www.uwgb.edu/birds/wso/listproject.htm

Zaret, T.M., and R.T. Paine. 1973. Species introduction in a tropical lake. Science 183: 449-455.

Zimmerman, A.L., J.A. Dechant, D.H. Johnson, C.M. Goldade, B.E. Jamison, and B.R. Euliss. 2002. Effects of management practices on wetland birds: Black Tern. Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/literatr/wetbird/blte/blte.htm

Appendicies

Appendix 1. Black Tern Habitat Characteristics (reproduced in part, and modified from Zimmerman et al. 2002.)

Author (s)	Location (s)	Habitat (s) Studied	Species-specific Habitat Characteristics
Bailey 1977	Wisconsin	Lake	Nested in and around large stands of hardstem bulrush ;nests were constructed of cattail, hardstem bulrush, or algae; 50% of 143 nests were placed on floating cattail rootstalks, 20% in live cattail stands (stands were 5-25 m in diameter, 14% on floating bulrush stems, 9% on mats of floating algae, and 7% on floating boards; the closest nest to shore was 25 m and all nests were within 1-2 m of open water; nested in loose groups of two to four pairs, but sometimes in groups of 10 or more pairs; two closest nests were 75 cm apart; of 82 nests surveyed in 1976, 6% were 0-1 m apart, 25% were 1-5 m apart, 37% were 5-20 m apart, 16% were 20-50 m apart, and 16% were >50 m apart
Burger 1985	Minnesota	Wetland	Nested in areas of sparse (not defined) cattails, usually on floating nests that were loosely attached to vegetation stems, or less commonly on top of muskrat houses
Cuthbert 1954	Michigan	Wetland	Nested mostly in hardstem bulrush and softstem bulrush, followed by cattail/bulrush mixture, cattail, cattail/yellow pond lily mixture, and bur-reed; nest substrates were floating dead plant material, floating logs or boards, abandoned muskrat lodges, and non-floating piles of dead bulrushes; of 27 nests, 85% were placed in water 0.6 m or more in depth; nested most commonly in thinly scattered bulrush 1 m or less from open water, although two nests were in dense cattails near a clearing made by muskrats; a colony of 17 nests were in a 8-ha tract and an additional 10 nests were scattered in five sets of two each; distances between nests

			ranged from 9 to 36 m; distances between the pairs of nests ranged from 90 to 200 m
Delehanty and Svedarsky 1993	Minnesota	Impound-ment (restored)	Nested in newly restored wetland in all 3 yr. of study; used dead hardstem and softstem bulrush for nesting material; nested near the wetland edge in an area protected from the wind by emergent vegetation, trees, and a ridge; fledglings moved from the nest in the restored wetland to open, sandy points on the edge of the reservoir where they were fed by adults
Doane 1972	Wisconsin	Wetland	Colony contained 16 nests; one nest was on a mudflat; a few nests were < 1 m from one another
Eddy 1961	Minnesota	Lake	Nested in bulrush, waterlily, and cattail; water depth at 51 nests was 15-79 cm and nests were located in a 5.1-ha area; defended the area up to 2 m from nest
Eichhorst and Reed 1985	Wisconsin	Lake	Renested on a deserted Red-necked Grebe nest
Einsweiler 1988	Michigan	Impound-ment, lake, wetland	Nested in cattail and bulrush; mean water depth at 34 nests was 24 cm during incubation and decreased to 20.5 cm during the nestling stage; 17 of 34 nests were on mud mounds in shallow water, 14 nests were on floating grass/sedg mats in deep-water areas, 2 nests were on deserted Pied-billed Grebe nests, and 1 was on an artificial nest platform
Faanes 1979	Wisconsin	Wetland	Of 52 nests, 51 were on mats of floating vegetation in the deep-marsh zone of a wetland; one was on a muskrat lodge; nest substrates were cattail (17 nests), river bulrush (16 nests), hardstem bulrush (12 nests), submerged aquatic vegetation (6 nests), and muskrat lodge (1 nest)
Faanes 1981	Minnesota, Wisconsin	Wetland	Occurred on large seasonal and semipermanent wetlands that supported an abundance of emergent vegetation; preferred to nest on floating mats of vegetation composed of submerged plants and emergent plant leaves
Faber 1990, 1992a, 1992b, 1996	Minnesota	Wetland	Nested in shallow (<46 cm) water among bur-reed, common threesquare, and cattail; nested on larger (81 cm by 81 cm) artificial platforms more frequently than on smaller (61 cm by 61 cm) platforms; nest success was greater on artificial platforms (65% of 23 nests) than on natural substrates (44% of 185 nests);

			successful nests had greater water depths than unsuccessful nests (49.7 cm vs. 39.9 cm in one year and 53.6 vs. 46.6 cm in the second year); only four of 21 nests with a minimum water depth<30.5 cm were successful; colony size ranged from 2 to 56 pairs
Graetz and Matteson 1996	Wisconsin	River, wet meadow, wetland	Occurred in wetlands, river edges, and flooded sedge meadows; breeding sites were dominated by bulrush, cattails, bur-reed, sedges, grasses, water plantain, and arrowhead
Hoffman 1926	Wisconsin	Lake	Nested on small hummocks or on floating mats of dead bulrush; nests were constructed of dead bulrush; six nests were found in a 21 m square area
Hoffman 1954	Wisconsin	Lake	Nested in shallow bays of inland lakes or shallow river widenings that contained cattails, bulrush, wild rice, pond lilies, and pickerelweed; nested on floating dead bulrush that gathered along the outer edges of cattail and bulrush stands, or on abandoned muskrat lodges or exposed mudflats; nested in loose colonies; most nests were 3 m or more apart, rarely 1.5 m apart
Manci and Rusch 1989	Wisconsin	Wetland	Nested in cattail stands where the mean water depth was 29 cm; avoided water >50 cm deep
Mossman et al 1988	Wisconsin	Wetland	Nested in areas with a mixture of emergent vegetation, mudflats, and shallow open water; 71% of 173 nests were located on rhizomes of hardstem bulrush, 9% on mats of residual bulrush or cattail stems, 7% on floating boards, 3% on mats of muskgrass, and 1% on inactive nest structures of Red-necked or Piled-billed grebes; avoided dense stands of cattails
Powell 1991	Minnesota	Wetland, wetand complex	Nested on semipermanent wetlands 15-50 ha in size with 5-95% open water and patches of sparse to moderately dense emergent cover; vegetation was dominated by bulrush; nested on mats of floating dead bulrush in the interior of the wetland; three colonies contained 4, 10, and 15 pairs; colonies occurred only on wetland within wetland complexes
Svedarsky 1992	Minnesota	Idle mixed-grass, idle mixed grass/	Nested in a restored wetland in an area that had equal amounts of open water and emergent vegetation; foraged in areas of open water

		tame, idle tame, impound-ment, wetland restored	
Tilghman 1980	Wisconsin	River, wet meadow, wetland	Nested in wetlands, river edges, and flooded sedge meadows in areas dominated by cattail, bulrush, and sedges; emergent vegetation cover ranged from 51 to 75% in over 85% of 205 occupied sites; nest substrates were floating peat mats, muskrat feeding platforms, dead floating cattails, or floating cattail rootstalks

Appendix 2. Black Tern Occurrence in the Great Lake States and Ontario by County and Year*

State	County of Occurrence	Number of Occurrences and Year
Illinois	Cook County	7 occurrences, 1978, 1979, 1989, 1990, 1991, 1992, 1996.
	DuPage County	4 occurrences, 1987 (2), 1989, 1994.
	Lake County	9 occurrences, 1976, 1991 (3), 1992, 1994, 1995, 1998.
	McHenry County	8 occurrences, 1991, 1993, 1995, 1998, 1999 (2), 2000 (2).
Indiana	Kosciusko County Lagrange County Laporte County Newton County Noble County Steuben County St. Joseph County Wabash County White County	No information
Michigan	Allegan County (ABB) Alpena (ABB) Arenac County (ABB) Barry County (ABB)	2 confirmed, 5 probable. 2 probable, 1 possible. 2 probable, 1 possible. 1 confirmed, 1 probable, 1 possible.

State	County of Occurrence	Number of Occurrences and Year
		1 confirmed, 2 probable, 2 possible.
	Bay County (ABB)	1 probable, 3 possible.
		1 possible.
	Berrien County (ABB)	1 possible.
	Cass County (ABB)	2 probable, 1 possible.
	Charlevoix County (ABB)	3 occurrences, 1993, 1996 (2
	Cheboygan County (ABB)	1 probable, 1possible.
	Chippewa County	1 occurrence, 1994 MNFI.
		1 possible.
		1 possible.
	Clare County (ABB)	2 confirmed, 3 probable.
	Delta County	2 probable.
		1 confirmed, 1 probable.
		1 probable, 2 possible.
	Dickinson County (ABB)	1 possible.
	Eaton County (ABB)	1 possible.
	Emmet County (ABB)	1 possible.
	Gladwin County (ABB)	1 confirmed, 1 probable, 2 possible.
	Gogebic County (ABB)	3 confirmed, 1 possible.
	Huron County (ABB)	4 possible.
	Ionia County (ABB)	1 probable.
	Iosco County (ABB)	1 possible.
	Iron County (ABB)	6 confirmed, 6 probable, 5 possible.
	Jackson County (ABB)	1 confirmed, 1 probable.
	Kalamazoo County (ABB)	2 confirmed.
	Kent County (ABB)	1 confirmed.
	Livingston County (ABB)	1 probable.
	Luce County (ABB)	1 probable.
	Mackinac County (ABB)	1 probable, 1 possible.
	Macomb County (ABB)	1 confirmed on border of counties.
	Manistee County (ABB)	1 confirmed, 1 probable, 4 possible.
	Mecosta County (ABB)	1 confirmed.
	Menomiee County (ABB)	1 confirmed, 1 possible.
	Midland County (ABB)	2 confirmed.
	Missaukee County (ABB)	1 possible
	Monroe/Wayne County border (ABB)	1 confirmed, 5 probable, 2 possible.
	Muskegon County (ABB)	1 confirmed, 1 probable.
	Newaygo County (ABB)	2 confirmed, 4 probable, 3 possible.
	Oakland County (ABB)	1 occurrence, 1990.
	Oceana County (ABB)	2 confirmed, 2 probable, 2 possible.
	Ogemau County (ABB)	1 occurrence, 1995.
	Ottawa County (ABB)	3 possible.
	Presque Isle County (ABB)	1 probable, 2 possible.
	Roscommon County (ABB)	

State	County of Occurrence	Number of Occurrences and Year
	Saginaw County Schoolcraft County (ABB) St. Claire County Washtenaw County (ABB) Wayne County (ABB)	
Minnesota**		All considered active colonies 1970-2000 prior to 1995-2000 late 1980s-2000 late 1980s-2000 early 1970s-2000
New York	Cayuga County Clinton County Erie County Genesee County Genesee, Niagara, Orleans Co. Jefferson County Monroe County Monroe County, NY State Waters Oneida County Onondaga County Oswego County Oswego, Jefferson County Seneca, Cayuga County St. Lawrence County Wayne County	1 occurrence, 1973. 2 occurrences, 1964, 1994. 1 occurrence, 1970. 3 occurrences, 1992,1994, 1995. 1 occurrence, 1995. 8 occurrences, 1991, 1992, 1994 (3), 1995(2), 1998. 5 occurrences, 1980, 1989, 1990, 1995 (2). 1 occurrence, 1989. 1 occurrence, 1969. 1 occurrence, 1956. 4 occurrences, 1992, 1994 (2), no date. 1 occurrence, 1994. 1 occurrence, 1989. 2 occurrences, 1974, 1995. 1 occurrence, 1994.
Ohio	Lucas County (Schieldcastle pers. comm.) Sandusky County (Schieldcastle pers. comm.)	Probable nesting. 2-3 occurrences.

State	County of Occurrence	Number of Occurrences and Year
Ontario	Algoma District	1 occurrence, 1991.
	Brant County	1 occurrence, 1967.
	Bruce County	6 occurrences, 1984, 1989, 1990,1991 (3).
	Cochrane District	2 occurrences, 1988 (2).
	Durham Regional Municipality	5 occurrences, 1989 (2), 1990, 1991, 1997.
	Essex County	3 occurrences, 1982, 1991, 1997.
	Frontenac County	5 occurrences, 1991.
	Grey County	5 occurrences, 1989 (2), 1990, 1991 (2).
	Haldimand-Norfolk Regional Municipality	3 occurrences, 1991 (2), 1997.
	Hamilton Regional Municipality	1 occurrence, 1991.
	Hastings County	3 occurrences, 1988, 1991 (2).
	Huron County	1 occurrence, 1990.
	Kent County	5 occurrences, 1991 (30, 92-97)
	Lambton County	3 occurrences, 1991 (2), 1997.
	Lanark County	10 occurrences, 1986, 1989 (3), 1990 (3), 1991 (3).
	Leeds and Greenfield County	12 occurrences, 1989, 1990 (4), 1991 (7).
	Lennox and Addington County	5 occurrences, 1991 (4), 1992.
	Manitoulin District	8 occurrences, 1974, 1977,1978 1983, 1989, 1990, 1991 (2).
	Metro Toronto	1 occurrence, 1997.
	Niagara Regional Municipality	2 occurrences, 1989, 1991.
	Nipissing District	1 occurrence, 1990.
	Northumberland County	3 occurrences, 1991, 1992. 1997.
	Ottawa-Carleton Regional Municipality	1 occurrence, 1991. 1 occurrence, 1987.
	Perth County	8 occurrences, 1969, 1982, 1988, 1990 (3), 1991, 1997.
	Peterborough County	7 occurrences, 1989, 1991(6).
	Prince Edward County	2 occurrences, (2).
	Rainy River District	1 occurrence, 1990.
	Renfrew County	6 occurrences, 1984, 1985, 1991 (3), 1997.
	Simcoe County	Occurrence, 1991.
	Thunder Bay District	2 occurrences, 1968, 1989.
	Timiskaming District	1 occurrence, 1991.
	Victoria County	8 occurrences, 1987, 1988 (2), 1989 (2), 1991 (2), 1997.
	Waterloo Regional Municipality	2 occurrences, 1979 (2).
	Wellington County	2 occurrences, 1980, 1997.
	York Regional Municipality	3 occurrences, 1989, 1991, 2000.

State	County of Occurrence	Number of Occurrences and Year
Pennsylvania	Crawford County	4 occurrences, first observed and last observation dates are given: 1910-1983, 1926-1967, 1934-1936,1989.
	Erie County	3 occurrences, 1890-1958, 1987 and 1990.
Wisconsin	Adams County	1 confirmed
	Ashland County	1 confirmed, 1 probable.
	Barron County	1 probable.
	Bayfield County (WBBA)	2 confirmed, 1 probable.
	Buffalo County (WBBA)	
	Burnett County	1 confirmed, 1 probable.
	Calumet County (WBBA)	1 probable.
	Chippewa County (WBBA)	6 confirmed, 2 probable.
	Columbia County (WBBA)	1 probable.
	Crawford County (WBBA)	4 confirmed, 2 probable
	Dane County (WBBA)	4 confirmed
	Dodge County (WBBA)	1 confirmed
	Door County (WBBA)	
	Douglas County	1 confirmed
	Dunn County (WBBA)	
	Florence County	2 confirmed
	Forest County (WBBA)	4 confirmed, 1 probable
	Green County (WBBA)	3 confirmed
	Iron County (WBBA)	1 confirmed
	Jackson County (WBBA)	
	Jefferson County	4 confirmed, 1 probable
	Juneau County (WBBA)	
	Kenosha County	2 confirmed
	La Crosse County (WBBA)	1 confirmed
	Lake Fond du Lac (WBBA)	3 probable, 1 confirmed
	Langlade County (WBBA)	2 confirmed
	Manitowoc County (WBBA)	
	Marathon County	possible
	Marinette County	3 confirmed, 1 possible
	Marquette County (WBBA)	1 confirmed
	Milwaukee County (WBBA)	
	Monroe County	3 confirmed
	Oconto County (WBBA)	
	Oneida County	3 confirmed
	Outagamie County (WBBA)	
	Pepin County	1 confirmed
	Pierce County (WBBA)	1 confirmed
	Polk County (WBBA)	6 confirmed
	Portage County	possible
	Price County	3 confirmed
	Racine County (WBBA)	1 confirmed
	Rock County (WBBA)	1 probable
	Rusk County (WBBA)	1 confirmed
	Sawyer County (WBBA)	3 confirmed

State	County of Occurrence	Number of Occurrences and Year
	Shawano County (WBBA)	1 confirmed
	St. Croix County (WBBA)	1 confirmed
	Vilas County (WBBA)	1 confirmed
	Walworth County	5 confirmed, 5 probable
	Washburn County (WBBA)	1 confirmed
	Washington County	1 confirmed, 1 probable
	Waukesha County (WBBA)	1 confirmed, 1 probable
	Waupaca County	2 confirmed
	Waushara County (WBBA)	2 confirmed
	Winnebago County	1 confirmed, 1 probable
	Wood County (WBBA)	1 confirmed, 1 probable

*County occurrence information from the following on-line searches of Michigan Natural Features Inventory, Michigan County Element List-September 1999; Wisconsin Natural Heritage Program, Rare Species and Natural Communities, NHI Working List by County; Wisconsin Breeding Bird Atlas available on-line; Indiana Natural Heritage Data Center, List of Endangered, Threatened, and Rare Species by County, November 16, 1999; Ontario Natural Heritage Information Centre, Rare Species Query by County query ran 1/9/01 and information supplied from database queries received from the Minnesota Heritage and Nongame Research Program, Ontario Natural Heritage Information Centre, Illinois Heritage Database, New York Natural Heritage Program, Michigan Natural Features Inventory, and Pennsylvania Natural Diversity Inventory (western Pennsylvania only).

** Minnesota active/inactive colony in 2000.

Information on county occurrence from sources other than State Heritage Databases, have their sources in parenthesis. ABB=Atlas of Breeding Birds in Michigan, WBBA= Wisconsin Breeding Bird Atlas.

Appendix 3. Number of Black Tern Occurrences and Land Ownership by National Forest

Forest	Number of Occurrences	County	Land Ownership	Comments
Cheq.-Nicolet	1	Price County	Lakeshore is a mixture of FS and private ownership.	Laona District 1993
	1	Oneida County	50% FS ownership	Eagle River District (both in 1988).
	2	Oneida County (2)	Mixture of private and National Forest. Approx. 50:50 mix each location.	Laona District 1991-1997 Laona District 1993
	5	Forest County	60% FS ownership	Laona District 1991
	1	Forest County	50% FS ownership	Laona District 1993
	1	Forest County	70% FS ownership	Lakewood District 1991-1992
	1	Forest County	100% FS ownership	Laona District 1992-1997
	2	Forest County	20% FS ownership	Laona District 1991
	4	Forest County	unknown	Laona District 1992
	1	Forest County	90% FS ownership	Laona District 1992
	1	Forest County	95% FS ownership	Laona District 1992
	1	Forest County	20% FS ownership	Laona District 1992-1997
	1	Forest County	Private ownership	Laona District 1992
	4	Forest County	unknown	Laona District 1993
	1	Forest County	Private ownership	Eagle RD, 1992, 1994.
	1	Forest County	100% FS ownership	Florence District 1991
	1	Forest County	100% FS ownership.	Florence District 1991
	1	Florence County	40% FS ownership	Florence District 1991 Florence District 1991

Forest	Number of Occurrences	County	Land Ownership	Comments
	1	Florence County	100% FS ownership	Florence District, 1990, 1992, 1994.
	1	Florence County	10% FS ownership	Florence District, 1990.
	1	Florence County	100% FS ownership	Lakewood District 1989, 1993, 1995 and 1997.
	2	Florence County	Unknown	1994, 1998.
		Unknown County	Unknown	
	1	Oconto County	100% FS ownership	
	1	Marinette County?	Off Forest	
Chippewa	4	Beltrami County	Private (1), State (2) NF (1)	
	1	Cass County	State land	Leech Lake
	2	Itasca County	National Forest	
Hiawatha	2	Mackinac County	Both areas 50% FS /50% private	
	2	Alger County	95% and 100% FS	
	7	Delta County	100% FS except Moss Lake ½ private	On private land (Nahama site)
	2	Schoolcraft County	100% FS	
Huron-Manistee	2	Oscoda County	100% FS ownership	Location is within a wildlife management unit
	2	Iosco County	Unknown	
Ottawa	2	Gogebic County	No USFS ownership. Small amount of ownership of wetland along river drainage into this lake. The second location is 95% FS ownership. Private	

Forest	Number of Occurrences	County	Land Ownership	Comments
			ownership at dam.	
Superior	1 confirmed 1989 by (Litchfield) also active in 1991.	St. Louis County	100% Forest Service	Hasn't been active for the past 4-5 years. High water levels at the time may have decreased the suitability of the site.
	2 confirmed, believed to be feeding young on one site 1995 (Litchfield and Wilson)	Lake County	MNDNR ownership	

List of Contacts

A list of regional, state, provincial, and territorial contacts and contributors for the U.S. Fish and Wildlife's Status Assessment and Conservation Plan for the Black Tern (Shuford 1999) is contained in Appendix 2 of that document, and is an excellent source for further information. The list below are those individuals contacted for this Conservation Assessment.

Steve Mortensen, Leech Lake Division of Resource Management, Leech Lake Band of Objibwe, Minnesota
Ed Lindquist, Forest Wildlife Biologist, Superior National Forest, Minnesota
Mary Shedd, Planning Biologist, Superior National Forest, Minnesota
Melissa Grover, District Wildlife Biologist, Kawishiwi District, Superior National Forest
Al Williamson, Forest Ecologist, Chippewa National Forest, Minnesota
John Casson, District Wildlife Biologist, Cass Lake Ranger District, Chippewa National Forest, Minnesota
Sharron Nelson, Minnesota Heritage and Nongame Program
Francesca Cuthbert, Dept. Fish, Wildlife and Cons. Biol, University of Minnesota
David Shealer, Dept. Biology, Loras College, Iowa
Steve Wilson, Minnesota Department of Natural Resources
Dan Litchfield, Minnesota Department of Natural Resources

Norm Weiland, Forest Wildlife Biologist, Chequamegon-Nicolet National Forest, Wisconsin
Dan Eklund, Forest Wildlife Biologist, Chequamegon-Nicolet National Forest, Wisconsin
Linda Parker, Forest Ecologist, Chequamegon-Nicolet National Forest, Wisconsin
Michael Steck, Biological Sciences Technician, Lakewood-Laona Ranger District, Chequamegon-Nicolet National Forest, Wisconsin
Tom Matthiae, District Wildlife Biologist, Laona Ranger District, Chequamegon-Nicolet National Forest
Sumner Matteson, Avian Ecologist, Wisconsin Department of Natural Resources
Michael Mossman, Research Biologist, Wisconsin Department of Natural Resources
Robert Howe, University of Wisconsin-Green Bay
Jerry Edde, Forest Fisheries Biologist, Ottawa National Forest, Michigan
Robert Johnson, District Wildlife Biologist, Ontonagon Ranger District, Ottawa National Forest, Michigan
Paul Makela, Forest Wildlife Biologist, Hiawatha National Forest, Michigan
Kevin Doran, District Wildlife Biologist, Munising Ranger District, Hiawatha National Forest, Michigan
Bill Glass, Midewin Grassland, Illinois
Steve Sjogren, District Wildlife Biologist, St. Ignace District, Hiawatha National Forest, Michigan
Kenneth Ennis, Forest Wildlife Biologist, Huron-Manistee National Forest, Michigan
Phil Huber, Wildlife Biologist, Mio Ranger District, Huron-Manistee National Forest, Michigan
Dave Riegle, Wildlife Biologist, Huron Shores Ranger District, Huron-Manistee National Forest, Michigan
Michael Fashoway, Michigan Natural Features Inventory Program
Ray Adams, Kalamazoo Nature Center, Michigan
Mark Schieldcastle, Research Wildlife Biologist, Ohio Department of Natural Resources, Crane Creek Wildlife Area
Anthony Zammit, Ontario Natural Heritage Information Centre
Robert Gottfried, Illinois Natural Heritage Database
Teresa Mackey, Information Services, New York Natural Heritage Program
Kierstin Carlson, Pennsylvania Natural Heritage Inventory