Conservation Assessment for Caspian tern (Sterna caspia)

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This document is undergoing peer review, comments welcome

This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation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 the subject taxon, 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 draft conservation assessment providing a summary of readily available information on the distribution, ecology, habitat, and population biology of Caspian tern in the Great Lake States. This document was compiled to assist in writing of the Conservation Assessment for the Beach Dune Community.

The Great Lakes Region harbors approximately one third of the North American continent's population of Caspian terns. Historically the Caspian tern was restricted to Northern Lake Michigan (Evers 1992). Populations had fluctuated naturally until the invasion of the alewife in the mid-1950s, allowing this species to increase due to increased food availability (Evers 1992). The Caspian tern population has nearly tripled since 1963, greatest on Lake Ontario (Cuthbert and Wires 1999). This increase in population of Caspian terns continued into the early 1990s (Evers 1992). The North American Breeding Bird Survey shows a significant increasing trend for this species in the survey-wide and United States region (Sauer et al. 2000). Despite increasing numbers in the Great Lakes, the Caspian tern has special status in Michigan (threatened), and Wisconsin (Endangered) (Cuthbert and Wires 1999) due to the low number of nesting sites and human-related pressures (Evers 1997).

Colony instability, poor reproduction, and the low number of nesting pairs have contributed to its endangered status in Wisconsin (WIDNR 1999). Chemical contaminants (especially PCBs) (Ludwig and Kurita 1988 In Ludwig 1991), human disturbance at colony sites, competition with ring-billed gulls, and predation by Great-horned owls and other predators may be the cause of declining nesting success and colony abandonment (WIDNR 1999). Gulls and Cormorants exert heavy competition for nesting space especially during periods of high water (Ludwig 1991). A correlation was found between PCB consumption from Caspian terns feeding on contaminated fish to rising rates of chick deformities and depressed hatching rates (Ludwig 1991). The mean fledge rate of 1.46 chicks per nest in 1962-1967 period plummeted to 0.61 in the 1986-1989 period (Ludwig et al 1990 In Ludwig 1991). Disturbance and development of nesting habitat have also been listed as major threats (NatureServe 2001). The primary factor limiting populations appears to be availability of high-quality nest sites protected from storms and free of mammalian and avian predators (Penland 1976, Shugart et al. 1978, Cuthbert 1981 In Cuthbert and Wires 1999).

Individual colonies characterized by lower-than-expected size or productivity should be carefully monitored to determine factors affecting the observed changes (Evers 1997). Clear conclusions about effects of toxic chemicals on reproduction and survival are needed (Cuthbert and Wires 1999). Other human-related impacts, such as mercury contamination of eggs (Vermeer 1973 In Evers 1997) and adult mortality in nylon monofilament fishline (Dunstan 1969 In Evers 1997) should be monitored. Little information exists on migration especially stopover sites and habitats used, and threats to and the biology of all populations of the Caspian tern during winter remain largely unknown (Cuthbert and Wires 1999). More information is needed on population dynamics, especially factors that favor population expansion and increase. No

information is available on the genetic structure of the North American population. More detail is needed on the plumage descriptions of young birds and on the molt cycle of North American birds. Additional topics that need to be researched include fossil history, control and physiology of migration, metabolism and temperature regulation, nutrition and energetics, nest microclimate, intraspecific brood parasitism, and home range (Cuthbert and Wires 1999).

Acknowledgements

Information was provided by the following individuals: John Casson, District Wildlife Biologist, Chippewa National Forest; Steve Sjogren, District Wildlife Biologist, St. Ignace Ranger District, Hiawatha National Forest; Andi Hales, Biological Science Technician, Munising Ranger District, Hiawatha National Forest; Sharron Nelson, Minnesota Heritage and Nongame Research Program; Anthony Zammit, Ontario Natural Heritage Information Centre; Robert Gottfried, Illinois Natural Heritage Database Watershed Management Section; Teresa Mackey, Information Services, New York Natural Heritage Program; and Kierstin Carlson, Pennsylvania Natural Diversity Inventory. Julie Williams compiled the State Endangered, Threatened, and Sensitive Species lists for the majority of the states within the continental U.S. and Canada. Mike Tripp conducted a literature search of current Caspian tern research. Editorial assistance provided by Beth Funderburg, USFS, St. Ignace, MI.

Nomenclature and Taxonomy

Scientific name: *Sterna caspia* (Pallas, 1770)
Subspecies:
Common name: Caspian tern
Order: Ciconiiformes
Family: Laridae
Synonym (s): No synonyms for common name

Description of Species

The Caspian tern is the largest tern in the world (Evers 1997). Adults vary from 19 to 23 inches (48 to 58 cm) in length and have a 30 to 55-inch (127 to 140 cm) wingspan (Evers 1997). Caspian terns are barrel-chested terns with a long thick reddish bill (Gough et al. 1998). The rear of the head shows a hint of a crest. The underwings are pale with dark patches in the primaries. The tail is short and is notched. The sexes are similar. As other terns, the Caspian tern dives into the water for prey (Gough et al. 1998). When in **adult alternate plumage**, Caspian terns have a deep red bill, often with an indistinct black ring at the tip, black legs, white face, neck, breast, and belly. A black cap has a very slightly crested appearance. The upperwings and back are a pale gray. The underwings are pale with dusky gray on the outer 5-6 primaries. The tail is white. Caspain terns reach full adult plumage in three years (Gough et al. 1998). The **adult basic** is similar to the adult alternate but has a black cap streaked with white and the primaries are darker and more worn (Gough et al. 1998). In **juvenile plumage**, Caspian terns have pale legs, a deep

orange bill, a brownish cap streaked with white and a white face, neck, breast, and belly. The upperwing coverts and scapulars are marked by crisp black scallopings. The upperwing is pale and has darker outer primaries and secondaries. The tail is grayish (Gough et al. 1998). **Immature plumage**, first-year birds are like basic-plumaged adults but have darker uppersurfaces to the outer primaries, dark secondaries, a grayish tail, and a pale forehead. Second-year birds are almost identical to alternate-plumaged adults, but often have white spots in the cap, darker outer primaries, and some gray in the tail (Gough et al. 1998). The Royal and Elegant terns are the only other large, orange-billed terns, however the elegant tern is smaller, has slim wings, and has a slimmer orange bill. The Caspian can be distinguished from the Royal by its thicker, reddish bill, dark wedge on the outer portion of the underwing, and its tendency to have an almost complete cap in basic and immature plumages (Gough et al. 1998).

Life History

Caspian terns breed in wetland-open water habitats (Gough 2000). Caspians can nest singly (NatureServe 2001), but most typically in colonies consisting of several hundred birds (Evers 1992). NatureServe also reports nesting of up to several thousand pairs (5000+ at Sand Island, Washington). Eggs are laid in a shallow depression (scrape) in the ground on open pebbly or sandy beaches (Ludwig 1991) or in nests lined with grasses, seaweeds, or mosses (WIDNR 1999). The nest is frequently within a few feet of a neighbor's nest (Evers 1992). Islands appear to be preferred (Ludwig 1991), unvegetated islands (WIDNR 1999). Colonies are strongly associated with traditional breeding areas in Michigan (Ludwig 1991). Caspian terns nest at 2-3 years of age (WIDNR 1999). Clutch size is 1-4 (Gough 2000), 2-3 (WIDNR 1999, NatureServe 2001, Evers 1992), eggs are grayish or buffy colored eggs with irregular spots and are laid from May to July (WIDNR 1999); mid-May to mid-July (Evers 1997). Both sexes incubate eggs, and the young are tended by both parents (NatureServe 2001). Incubation lasts 20-22 days (Gough 2000, van Frankenhuyzen 1994). One brood is produced per year (Gough 2000). The young fledge at 28-35 days old (Gough 2000). Young first fly at 4-5 weeks of age, feeding of the young may continue up to 5-7 months after fledging (NatureServe 2001). One young typically fledges from a successful nest (WIDNR 1999). If the nesting attempt fails early in the nesting season, adults will reattempt nesting (Evers 1992). The diet of Caspian tern is almost exclusively fish with lesser quantities of aquatic invertebrates (Gough 2000). Two species of introduced fish, the alewife and American smelt are important prey for Caspian terns in the Great Lakes (Evers 1992). Foraging habitat may be almost any large body of water (Ludwig, 1991). Since 1960 numbers have more than tripled possibly in response to large increases in alewives and smelt (Ludwig 1991).

Habitat

Caspian terns prefer nesting on sandy islands with sparse vegetation (Evers 1992). The Caspian tern breeds in a wide variety of habitats, ranging from coastal estuarine, salt marsh, and barrier islands. Nests are found among driftwood and debris on low, flat, sandy or rocky islands, shell banks and beaches and on sandy, muddy, or pebbly shores

with sparse vegetation (Cuthbert and Wires 1999). Breeding habitat is specific: open, fairly flat islands. On Pacific and Gulf Coasts, often nests on sparsely vegetated natural and dredge-material islands and salt dikes with the largest populations associated with artificial habitats (Gill and Mewaldt 1983, Quinn 1990, Stadlander et al. 1993, Rodgers et al. 1996 In Cuthbert and Wires 1999).

In the Great Lakes, nests are on pristine habitat on open, pebble, gravel, or sandy beach islands, where the average temperature is 5-20 degrees Centigrade (Cuthbert 1981, Ludwig 1991 In Cuthbert and Wires 1999).

Distribution and Abundance rangewide/regionwide)

In the Eastern U.S. Caspian terns breed locally on the Atlantic and Gulf Coasts from Virginia to northern Florida (very few), also recently in New Jersey, on the central Gulf Coast of Florida, and in southeastern Louisiana, Alabama, Mississippi, Texas, and around the Great Lakes. In Canada: Labrador, southeastern Quebec and Newfoundland, southern Ontario, southern Manitoba and central Saskatchewan, along shores of Lake Winnipeg, northeastern Alberta, and southern Mackenzie. In western North America, locally, mostly in the interior but on the coast in Washington and California, eastern Oregon, northern Utah, northwestern Wyoming, Idaho (recent range expansion), North Dakota, south to southern California and western Nevada, also Baja and Sinaloa (NatureServe 2001). It Winters in the southern U.S. (mainly coastal areas north to California and North Carolina) south to Mexico, sometimes to northern South America (Colombia, Venezuela), rarely in the West Indies, casual in Hawaii. It breeds and winters extensively also in the Old World (Africa, Eurasia, and Australia) (NatureServe 2001). The Great Lakes population winters along shores of the Gulf of Mexico (Ever 1992 In NatureServe 2001). Juveniles remain in the wintering area through the second winter. Thereafter, they make annual migrations between breeding and wintering areas (Gill and Mewaldt In NatureServe 2001). The Great Lakes population winters along the shores of the Gulf of Mexico (Evers 1992). Caspian terns are most abundant on the Pacific Coast, and in central Canada, numbers in Manitoba have more than tripled since 1970 (Bennett 1995, Smith 1996 In Cuthbert and Wires 1999). In the Great Lakes numbers have increased steadily since the 1960s, nearly tripling since 1963; with the greatest increase on Lake Ontario (Nueman and Blokpoel 1997 In Cuthbert and Wires 1999). Reasons for increases are multifaceted and in some areas unknown. In the Great Lakes, legislation has protected pristine islands (remote, inaccessible islands) and the increase in smaller fish such as the alewife as previously mentioned. On the Pacific and Gulf Coasts, artificial habitat (dredge-spoil islands and salt dikes) provides quality breeding habitat (Stadtlander et al. 1993, Parkin 1998, Roby et al. 1998 In Cuthbert and Wires 1999). The Great Lakes population in 1982 was estimated at 3,800 in the U.S. and 4,900 in Canada (Spendelow and Patton 1988 In NatureServe 2001). The combination of predation and competition from other colonial waterbirds has contributed to recent lower fledging rates (Ludwig 1991).

Figure 1. North American Breeding Bird Survey Summer Distribution of Caspian Tern

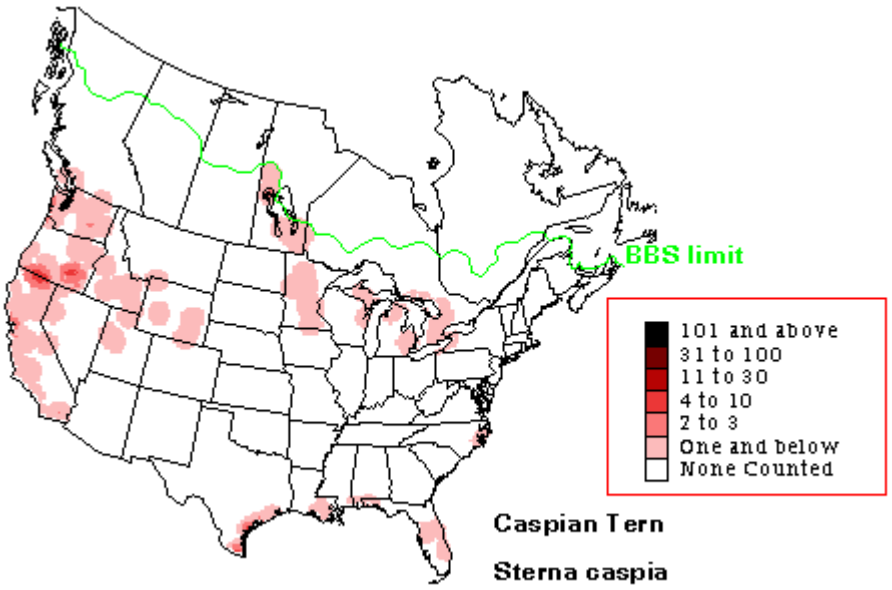
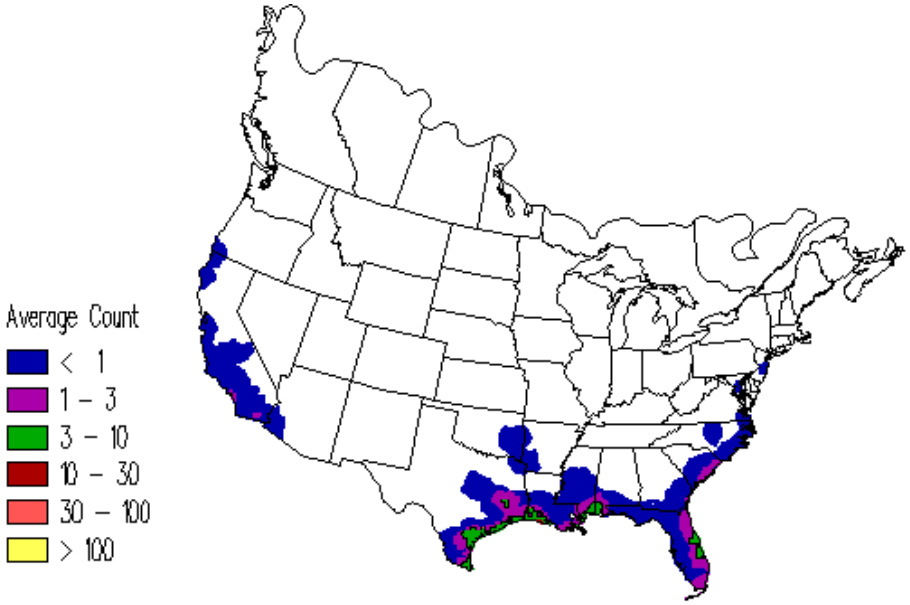


Figure 2. North American Breeding Bird Survey Winter Distribution of Caspian Tern



Status in the Great Lakes Region

Table 1. State Rankings for Caspian Tern

State	State Threatened/ Endangered or Special Concern Listing	State/Province Heritage Status Ranks
Indiana	Not listed as T/E or SC	State status SAB, SZN
Michigan	Threatened	S2
Minnesota	Not listed as T/E or SC	S?
New York	Not listed as T/E or SC	S1
Ohio	Not listed a T/E or SC	S?
Ontario	Not at risk	S3B, SZN
Pennsylvania	Not listed as T/E or SC	SZN
Wisconsin	Endangered	S1B, S2N

State Ranks:

- S1 = 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.
- S2 = imperiled in the 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.
- S3B = (S3 = rare or uncommon in state (on the order of 21 to 100 occurrences). S3B has the same definition as S3 but during the breeding season.
- N = National Rank based on population and occurrences in the United States (including Alaska and Hawaii).
- SZ = Migratory Transient.
- SAB = Breeding accidental.
- SZN = Non-breeding migrant/vagrant.
- S? = Incomplete data.

A Global Rank of G5 was given on November 27, 1996 (NatureServe 2001). Global rank is based on populations and occurrences around the globe. The Nature Conservancy and Natural Heritage Program Ranking have specific definitions, G5 = Demonstrably secure, widespread and abundant though it may be quite rare in parts of it's range, especially at the periphery. The rationale for the G5 ranking is Caspian terns have a large range and there are increasing numbers in some areas.

Other states in the continental U.S. that list this species as a species of Special Concern are Montana, Utah, Virginia, Wyoming, and Louisiana (Cuthbert and Wires 1999). In Quebec, Caspian terns have a very limited breeding range (the Ile a la Brume Migratory Bird Sanctuary and it's surroundings on the Lower North Shore). Here their populations have fallen drastically over the past century (Canadian Wildlife Service 2000).

The North American Breeding Bird survey trend data shows a significant increasing trend

from 1966-1998 in the survey-wide and United States regions and a non-significant increasing trend during the same time period for the Eastern Breeding Bird region. The regional credibility measure for the Survey-wide and United States regions assigned by the North American Breeding Bird Survey is the intermediate level. This data category reflects data with a deficiency such as low abundance, small sample size and imprecise results, however the BBS data has been collected since 1966 and is the best data available. Cuthbert and Wires 1999 also reported an increase population trend.

Population Biology and Viability

In the Great Lakes band recoveries showed the average life span of a Caspian tern to be 11.9 years with a maximum age of 26 years (Ludwig 1965, Bergstrom 1952, Clapp et al. 1983 In Cuthbert and Wires 1999).

Caspian terns do not breed until 3 years of age (Cuthbert and Wires 1999). Young return to general area of hatching (e.g., Great Lakes, Pacific Coast). However, first-time breeders tend to nest at colonies other than natal colonies (Cuthbert 1981 In Cuthbert and Wires 1999). In the Great Lakes, 10 % of the twenty banded three-year olds nested at the colony in which they hatched while the remainder were recorded breeding at other locations (Cuthbert 1981 In Cuthbert and Wires 1999). Adults show a strong fidelity to the colony where they bred the previous year in life (Cuthbert 1988 In Cuthbert and Wires 1999) when the previous nesting was successful (Ludwig 1968, Cuthbert 1988 In Hyde 1996). Combined with geographic separation of colonies, this suggests there is little mixing between populations of different regions and local perturbations could cause a dramatic decline in the region's population (Shugart et al. 1978 In Hyde 1996). Sub-adult mortality is relatively high; Ludwig (1965 In Evers 1997) found 62% died before breeding at age 3 to 4 years in the northern Great Lakes.

Potential Threats and Monitoring

Present or Threatened Risks to Habitat or Range

Colony instability, poor reproduction, and the low number of nesting pairs have contributed to its endangered status in Wisconsin (WIDNR 1999). Poor reproduction could be related to high water levels, chemical contamination, and predation from mammals (Evers 1992). In Michigan, limited island nesting sites, competition with expanding gull populations, and continued human disturbance have cause its threatened status (Evers 1992). Chemical contaminants (especially PCBs) (Ludwig and Kurita 1988 In Ludwig 1991), human disturbance at colony sites, competition with ring-billed gulls, and predation by great-horned owls and other predators may be the cause of declining nesting success and colony abandonment (WIDNR 1999). Gulls and Cormorants exert heavy competition for nesting space especially during periods of high water (Ludwig 1991). A correlation was found between PCB consumption from Caspian terns feeding on contaminated fish to rising rates of chick deformities and depressed hatching rates (Ludwig 1991). The mean fledge rate of 1.46 chicks per nest in 1962-1967 period plummeted to 0.61 in the 1986-1989 period (Ludwig et al 1990 In Ludwig 1991).

Disturbance and development of nesting habitat have also been listed as major threats (NatureServe 2001). Caspian terns have been found to collide with man-made stationary objects. They have been reported to fly into electric wires, and to collide with vehicles and trains (Cooke 1937, Tomkins 1934, and Ludwig 1965 In Cuthbert and Wires 1999). Causes of egg mortality include predation, abandonment, and strong winds and high tides washing eggs from or flooding nests. Chick mortality includes attacks by adult terns, predation, exposure to cold temperatures, or drifting sand resulting from when parent birds are flushed from nests (Cuthbert and Wires 1999).

Key nesting islands in Michigan are owned by public agencies or private conservation groups which will reassure that critical breeding habitat will be preserved in Michigan (Ludwig 1991).

A gull deterrent study conducted in common tern colonies found that if Caspian terns were present they were vulnerable to entanglement in monofilament (Maxson et al. 1996).

Habitat quality for the Caspian tern appears to be deteriorating in the Leech Lake area of Minnesota. Erosion is reducing beach nesting habitat, soil deposition is connecting nest islands to shores so predators can access nesting areas, fishing territories are subject to increasing human development and activities, fish populations may be reduced due to reduction in water quality, and a proliferation of fishing tackle in the habitat is a compounding issue as these terns are prone to getting tangled in fishing line (Mortensen In Russ 1999).

Table 2. Threats or Risks to Caspian Tern and Its Habitat by Forest

National Forest	Threat or Risk
Chequamegon-Nicolet	Not listed as RFSS
Chippewa	There are no Caspian terns nesting on National Forest, the only suitable habitat is on an island in Leech Lake managed by the Leech Lake Band of Objibwe. These terns are seen all summer on the larger lakes. Juvenile Caspian terns use this area. Breeding takes place farther north. Some known habitat is protected with candidate RNA status (Russ 1999). Leech Lake habitat is vulnerable (as listed above in this document).
Hiawatha	Increased predation risk from high gull and cormorant populations. Habitat is maintained due to shoreline of Lake Michigan and Lake Huron. Outside development in other areas pose threats. Some known habitat in cRNA status on Forest (Sjogren/Prout 2000).
Huron-Manistee	Not listed as RFSS
Ottawa	Not listed as RFSS
Superior	Not listed as RFSS

Commercial, Recreational, Scientific or Educational Over-utilization

Shooting, trapping, and collecting have been significant mortality factors in several populations (Cuthbert and Wires 1999). Caspian terns are sensitive to human disturbance especially early in the breeding cycle and incubation period. In colonies in Michigan Cuthbert 1981 found 22% of reproductive failures were caused by investigator disturbance (Cuthbert and Wires 1999).

Disease or Predation

Four species of lice have been found on Caspian terns from the eastern United States (*Actornithophilus funebre*, *Degeeriella praestans*, *Menophon spp*. and *Philopterus melanocephalus* (Peters 1936 In Cuthbert and Wires 1999). Internal parasites recorded in birds in the Great Lakes include the cestodes *Dibothriocephalus oblongatum*, *Schistocephalus solidus* and *Paricterotaenia spp*., the nematode *Cosmocephalus spp.*, and the trematodes *Diplostomum spp*., *Cotylurus spp*., *Ornithobilharzia spp*. (possibly O. *lari*), *Clinostomum spp*. and *Stephanoprora spp*. (Thomas 1947, Ludwig 1965 In Cuthbert and Wires 1999).
The major predator of the Caspian tern is the Herring Gull, which kills the chicks. Double-crested cormorants and ring-billed gulls compete for nesting space (Ludwig 1991). Mammalian predators include fox (*Vulpes vulpes*) and coyotes (*Canis latrans*) (Shugart 1977 In Evers 1997). Raccoons (*Procyon lotor*) and skunks (*Mephitis mephitis*) are potential predators (Feterolf and Blokpoel 1983 In Evers 1997).

Inadequacy of Existing Regulatory Mechanisms

None known**.**

Other Natural or Human Factors Affecting Continued Existence of Species

Toxic chemical loads in the Great Lakes have severe implications for the long-term survival of Caspian tern populations because of direct poisoning and bioaccumulation of environmental contaminants in their prey (Evers 1997). Pesticides and other contaminants, Grasman et al. 1996 (In Cuthbert and Wires 1999) found organochlorine-associated suppression of T-cell mediated immunity in pre-fledgling Caspian tern chicks from the Great Lakes (total of 5 sites samples, n = 35-50 chicks from each site); suppression was most severe at the more contaminated colonies in Saginaw Bay and Lake Ontario. PCBs were the contaminant most closely associated with immunosuppression. They concluded that contaminant-associated immunosuppression provides a potential mechanism to explain low recruitment into the breeding population of Caspian terns raised at highly contaminated colonies.

Summary of Land Ownership and Existing Habitat Protection

Table 3. Number of Occurrences and Land Ownership by National Forest

Forest	Number of Occurrences	County	Land Ownership	Comments
Chequamegon -Nicolet	Not a RFSS on this Forest.			Refer to county occurrence listing in Table 4.
Chippewa	1 occurrence.		Land managed by Leech Lake Band of Objibwe.	Refer to county occurrence listing in Table 4.
Hiawatha	**Westside**: There is no data available to confirm breeding, Caspian use of shoreline is presumed. **Eastside**: 1-2 occurrences, habitat within a cRNA. Overall rare on the Forest. Observations of eleven birds were made during surveys in Mackinac County in 2001.	Prime habitat occurs in Nahma (Delta County) and Stonington areas (Menominee County). Mackinac County (3 observations on Lake Michigan)	Private ownership. (FS ownership at Peninsula Point otherwise is privately owned). 100% Forest Service ownership.	One of three observations on Lake Michigan may have been the same individual.
Huron-Manistee	Not a RFSS on this Forest.			Refer to county occurrence listing in Table 4.
Ottawa	Not a RFSS on this Forest.			Refer to county occurrence listing in Table 4.
Superior	Not a RFSS on this Forest.			Refer to county occurrence listing in Table 4.

Table 4. Caspian Tern Occurrence in the Great Lake States by County, State and Year*

State	County of Occurrence	Number of Occurrences and Year
Illinois	Not tracked in Illinois	
Indiana	Not tracked in Indiana	
Michigan	Alcona County	1 occurrence, 1982.
	Alpena County	1occurrence, 1981-1989.
	Arenac County	1 occurrence, 1994.
	Bay County	1 occurrence, 1982-1985.
	Cheboygan County (ABB)	ABB confirmed, 2 possible.
	Charlevoix County	3 occurrences, first observed 1896-last observed 1982, 196?-1985, 1896-1987.
	Chippewa County (ABB)	3 ABB possible occurrences.
	Delta County	2 occurrences 1892-1982, 1996.
	Emmet County (ABB)	ABB confirmed, 1 possible. ABB possible.
	Grand Traverse County (ABB)	ABB confirmed, 1 probable, 2 possible.
	Huron County (ABB)	ABB possible.
	Leelaunau County (ABB)	ABB possible.
	Luce County (ABB)	
	Mackinac County	4 occurrences, 1981-1985, 1982, 1986, 1996.
	Manistee County (ABB)	ABB possible.
	Presque Isle County (ABB)	ABB probable, 1 possible.
	Tuscola County (ABB)	ABB two possible.
	Wayne/Monroe County border offshore (ABB)	ABB possible on boundary.
Minnesota**	Cass County	1 occurrence, 1971, active.
	Mille Lacs County	1 occurrence, 1985, active.
	St. Louis County	1 occurrence, 1985, active.
New York	Jefferson County	1 occurrence, 1992.
Ohio	No occurrences in Ohio	0
Ontario	Algoma District	2 occurrences, 1989 (2).
	Bruce County	2 occurrences, 1985, 1990.
	Frontenac County	1 occurrence, 1990.
	Hamilton Regional	1 occurrence, 1990.

State	County of Occurrence	Number of Occurrences and Year
	Municip.	
	Kent County	1 occurrence, 1983.
	Manitoulin County	3 occurrences, 1985, 1989, 1990.
	Metro Toronto	1 occurrence, 1985.
	Muskola County	2 occurrences, 1989 (2).
	Northumberland County	1 occurrence, 1990.
	Parry Sound District	1 occurrence, 1989.
	Peterborough County	2 occurrences, 1971, 1984.
	Simcoe County	1 occurrence, 1991.
	York Regional Municip.	2 occurrences, 1985, 1991.
Pennsylvania	No occurrences recorded by the Pennsylvania Natural Diversity Inventory	
Wisconsin	Ashland County	Information requested 1/01 has not been received.
	Brown County	
	Door County (WBBA)	Probable occurrence WBBA.
	Douglas County	
	Kewaunee County (WBBA)	Confirmed occurrence WBBA.
	Marinette County (WBBA)	Probable occurrence WBBA.
	Oconto County	
	Racine County (WBBA)	Probable occurrence WBBA.
	Winnebago County	

*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; 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; and Michigan Natural Features Inventory Inventory. The County occurrence data was supplied by Sharron Nelson, Minnesota Heritage and Nongame Research Program; Anthony Zammit, Ontario Natural Heritage Information Centre; Robert Gottfried Illinois Natural Heritage Database; Teresa Mackey New York Natural Heritage Program; and Kierstin Carlson, Pennsylvania Natural Heritage 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.

Barrows (1912 In van Frankenhuyzen 1994) indicated that Caspian tern colonies have been known from the Beaver Island group (Charlevoix County) and islands near the tip of the Garden Peninsula (Delta County) since the 1800s.

Summary of Existing Management Activities

Past and Current Conservation Activities

Conservation measures include controlling public access to the nesting colonies to minimize disturbance (avoid boat landings near colonies for example (Evers 1992), eliminate predators from colony sites, monitoring all potential nesting habitat (especially dredge spoil islands) (WIDNR 1999). Caspian terns will colonize artificially created islands as discovered in Saginaw Bay Michigan, where a colony was formed on a disposal dike (Evers 1992). Habitat improvement projects that could be undertaken for this species are creation of artificial nesting islands and clearing vegetation on existing sites (Evers 1992).

Conservation activities are usually aimed at protecting or enhancing nesting areas. Measures include providing artificial nesting sites (Lampmann et al. 1996 In Cuthbert and Wires 1999), providing preferred or amending substrates, preventing or removing gull nests (Stadtlander et al. 1993, Quinn e. al. 1996 In Cuthbert and Wires 1999), covering nests to reduce egg predation by gulls (Quinn 1984 In Cuthbert and Wires 1999), maintaining or suppressing vegetation (Clay 1992, Quinn et. al. 1996 In Cuthbert and Wires 1999), and using decoys and taped vocalizations to attract terns (Lampman et al. 1996 In Cuthbert and Wires 1999). Other measures include limiting or preventing public access to breeding colonies, minimizing and carefully planning investigator activities (Penland 1976, Blokpoel 1981 In Cuthbert and Wires 1999), preventing low-level overflights by aircraft during breeding season, monitoring populations to determine trends and shifts, and accessing effects of gull species in certain areas (Blokpoel and Harfenist 1986 and D. Roby pers. comm. In Cuthbert and Wire 1999).

Research and Monitoring

Existing Surveys, Monitoring and Research

Research conducted on this species varies from effects of organochlorine contamination on young Caspian terns (Ecotoxicology 10 [2]: 1101-114), nesting substrate preference (Biological Conservation, 85 [1-2]: 63-68), foraging patterns (Colonial Waterbirds, 20, [3]: 429-435), breeding on a nesting raft (Colonial Waterbirds, 19 [1]:135), and tactics for conserving colonial waterbird diversity on artificial islands (Canadian Journal of Fisheries and Aquatic Sciences, 53 [1]: 45-57).

Survey Protocol

Erwin and Hoover (undated) recommend ground estimates of large colonies (>200) and direct nest counts for smaller colonies. Counts of incubating birds can often be made from a vehicle or on foot using a scope. This has the advantage of avoiding disturbance and egg loss to avian predators. The optimal time to survey for Caspian terns in Michigan is during May, June, and July (Hyde 1996).

Research Priorities

Individual colonies characterized by lower-than-expected size or productivity should be carefully monitored to determine factors affecting the observed changes (Evers 1997). Clear conclusions about effects of toxic chemicals on reproduction and survival are needed (Cuthbert and Wires 1999). Other human-related impacts, such as mercury contamination of eggs (Vermeer 1973 In Evers 1997) and adult mortality in nylon monofilament fishline (Dunstan 1969 In Evers 1997) should be monitored. Little information exists on migration especially stopover sites and habitats used, threats to and the biology of all populations of the Caspian tern during winter remain largely unknown (Cuthbert and Wires 1999). More information is needed on population dynamics, especially factors that favor population expansion and increase. Most Caspian terns nest in colonies of >100 pair, however in the Northwest Territories and elsewhere, some Caspian terns typically nest as single pairs. A comparative study of colonial and solitary nesting would contribute to knowledge of the evolution of colonial behavior in this and other colonial nesting species (Cuthbert and Wires 1999). No information is available on the genetic structure of the North American population. More detail is needed on the plumage descriptions of young birds and on the molt cycle of North American birds. Additional topics there is little or no information include fossil history, control and physiology of migration, metabolism and temperature regulation, nutrition and energetics, nest microclimate, intraspecific brood parasitism and home range (Cuthbert and Wires 1999).

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APPENDIX

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Information Requests

Review Requests