4-1999

Status Assessment and Conservation Plan for the Black Tern (*Chlidonias niger surinamensis*) in North America

W. David Shuford
Point Reyes Bird Observatory

U.S. Fish & Wildlife Service

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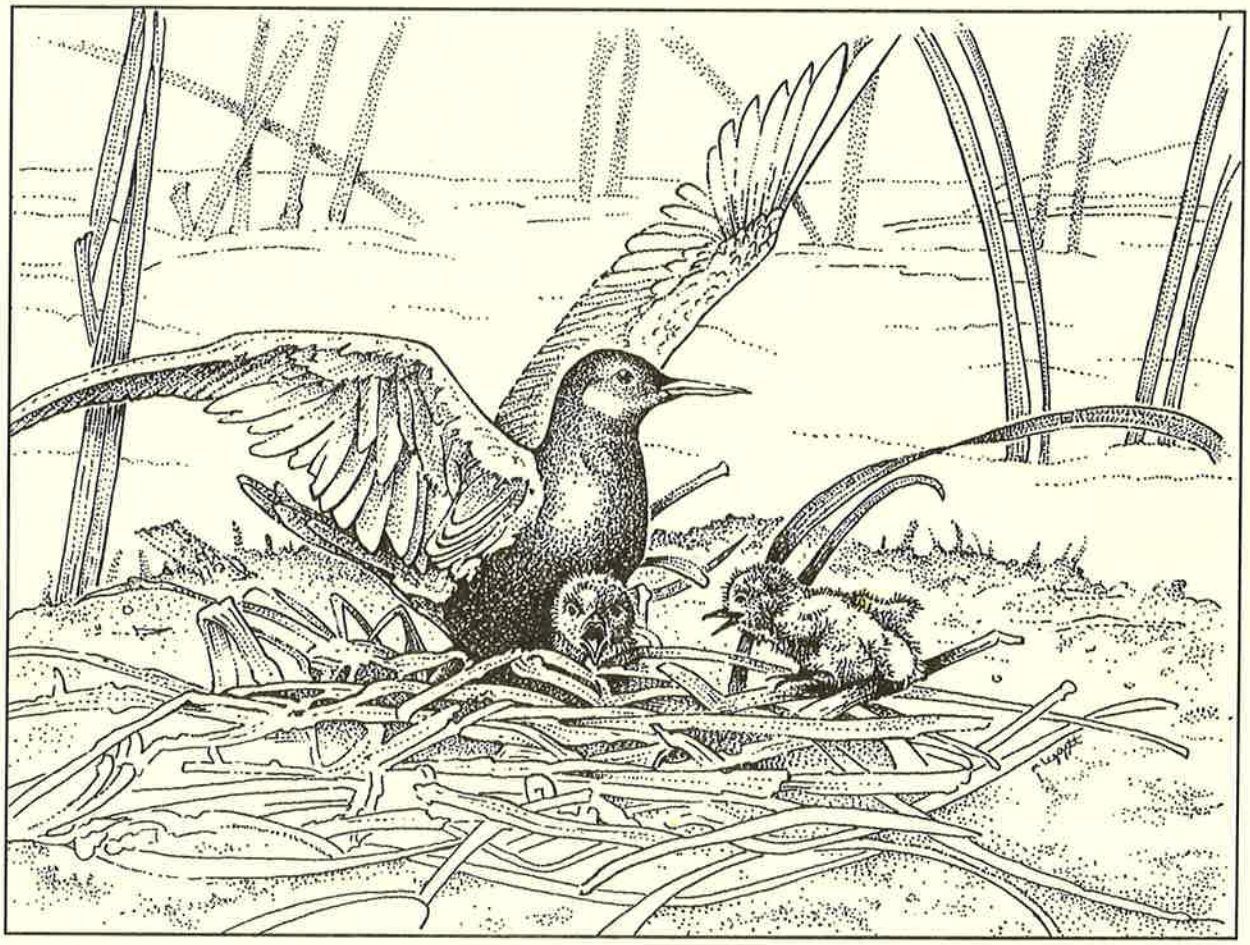

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CONVENTIONS USED IN THE TEXT

In Table 1 and in each state, provincial, or territorial account (Appendix 1), The Nature Conservancy's standardized subnational (state/provincial) SRANK priority categories (codes) for breeding (B) are expressed as their verbal equivalents (TNC 1996). The SRANK codes, verbal equivalents, and definitions are:

Natural Heritage Ranks

SX = *Extirpated* (element believed to be extirpated from the state, province, or other subnational unit).

S1 = *Critically Imperiled* (critically imperiled in the state because of extreme rarity or because of some factors making it especially vulnerable to extirpation from the state; typically 5 or fewer occurrences or very few remaining individuals or acres).

S2 = *Imperiled* (imperiled in the state because of rarity or because of some factors making it very vulnerable to extirpation from the state; typically 6 to 20 occurrences or few remaining individuals or acres).

S3 = *Vulnerable* (vulnerable in the state either because rare and uncommon, or found only in a restricted range, even if abundant at some locations, or because of other factors making it vulnerable to extirpation; typically 21 to 100 occurrences).

S4 = *Apparently Secure* (uncommon, but not rare, and usually widespread in the state; usually more than 100 occurrences).

S5 = *Secure* (demonstrably widespread, abundant, and secure in the state and essentially ineradicable under present conditions).

S? = *Unranked* (state rank not yet assessed).

SA = *Accidental* (accidental or casual in the state, i.e., infrequent and outside usual range; includes species recorded once or only a few times, a few of which may have bred on the one or two occasions they were recorded).

Occasionally rankings combine two of these categories (e.g., S3S4 = Vulnerable/Apparently Secure). For purposes of this report, the Black Tern is considered of "conservation concern" in the states and provinces that list the species as Critically Imperiled, Imperiled, or Vulnerable.

Acronyms Used

BBS = Breeding Bird Survey
GIS = Geographic Information System
NASFN = National Audubon Society Field Notes
NWR = National Wildlife Refuge
SWA = State Wildlife Area
USFWS = U.S. Fish and Wildlife Service
WA = Wildlife Area
WMA = Wildlife (or Waterfowl) Management Area
WPA = Waterfowl Production Area

Descriptive Statistics

Depending on completeness of the data source, the central tendency of data is usually expressed as an average [minimum-maximum, Standard Error (SE), sample size (n)].

ACKNOWLEDGMENTS

I am extremely grateful to the over 100 people who took time from their busy work schedules and private lives to provide me with reports, unpublished data, and insight about the status and biology of Black Terns, without which this report would not have been possible. These contributions were supported by a host of state, federal, and private organizations. Most of these individuals and institutions are cited in the text or are listed in Appendix 2. Albert Beintema, Hans Blokpoel, John Cooper, Jeanne Hickey, George Linz, Irene Mazzocchi, Ian Nisbet, Bruce Peterjohn, and Chip Weseloh were very helpful in providing the in-press versions of their articles from the Black Tern symposium prior to their publication in Colonial Waterbirds, which allowed incorporation of the latest findings on Black Terns in the report manuscript before it was sent out for review. Thanks to the following individuals for reviewing the entire report or individual state, provincial, or territorial summaries: Rob Alvo, Diane Amirault, Pierre Aquin, Doug Backlund, Hans Blokpoel, Dan Brauning, Bill Busby, John Castrale, Andrea Cerovski, John Cooper, Ellie Cox, Christine Custer, John Dinan, James Dinsmore, Kristi DuBois, Erica Dunn, Tony Erskine, Mike Fournier, Jim Herkert, Jerry Horak, Stephanie Jones, Tom Kent, Hugh Kingery, Charles Kjos, Rudolph Koes, Steve Lewis, Mark McCollough, Richard Malecki, Sumner Matteson, Steve Maxson, Irene Mazzocchi, Bob Miller, Wayne Mollhoff, Dave Naugle, Larry Neel, Eric Nelson, Ian Nisbet, Steve Parren, Diane Pence, Bruce Peterjohn, Fritz Prellwitz, Michael Richardson, William Scharf, Nat Shambaugh, Ella Sorensen, Mark Stern, Eileen Dowd Stuckel, Chuck Trost, Bill Tweit, Chip Weseloh, and Tara Zimmerman. The Nature Conservancy and the International Network of Natural Heritage Programs and Conservation Data Centers provided much valuable unpublished data. Joanne Munro prepared the map in Figure 1, Rusty Scalf helped in the preparation of the map, and Garreth Penn and Maggie Brown provided important references. Funding to attend the Black Tern symposium at the Colonial Waterbird Society meeting in Charleston and to prepare this report was provided by the U.S. Fish and Wildlife Service Regional Nongame Migratory Bird Coordinators Tara Zimmerman (Region 1), Steve Lewis (Region 3), Chuck Hunter (Region 5), and Stephanie Jones (Region 6). Many thanks to Stephanie Jones for sheparding the manuscript through the review and publication process and to Melvie Uhland and Laura Hubers for design and publication. This is Contribution No. 728 of Point Reyes Bird Observatory.

SUMMARY

The Black Tern (*Chlidonias niger surinamensis*) has been a species of concern in North America because of continentwide population declines, particularly since the 1960s. Currently the species is listed as Threatened or Endangered in 6 states and is considered of conservation concern in 18 other states and provinces. Breeding Bird Survey data indicate that Black Terns declined significantly survey-wide at an average rate of 3.1% annually (61.1% overall) from 1966 to 1996. Also during this period, the Canadian population decreased significantly at an average annual rate of -3.5% (-65.7% overall), whereas the U.S. population showed no significant trend. These declines largely reflect trends prior to 1980, and most trends were reversed in the 1990s. The North American population recently has leveled off or increased slightly. The species still occupies most of its former range, and the continentwide breeding population probably still numbers in the low to mid hundreds of thousands.

The main causes of population declines in North America appear to be habitat loss and degradation on the breeding grounds, although introduced species, human disturbance, and contaminants may be contributing factors. Since the 1950s, the freshwater emergent wetlands upon which the species depends for breeding have declined by 25%. Very little is known, however, about threats to the Black Tern during migration and winter, which account for 8 to 9 months of the species' annual cycle.

Recovery of Black Tern populations likely will require a combination of management efforts and policy initiatives to improve habitat conditions and nesting success. Conservation priorities are (1) refining monitoring techniques to better detect population trends and determine the causes of changes, (2) stemming the tide of wetland loss by forming partnerships to protect and restore wetlands from a landscape perspective, (3) managing habitat for Black Terns based on current knowledge while conducting further research to identify limiting factors and evaluate additional management techniques, and (4) educating the public about the value of wetlands and possible effects of their actions on Black Terns.

TAXONOMY

Common name: Black Tern
Scientific name: *Chlidonias niger* Linnaeus
Order: Charadriiformes
Family: Laridae

The Black Tern has a holarctic distribution with two subspecies, *C. n. niger*, breeding in Eurasia, and *C. n. surinamensis*, breeding in North America (Cramp 1985; A.O.U. 1957, 1998).

LEGAL STATUS

United States

The Black Tern was proposed for listing under the federal Endangered Species Act (USFWS 1991), and the U.S. Fish and Wildlife Service concluded there was not enough data to make a determination. The species has been included on U. S. Fish and Wildlife Service's 1995 list of Migratory Nongame Birds of Management Concern in the U.S. (USFWS 1995), National Audubon Society's Blue List from 1978 to 1986 (Tate 1981, Tate and Tate 1982, Tate 1986), and Partners in Flight's 1996 WatchList as a "moderate priority species" (Carter et al. 1996). At the state level, the Black Tern is listed as Endangered in Illinois, Indiana, Ohio, Maine, and Pennsylvania and Threatened in Vermont; it also is considered a Species of Special Concern (or equivalent) or Vulnerable in 15 other states (Table 1). The Nature Conservancy ranks the Black Tern globally (rangewide) and for its U.S. range as "Apparently Secure" (G4 and N4 respectively, M. Steiner written comm.).

Canada

The Committee on the Status of Endangered Wildlife in Canada concluded the species warranted "no designation required" in 1988 and was "not at risk" in 1996, despite recommendations for listing as "threatened" by Gerson (1988) and as "vulnerable" by Alvo and Dunn (1996). The Blue List and WatchList status applies to Canada as well as the U.S. The Nature Conservancy ranks the Black Tern in Canada as "Apparently Secure" (N4, M. Steiner written comm.). At the provincial level, the Black Tern is considered Vulnerable in Manitoba, Ontario, and Québec (Table 1), and in Ontario it has been recommended for listing as Threatened (Austen 1994, Austen and Cadman 1994).

Mexico

The Black Tern has no legal status in Mexico (P. Escalante Pliego written comm.).

Central and South Americas

The Black Tern has no legal status in Central and South America (Gerson 1988).

Table 1. Government and Natural Heritage conservation breeding status rankings for Black Terns in 34 states, provinces, and territories in North America.

State, Province, or Territory	Government Status	Natural Heritage Status
UNITED STATES		
California	Species of Special Concern	Imperiled
Colorado	No status	Vulnerable/Apparently Secure
Idaho	Species of Special Concern	Imperiled
Illinois	Endangered	Critically Imperiled
Indiana	Endangered	Critically Imperiled
Iowa	Species of Special Concern	Imperiled
Kansas	Species in Need of Conservation	Critically Imperiled
Maine	Endangered	Imperiled
Michigan	Species of Special Concern	Vulnerable
Minnesota	No status	Unranked
Montana	Species of Special Concern	Vulnerable
Nebraska	No status	Vulnerable
Nevada	No status	Imperiled/Critically Imperiled
New York	Species of Special Concern	Critically Imperiled
North Dakota	No status	Unranked
Ohio	Endangered	Imperiled
Oregon	No status	Vulnerable
Pennsylvania	Endangered	Critically Imperiled
South Dakota	Species of Concern	Vulnerable
Utah	Species of Special Concern	Imperiled
Vermont	Threatened	Imperiled
Washington	State Monitor Species	Apparently Secure
Wisconsin	Species of Special Concern	Vulnerable
Wyoming	Species of Special Concern	Critically Imperiled
CANADA		
Alberta	Yellow List	Apparently Secure
British Columbia	Yellow List	Apparently Secure
Manitoba	No status	Vulnerable/Apparently Secure
New Brunswick	No status	Unranked
Northwest Territories	No status	Unranked
Nova Scotia	No status	Unranked
Ontario	No status	Vulnerable
Québec	No status	Vulnerable
Saskatchewan	No status	Apparently Secure
Yukon	No status	Unranked

DESCRIPTION

The species is a small (23-26 cm, 50-60 g) dark tern, unmistakable in alternate plumage with the head, neck, and underparts blackish (blacker in male), the wings (paler on coverts), back, rump, and tail smoky grey, the undertail coverts white, and the underwings whitish; the leading edge of the inner wing is white (Novak 1992, Dunn and Agro 1995, Howell and Webb 1995). In late summer and fall, the underparts are blotched black and white during prebasic molt. The bill is black, eyes are dark, and legs are dark reddish brown. In basic plumage, the head, neck, and underparts are white with a black crown patch extending down onto the auriculars and a blackish patch occurring at the sides of the chest. The upperparts are smoky grey, darker on the mantle and lesser upperwing coverts; the underwings are pale grey. Juvenal plumage is similar to basic plumage but the upperparts are washed brown, the upperwing coverts are edged pale, and the underwing coverts are whitish. First summer plumage resembles adult basic plumage, but some birds have blackish patches on the underparts. The two subspecies show slight structural and plumage differences, which are summarized by Cramp (1985) and Dunn and Agro (1995).

GEOGRAPHIC DISTRIBUTION

Breeding

In North America, the Black Tern breeds from southeastern Yukon, southwestern Northwest Territories, central and northeastern British Columbia, northern Alberta, northern Saskatchewan, northern Manitoba, northern Ontario, southern Québec, southern New Brunswick and central Nova Scotia south locally to south-central California, northern Nevada, northern Utah, Colorado, Nebraska, northern Iowa, northeastern Illinois, northern Indiana, north-central Ohio, northwestern Pennsylvania, northern New York, northwestern Vermont, and Maine (Figure 1, Appendix 1). In Alaska, a former breeding record from Ft. Yukon (Gabrielson and Lincoln 1959) and recent summer sightings from the eastern interior suggest a pattern of irregular or very rare breeding in the state. The Black Tern is now extirpated as a breeder from Missouri and Kentucky and close to extirpation in Indiana and Pennsylvania. The species' population generally is patchily distributed on the fringes of its range, particularly in the Northeast and in arid portions of the West. The largest populations are concentrated in zones of highly productive wetlands, particularly in the prairies of Alberta, Saskatchewan, Manitoba, North Dakota, South Dakota, and Minnesota (Dunn and Agro 1995, Peterjohn and Sauer 1997).

Migration

During migration, the Black Tern is found throughout the interior of North America south of the breeding range, along both coasts and the interior of Middle America, along the Atlantic coast from Nova Scotia south to Florida, the West Indies, and Trinidad, and in northern South America east to French Guiana and south to Ecuador and Peru, and often far out at sea (Dunn and Agro 1995, AOU 1998). The species is casual to accidental in the Hawaiian Islands, Alaska (Wrangell, and Walker Lake in the Brooks Range), Newfoundland, Prince Edward Island, Clipperton Island, Bermuda, Chile, Brazil, Uruguay, and northern Argentina.

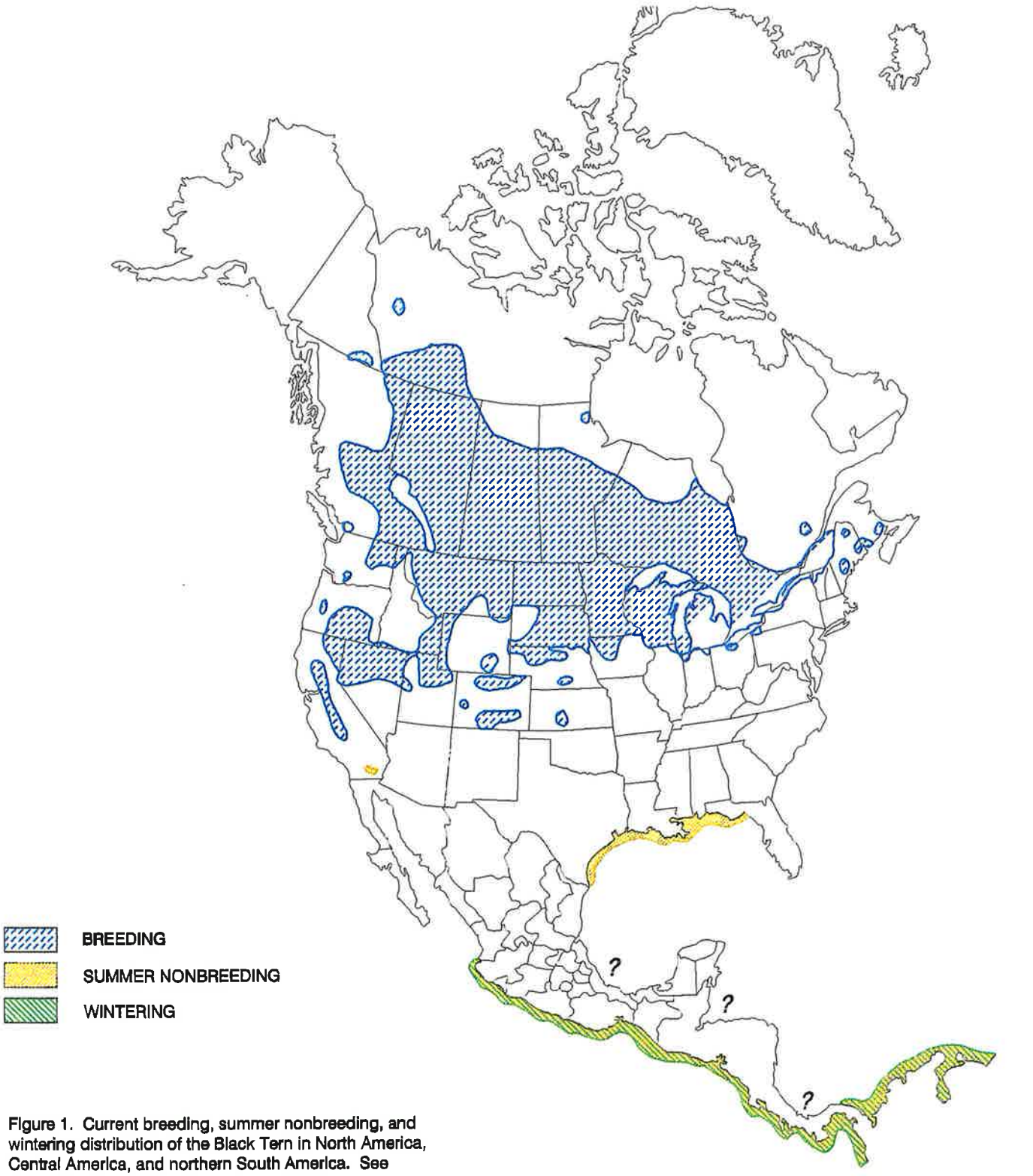

Figure 1. Current breeding, summer nonbreeding, and wintering distribution of the Black Tern in North America, Central America, and northern South America. See Appendix 1 for details of breeding distribution. Nonbreeding summer distribution along the Gulf and Atlantic coasts of Central America is not well known.

Winter

The Black Tern winters mainly in marine and marine-coastal areas in the Americas along the Pacific Coast from southern Mexico (Jalisco) east and south to Peru and on the Atlantic coast from eastern Panama east along northern South America to French Guiana (Dunn and Agro 1995, Howell and Webb 1995, AOU 1998 B. Pittman written comm.). Occurrence in many areas can be irregular (Dunn and Agro 1995). The species' abundance off the Pacific Coast is variable, with the Gulf of Panama an important area of concentration (Dunn and Agro 1995, Figure 2, L. Spear pers. comm.). The Black Tern is rare to accidental in winter in central and southern South America south to Chile and Argentina and accidental in North America in Ontario, California, Texas, Alabama, Florida, and Louisiana (Dunn and Agro 1995).

Summer Nonbreeding

The Black Tern occurs in summer outside the breeding range, mainly in marine and marine-coastal areas from the Gulf Coast through Central America to northern South America and also at the Salton Sea in southern California (Dunn and Agro 1995). Limited numbers of nonbreeders also occur in the interior to Arizona and New Mexico and in eastern North America (AOU 1998).

BIOLOGY

Migration

Black Terns gather at favored feeding sites after young fledge and then migrant singly or in small groups, mainly inland on a broad front through the U.S. (Dunn and Agro 1995). Large flocks of up to thousands may form, probably where food is concentrated, particularly in coastal or marine habitats south of the breeding range and at a few favored sites in the interior of the western U.S. (Dunn and Agro 1995, Appendix 1). No data are available on the length of time terns remain at migratory stopover sites (Dunn and Agro 1995). Fall movement may begin by late July, and most birds leave northern breeding grounds by mid- to late August and are scarce in the U.S. after September; migration extends through mid-November in Central America. Spring migration is more rapid and less coastal than in fall, occurring primarily on a broad front through the interior of the U.S. Spring movement occurs primarily from mid-April through late May with stragglers into June. The degree of fidelity of terns to migratory stopovers such as interior wetlands or coastal marshes, or to particular portions of the marine winter range, is unknown (Dunn and Agro 1995).

Breeding

Nests and nest spacing

Black Terns nest semicolonially, placing their nests in clusters in favorable areas of marshes; clusters are typically about 11-50 nests but can range from two to hundreds (Dunn and Agro 1995). Nests are usually 5 to 20 m apart, but sometimes as close as 1 m. Up to 25% to 30% of birds nest "solitarily," or from 20 to 30 m up to 600 m from other nests. Birds from many or all sub-groups in a marsh, or even from different wetlands, may behave as a single "colony" in flock behavior. Territories are defended to about 2 m from the nest.

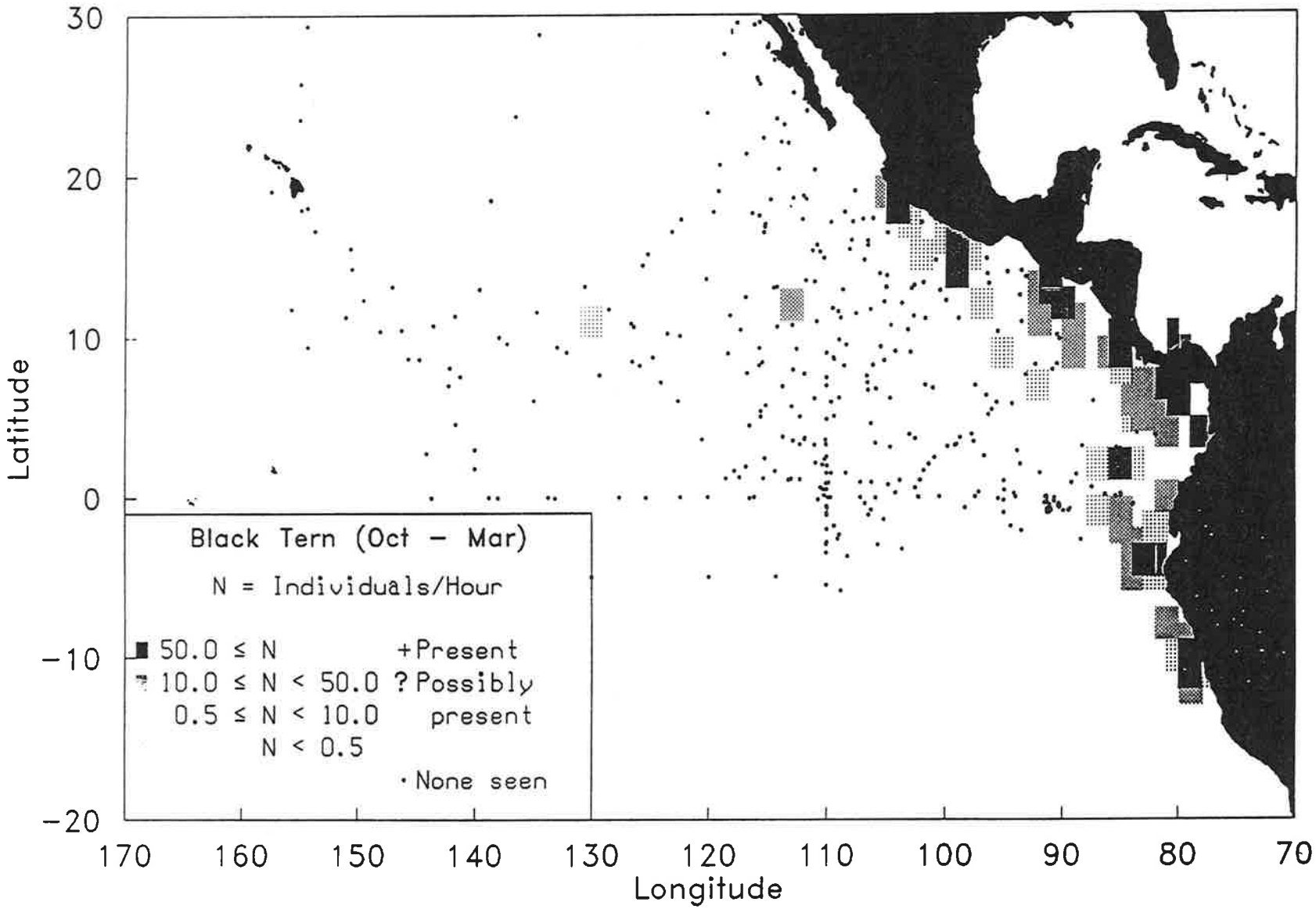

Figure 2. Winter (Oct-Mar) distribution of Black Terns in the eastern Pacific from several years of at-sea surveys in the last 20+ years. (Courtesy of R. L. Pitman.)

Nests are small cuplike gatherings of aquatic vegetation usually built on floating substrates of matted or decaying marsh vegetation (often mixed with mud), detached root masses, logs and boards, muskrat (*Ondatra zibethicus*) feeding platforms or clippings, algae or peat mats, lily pads, dried cowpies, and old nests of grebes, American Coots (*Fulica americana*), and Forster's Terns (*Sterna forsteri*). These substrates are usually anchored to or lodged in emergent vegetation or dense beds of submerged rooted aquatics (Novak 1992, Dunn and Agro 1995, Appendix 1). Non-floating nest substrates include muskrat lodges, raised mud patches, marshy hummocks, rooted flattened vegetation, and upturned tree roots with attached vegetation. Nests in California rice fields appear to be almost exclusively built on top of dirt mounds about 10 cm high that are unintentionally created during field preparation (Lee 1984).

Reproductive phenology

Nest site selection and nest building are rapid, with the time from colony occupation to egg laying being as little as 4 days (Dunn and Agro 1995). Initial nesting attempts are fairly synchronous, but renesting frequently prolongs the breeding season. Egg-laying has occurred as early as 11 May in lowland California, where the majority of clutches are initiated in the second or third week of May. At higher elevations or more northerly latitudes, most clutches are initiated from the third week of May through the first week of June. Average clutch size is 2.6 (n = 2297); 3-egg clutches account for about 65% of nests, 2-egg clutches for 20% to 25%, 1-egg clutches are uncommon, and clutches of 4 to 6 eggs are rare (Dunn and Agro 1995). Incubation begins with the first egg, and eggs require 19 to 23 days to hatch (Novak 1992, Dunn and Agro 1995). Earliest hatching is in early June but most occurs in late June to early July (Dunn and Agro 1995). Exact age of first flight, which probably varies with feather growth, is uncertain because chicks often leave the nest earlier. Chicks can fly as early as 18 to 19 days, most at 20 to 24 days, and some probably at 25 days (Dunn and Agro 1995). Most young fledge in mid- to late July but some as late as 20 August.

Breeding site fidelity

The low fidelity to the nest area probably is a function of year-to-year variation in water levels, vegetation density, and availability of nest substrates as a result of droughts, floods, winter storms, and muskrat activity (Dunn and Agro 1995, Neuman and Blokpoel 1997).

Demography and limiting factors

Little is known about the demography of Black Tern populations in North America and, hence, the effects of production, survival, recruitment, and dispersal in limiting the species' distribution and numbers (Nisbet 1997). Nesting success varies widely, but probably is usually less than one chick raised per nest (Dunn and Agro 1995). That birds can renest at least 42 km from their original nest makes estimating annual reproductive success of birds that fail on first attempts extremely difficult (Mazzocchi and Muller 1993). Nests or eggs often are lost to bad weather, effects of wind and waves, or changing water levels (Dunn and Agro 1995). Chick loss is also

highly variable and its causes generally are unknown. Predation can be severe, loss from starvation apparently can reach 20%, waves and rising waters may flood chick sleeping areas, and exposure to inclement weather may cause much mortality some years. Most of the factors thought to limit breeding success are natural ones that do not seem to have been elevated above expected levels by habitat modification or other changes that might be linked to population declines.

Predators

Known predators of Black Tern eggs or chicks are the Great Blue Heron (*Ardea herodias*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Great Horned Owl (*Bubo virginianus*), mink (*Mustela vison*), and Norway rat (*Rattus norvegicus*) (Dunn and Agro 1995). Other potential predators of eggs or chicks are the Northern Harrier (*Circus cyaneus*), Ring-billed Gull (*Larus delawarensis*), American Crow (*Corvus brachyrhynchos*), Common Raven (*Corvus corax*), raccoon (*Procyon lotor*), muskrat, long-tailed weasel (*Mustela freneta*), otter (*Lutra canadensis*), water snake (*Natrix sipedon*), and snapping turtle (*Chelydra serpentina*) (Gerson 1988, Novak 1992, Dunn and Agro 1995). Adults have been taken by a Northern Harrier and a large fish and attacked by a Common Raven (Dunn and Agro 1995).

Diet

Breeding Black Terns are mainly insectivorous, but fish make up a large part of the diet in some habitats and regions (Dunn and Agro 1995). Fish may dominate the diet by mass and provide an important source of calcium (Beintema 1997). Both parents feed the chicks (Dunn and Agro 1995).

POPULATION ESTIMATES AND TRENDS

Estimates

No former or current population estimates are available for North America. The United States breeding population is reasonably in the low hundreds of thousands. The largest breeding populations in the U.S. appear to be in North Dakota (about 83,000-86,000 individuals estimated in 1992-1993, Igl and Johnson 1997), South Dakota (Peterjohn and Sauer 1997), and Minnesota (perhaps the largest in the U.S., Baker and Hines 1996b). The greater extent of the breeding range in Canada versus the U.S. (Figures 1 and 3) and the large populations in the prairie provinces of Alberta, Saskatchewan, and Manitoba (Dunn and Agro 1995, Peterjohn and Sauer 1997, Figure 3), suggest the Canadian breeding population may be larger than that in the U.S. An estimate of roughly 2873 to 14,996 breeding pairs in Ontario (Austen 1994) appears to be the only regional estimate for any province or territory in Canada which is suspected of holding thousands of breeding terns (Appendix 1). The size of populations on the wintering grounds also are unknown, but those in the Gulf of Panama may number in the hundreds of thousands (L. Spear pers. comm.).

BLACK TERN ABUNDANCES

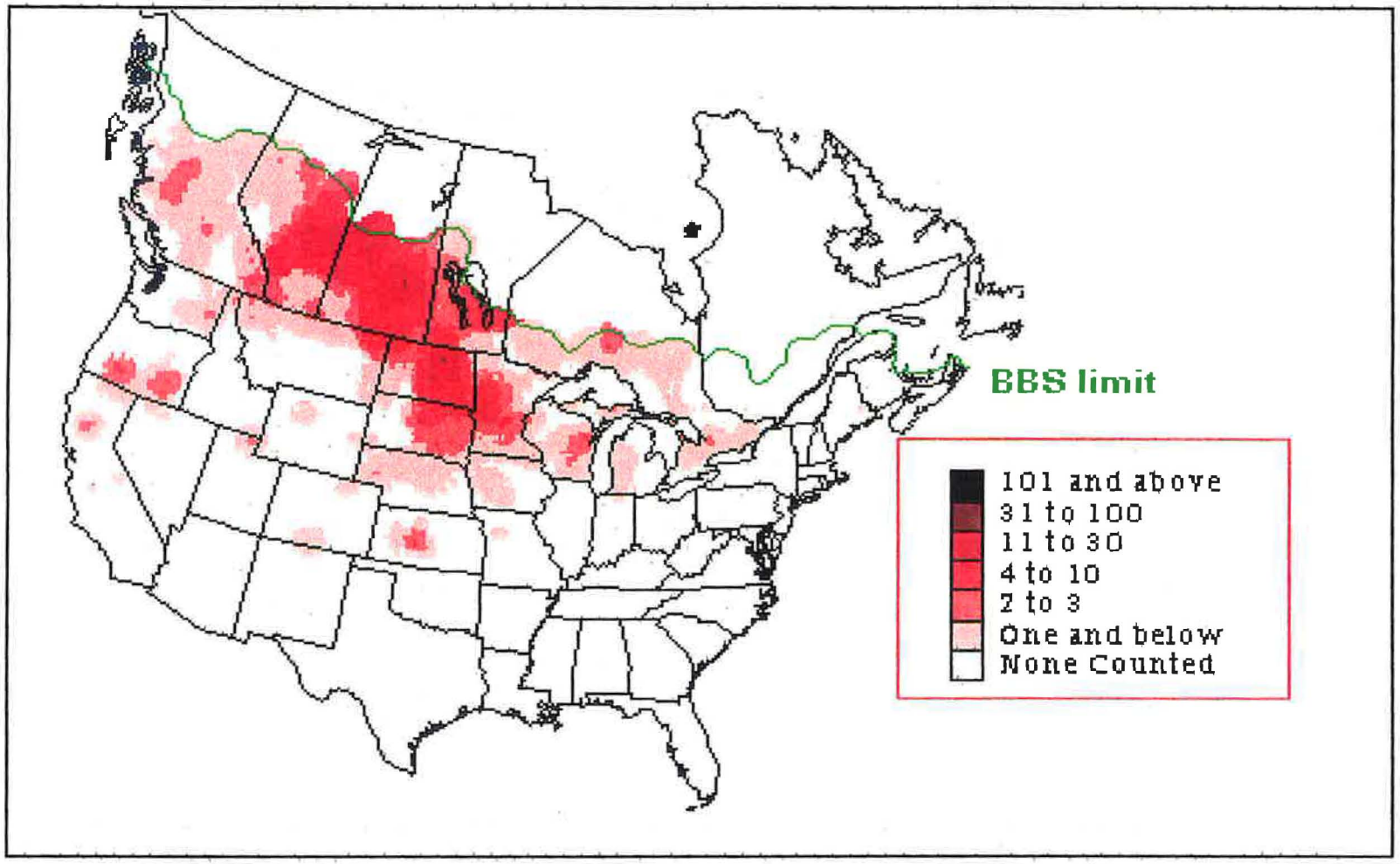

Figure 3. Relative abundance of Black Terns from Breeding Bird Survey routes in the United States and southern Canada, 1966-1996 (Sauer et al. 1997); abundances in average number of individuals detected per route per year.

Trends

Historically, the Black Tern has declined in numbers in much of North America, although it still occupies most of its former range. The species has been extirpated only from Missouri and Kentucky (Appendix 1). Whether based on surveys or, mostly, anecdotal data, populations of breeding Black Terns have declined in 14 and are stable or increasing in 4 of the 34 states, provinces, and territories currently occupied (Table 2). Historical range reductions and population declines have been most noticeable in the southern part of the breeding range, especially around the Great Lakes and in New England (Table 2, Appendix 1). Historical range expansions have been reported for British Columbia, Nova Scotia, New Brunswick, Maine, and Vermont (Appendix 1).

The best data on continentwide population trends are from the North American Breeding Bird Survey (BBS), which indicate Black Terns declined significantly survey-wide at an average rate of -3.1% annually (-61.1% overall) from 1966 to 1996 (Peterjohn and Sauer 1997). Also during this period, the Canadian population decreased significantly at an average annual rate of -3.5% (-65.7% overall). These declines reflect trends largely prior to 1980, where the trends for the period 1966— 1980 for the continental, Canadian, and U.S. populations decreased significantly at average annual rates of -7.5%, -5.6%, and -11.9%, respectively. Subsequently, most population trends were reversed in the 1990s (Peterjohn and Sauer 1997, Table 3). Geographically, BBS data show declining trends throughout much of the heart of the range, particularly in the prairie provinces of Canada (Figure 4), with increases centered from North Dakota across eastern Montana into part of southern Saskatchewan; increases in the northern Rocky Mountains of British Columbia and the northern United States are based on small samples and should be viewed cautiously (Peterjohn and Sauer 1997).

Associations between patterns of change in the numbers of Black Terns, Mallards *(Anas platyrhynchos)*, and numbers of ponds in the northern Great Plains suggest that some relationships exist between habitat availability and recent population trends (Peterjohn and Sauer 1997).

Data on numbers of Black Terns on migration are limited but suggest substantial population declines. For example, Carroll (1988b) reported a marked decline in numbers of Black Terns during fall migration along the upper Niagara River, Ontario, and New York, from the 1960s to early 1970s. The rapidity of the decline, from 3000 to 4000 in 1970 to 200 in 1972 (no count in 1971), suggests that part of the decrease may reflect a shift in areas used by the terns. In recent years, the highest fall migration count in this area was in 1991 when 479 Black Terns were counted on Point Peninsula shoal, Jefferson County, on Lake Ontario (Mazzocchi and Hickey 1997). Maximum fall migration counts at Cape May, New Jersey, in the 1920s and early 1930s ranged from "many hundreds" to 600, but in the 1980s reached only 30 to 45 (Sibley 1993). For Florida, Stevenson

Table 2. Apparent historical population trends of Black Terns in 34 states, provinces, or territories in North America. Data from Appendix 1.

State, Province, or Territory	Declining	Stable or Increasing	Equivocal or Unknown
UNITED STATES			
California	X		
Colorado	X		
Idaho		X	
Illinois	X		
Indiana	X		
Iowa	X		
Kansas			X
Maine		X	
Michigan	X		
Minnesota			X
Montana			X
Nebraska	X		
Nevada			X
New York	X		
North Dakota			X
Ohio	X		
Oregon			X
Pennsylvania	X		
South Dakota			X
Utah			X
Vermont	X		
Washington			X
Wisconsin			X
Wyoming			X
CANADA			
Alberta			X
British Columbia		X	
Manitoba		X	
New Brunswick			X
Northwest Territories			X
Nova Scotia			X
Ontario	X		
Québec	X		
Saskatchewan	X		
Yukon			X

Table 3. Breeding Bird Survey population trend estimates for Black Terns during the 1966-1996, 1966-1979, and 1980-1996 intervals for all states, provinces, strata, and regions where they occurred (Sauer et al. 1997). Trend is presented as average % change per year.

Area	1966-1996			1966-1979			1980-1996		
	Trend	P	N	Trend	P	N	Trend	P	N
Alberta	-0.3	0.93	47	0.3	0.94	19	-3.2	0.08	43
Manitoba	-6.5	0.18	23	-7.8	0.30	10	-1.1	0.54	19
Minnesota	-2.4	0.55	40	-5.6	0.11	23	4.9	0.66	31
North Dakota	2.0	0.54	29	-13.0	0.01	14	9.2	0.19	27
Ontario	-3.2	0.67	19	-13.2	0.01	10	1.6	0.84	16
Saskatchewan	-4.3	0.09	45	-6.6	0.05	25	-1.7	0.53	32
South Dakota	-2.7	0.57	14	-31.4	0.06	13	14.3	0.01	12
Wisconsin	-2.3	0.46	26	-1.8	0.71	23	1.0	0.84	13
Great Lake Plain	-8.8	0.06	16	1.2	0.88	15	-4.8	0.36	8
Great Lakes Transition	-2.4	0.54	23	-7.2	0.10	15	-2.7	0.63	20
N. Spruce-Hardwoods	-6.1	0.22	18	-15.7	0.00	13	-0.6	0.95	7
Aspen Parklands	-3.7	0.07	79	-5.2	0.06	32	-3.4	0.04	68
Drift Prairie	-1.4	0.54	51	-12.3	0.00	32	9.6	0.07	42
Glaciated Missouri Plateau	1.5	0.84	25	-2.9	0.77	15	9.1	0.46	19
Black Prairie	-0.5	0.93	27	-7.2	0.17	16	9.1	0.49	21
Eastern BBS Region	-6.1	0.00	74	-7.9	0.01	52	-1.9	0.56	47
Central BBS Region	-2.0	0.23	103	-13.0	0.00	58	7.2	0.10	85
Western BBS Region	-2.7	0.21	128	-4.5	0.07	62	-0.7	0.71	101
FWS Region 1	5.4	0.65	19	-5.6	0.11	10	19.2	0.01	13
FWS Region 3	-3.7	0.11	77	-4.9	0.03	54	4.3	0.56	49
FWS Region 6	0.5	0.83	57	-15.7	0.00	33	9.2	0.09	50
United States	-0.9	0.55	154	-11.9	0.00	98	9.1	0.02	112
Canada	-3.5	0.04	151	-5.6	0.02	74	-1.9	0.23	121
Survey-wide	-3.1	0.04	305	-7.5	0.00	172	1.3	0.45	233

BLACK TERN TRENDS

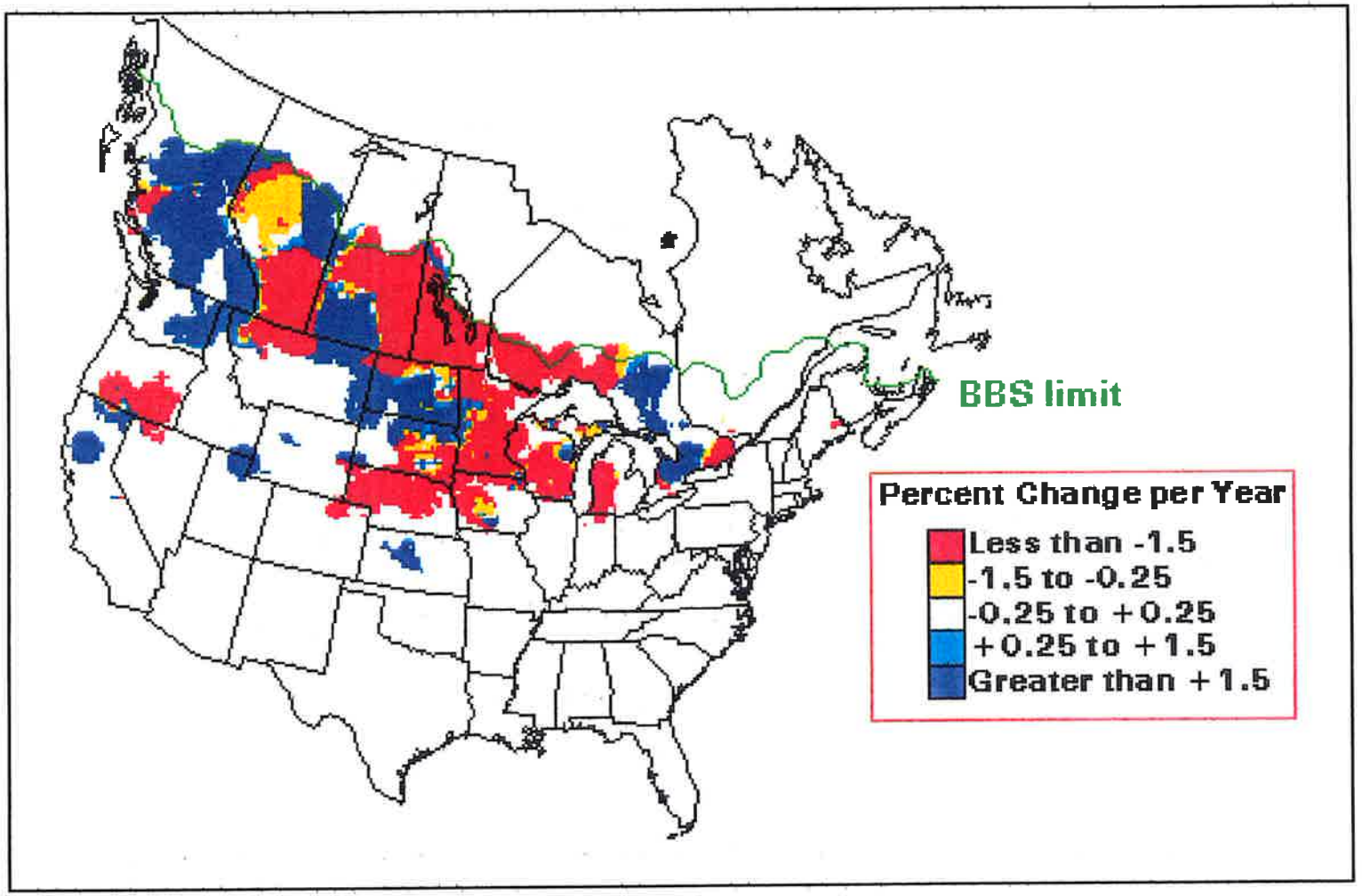

Figure 4. Annual population trend of Black Terns from Breeding Bird Survey routes in the United States and southern Canada, 1966-1996; change in percent per route per year (Sauer et al. 1997).

and Anderson (1994) reported four high counts during fall migration from 1929 to 1964 ranging from 2750 to >10,000 birds. They noted an "absence of such large numbers" in the 1970s and 1980s, but reported an estimate of >1000 birds offshore in 1976. Clapp et al. (1983) compiled records of peak concentrations of migrant Black Terns in the coastal southeastern U.S., but noted declines only in North Carolina "in recent years."

MONITORING ACTIVITIES

Breeding Bird Survey

The BBS has been run annually since 1966 and is the only survey that provides trend estimates for the Black Tern throughout North America (Peterjohn and Sauer 1997). Because of methodological shortcomings, some authors doubt the reliability and representativeness of the population and trend indices of the BBS (e.g., Nisbet 1997). BBS methodology is known to be deficient in surveying wetland birds, colonial nesters, and other species (Bystrak 1981, Robbins et al. 1986). Specifically, with the BBS there are problems with the use of a survey method designed primarily for passerines. It provides imprecise trend estimates of Black Terns resulting from their semicolonial nesting habits and considerable annual fluctuations in population size, and relies on roadside sampling of wetlands that may or may not be a representative subset of all habitats used by the species (Peterjohn and Sauer 1997). Nevertheless, all significant trends for various areas from 1966 to 1996 have been negative and none have been positive. Additionally, the association between changes in Black Terns on the BBS and Mallards from aerial surveys provides some confidence that the BBS trend estimates are reasonable. Even if reliable on the continentwide level, BBS data were considered adequate for trend analysis only for states and provinces in the heart of the range (Alberta, Saskatchewan, Manitoba, Ontario, North Dakota, South Dakota, Minnesota, and Wisconsin), leaving the smaller, and perhaps more vulnerable, populations at the edge of the range without adequate monitoring.

Few comparable data are available to assess the reliability of BBS data. Igl and Johnson (1997) repeated the multi-species surveys of Stewart and Kantrud (1972) and found a significant decline in Black Tern numbers in North Dakota from about 254,000 in 1967 to 83,000 to 86,000 in 1992 to 1993. BBS data, however, showed a significant average decline of -13.0%/yr from 1966 to 1979, but no significant trend from 1980 to 1996 or 1966 to 1996 (Peterjohn and Sauer 1997). In Wisconsin, total numbers of Black Terns detected on standardized roadside surveys declined 65% between 1980 to 1982 and 1995 to 1996 (Muschitz et al. 1996). Comparisons of the mean number of terns for each individual route across both time periods showed a significant difference, and the decrease averaged about 40%. Mean number of pairs, based on nest counts, at all survey sites decreased from 180 in 1980-1981 to 139 in 1995-1996. By contrast, nest search surveys for Columbia County (n = 45 sites), the area with the best comparative data, showed an 8% increase in mean nesting

pairs from 1980-1982 to 1995-1996, despite a -45% decline in the total number of sites where terns nested. For comparison, Peterjohn and Sauer (1997) found no significant trends in BBS data for Wisconsin for any of the three analysis periods 1966-1979, 1980-1996, and 1966-1996.

State and Provincial Surveys

In states with small populations of Black Terns, species-specific statewide surveys have been conducted annually in Maine and Vermont and irregularly in New York, Pennsylvania, Idaho, Wyoming, and Indiana (Appendix 1). Multi-species wetland monitoring programs also have surveyed Black Terns annually in Ohio, Illinois, and the Great Lakes region of Ontario and the adjacent U.S. (Appendix 1, Austen et al. 1996, LPBO 1997, LPBO and EC 1997). Wisconsin conducted roadside and nest search surveys for Black Terns that provided an index of population change from the early 1980s to mid-1990s (Graetz and Matteson 1996, Muschitz et al. 1996). In Québec, data from birders' checklists have been used to analyze population trends of Black Terns (LaCombe 1995). Data from recent distributional surveys in British Columbia, California, Montana, and Minnesota (Appendix 1) possibly may serve as the basis for future monitoring programs in those areas. More data, however, are needed to evaluate the effectiveness of all monitoring programs, including the BBS.

HABITAT REQUIREMENTS

Breeding Season

Black Terns nest in shallow, highly productive wetlands with emergent vegetation in freshwater (sometimes brackish or alkaline) marshes, along prairie sloughs, lake margins, edges of islands or slow-moving rivers, wet meadows, bogs, shrub-swamps, and, in California, cultivated ricefields or flooded fallow fields (Dunn and Agro 1995, Appendix 1). Nesting marshes occur in open or forested country to 1220 m (4000 ft) elevation in British Columbia (Campbell et al. 1990), 2004 m (6605 ft) in Montana (T. McEneanney written comm.), and 2000 m (6560 ft) in California (Shuford 1998). In North Dakota and South Dakota, Black Terns nest mostly in semipermanent ponds and lakes (Stewart 1975, Naugle 1997). In South Dakota, nest searches indicated that Black Terns bred in <1% of seasonal wetlands but used these habitats extensively for foraging (Naugle 1997).

Weller and Spatcher (1965) reported that during wetland succession the hemi-marsh stage (roughly 50:50 open water and vegetation) was ideal for most marsh-nesting birds, including Black Terns. They felt, however, that the interspersion of water and vegetation and the size of water areas was perhaps of greater significance than the ratio of water to cover. Studies by Tilghman (1980), Chapman Mosher (1986), Rabenold (1986, 1987), Hickey (1997), Hickey and Malecki (1997), and Mazzocchi et al. (1997) also support the conclusion that Black Terns generally select nest sites with an approximate 50:50 vegetation cover to open water ratio that is well interspersed with water; open water, though, can vary from 5% to 95% of the area of breeding marshes (Powell 1991). Black Terns in

northeastern California regularly use low stature spikerush (*Eleocharis* spp.) marshes with low stem-density that usually lack extensive areas of open water (Shuford 1998). Similarly, cultivated rice fields used by Black Terns in California lack areas of open water beginning with the growth of rice plants early in the tern breeding season (D. Shuford pers. obs.). Black Terns can rapidly colonize restored marshes or ones rejuvenated after drought, and initially numbers may build up as vegetative conditions improve and later decline as they deteriorate (Weller and Spatcher 1965, Weller 1979, Hemesath and Dinsmore 1993). Numbers of Black Tern nests reached a peak at two Iowa marshes 3 to 4 years after the initiation of gradual reflooding after a drought (Weller and Spatcher 1965).

The relationship of marsh size and landscape features to numbers of Black Terns appears to be complex. Brown and Dinsmore (1986) found Black Terns preferred marshes >20 ha and only rarely used smaller marshes (5 ha min.) unless part of larger wetland complexes. Naugle (1997) used GIS technology to develop a model of important Black Tern habitat in eastern South Dakota, and he also found the terns nesting in larger basins and wetland complexes. Using the 50% probability of occurrence (from logistic regression analysis) as a conservative estimator, he delineated the minimum area requirement of the Black Tern as a semipermanent wetland basin of 12.4 ha. Using this minimum area requirement criteria, Naugle subjectively ranked the Black Tern as moderately area dependent in relation to other wetland-dependent species whose probability of occurrence also increased significantly with increasing wetland area. Black Terns were found in 1 of 3 semipermanent wetlands surveyed, and the smallest basin in which they nested was 0.3 ha. In New York, Adams (1990) found 20 nests at a 24.8 ha marsh but only 1 to 5 each at 5 other marshes ranging in size from 42.0 to 548.0 ha, and Muller et al. (1992) found no correlation between wetland size and colony size at 33 sites. These studies might have obtained different results if they had restricted their analysis to wetlands with intermediate cover-to-water ratios (median vegetated area 38%-68%, Brown and Dinsmore 1986) as Naugle (1997) did.

Naugle (1997) also found that the area requirements of the Black Tern varied in response to the structure of the wetland landscape. Black Terns did not widely use wetland landscapes with a low density of primarily small wetlands, where few nesting wetlands occurred and potential food sources were spread over large distances. In contrast, their wetland area requirements were small (6.5 ha) in high wetland density landscapes with a mixture of large and small wetlands compared to 32.6 ha in landscapes of predominately large wetlands or 15.4 ha in landscapes with mostly small wetlands. Black Terns also were more likely to occur in wetlands whose surrounding grasslands were <50% tilled for agriculture (Naugle 1977). That average one-way foraging distances of Black Terns range from about 1-4 km from colonies (Chapman Mosher 1986) may suggest

why smaller marshes support terns only when part of larger marsh complexes or mosaics. The species' loose coloniality and scattered nest spacing might be another explanation of why Black Terns are more commonly found in larger wetlands and are considered an area-dependent species (Hickey and Malecki 1997).

Hickey and Malecki (1997) felt the size of vegetation patches within a marsh may be just as important as the size of the marsh itself. In their study area in western New York, no nesting or non-nesting marsh impoundments sampled were <5 ha and nearly all were >20 ha. A coarse assessment of the total favorable available habitat in nesting marshes was >10 ha, but made up <50% of the total size of these large units.

Black Terns use a wide range of vegetation types at their nesting areas. Dominant emergent vegetation in Black Tern breeding marshes can be cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), burreed (*Sparganium* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), spikerush, pickerelweed (*Pontederia* spp.), smartweed (*Polygonum* spp.), reed-canary grass (*Phalaris arundinacea*), tufted hairgrass (*Deschampsia caespitosa*), arrowhead (*Sagittaria* spp.), spatterdock (*Nuphar* spp.), water lilies (*Nymphaea* spp.), wild rice (*Zizania aquatica*), marsh horsetail (*Equisetum fluviatile*), cultivated rice, and, in northern areas, buttonbush (*Cephalanthus occidentalis*) and willows (*Salix* spp.) in shrub-swamps (Dunn and Agro 1995, Appendix 1). Floating dead vegetation is an important component of many nesting marshes.

Ideal nest site characteristics reduce nest loss from wind and waves and provide cover for chicks (Chapman Mosher 1986, Dunn and Agro 1995), but presumably also provide camouflage to incubating adults without greatly hindering their entry to the site or reducing their visibility of approaching predators. Nest sites must allow easy access of chicks and adults to open water even after vegetation density has increased by seasonal growth; dense homogenous stands of vegetation generally are avoided (Shambaugh 1995). Hence, vegetation around nest sites generally varies from sparse to moderately dense (Appendix 1). Emergent vegetation at nest sites grows from about <0.25 to 0.5 m high at nest initiation to >1 m before hatching (Dunn and Agro 1995). Nest sites are usually adjacent or close to small to large expanses of open water (Dunn and Agro 1995, Appendix 1); mean distances of nests from open water have ranged from 0.1 to 35.9 m (Dunn 1979, Novak 1990, Mazzocchi and Hickey 1997, Hickey and Malecki 1997). Black Terns may seek an optimum distance from both the water edge and upland edge that reduces the effects of wind and wave action and predators (Hickey and Malecki 1997). Hence, wetland habitat or patch fragmentation and increased edge might negatively influence reproductive success. Mean water depths at nests in wetlands have ranged from 25 to 134 cm and may vary considerably among sites, habitats, or years (Gould 1974, Stern 1987,

Dulin 1990, Novak 1990, Seyler 1991, Laurent 1993, Faber 1996, Hickey and Malecki 1997, Mazzocchi et al. 1997, W. C. Scharf written comm.). In California rice fields, water depths at 27 nests ranged from 5 to 15 cm before farmers raised water levels in July (Lee 1984). The availability of exposed perch sites -- used for copulation, resting, and sites for feeding recently fledged young -- may influence nesting habitat selection (Novak 1990). Areas of open water or sparse vegetation are used for foraging (Chapman Mosher 1986; Shambaugh 1995, 1996b, Shambaugh and Parren 1997). Water clarity at nesting and foraging sites also may be an important habitat need (Richardson 1996).

Mazzocchi et al. (1997) remarked that because nest success is so variable among regions, years, and colonies, it has been difficult to identify consistent significant relationships between nest success and habitat features. In British Columbia, experiments showed that nests surrounded by vegetation or on platforms suffered the least from wind and wave action or fluctuating water levels (Chapman Mosher 1986). Nests in *Phalaris* survived water level fluctuations better than those in other habitats, and fledging success was greatest in areas with the shortest plants, *Equisetum*. In northern New York, water levels at successful nests were not significantly different than at failed nests (Mazzocchi et al. 1997). By contrast, in Wisconsin and Minnesota, Laurent (1993) and Faber (1996) found that nests that failed to hatch had significantly lower minimum water depths than those that successfully hatched young. In Oregon, nest success and fledging rates did not differ among habitats of varying vegetative composition and water depth (Stern et al. 1985). Neither Bergman et al. (1970) or Dunn (1979) found a correlation between nest success and nest-site characteristics. Similarly, Hickey (1997) found few significant relationships between nest fate and nest site habitat features; successful nests were closer than failed nests to a dominant cover change and permanent marsh edge.

Few studies have compared nest site characteristics to random sites or used models to predict the presence of nests in marshes. In Maine, Gibbs and Melvin (1990) found that wetlands with breeding terns on average had a greater extent of fine-leaved emergents, submerged and floating vegetation, scrub vegetation, open water, and flooded timber, and a higher vegetative (life-form) diversity than did wetlands not used by terns. Maxson's (1993, 1994) preliminary analysis indicated nest sites had greater water depths, a shorter distance to open water, greater nest visibility, and tallest vegetation (within 1 m) was shorter when compared to 400 random sites. Hickey and Malecki (1997) developed a model to examine nest site selection with the significant model variables being vegetation density, horizontal cover 0.5 m above the water, cover:water ratio, and water level. In 1995, the model accurately predicted 87.5% of nest sites sampled in western New York, but only 64.0% of those in northern New York, where at Perch River WMA 70.0% were accurately

predicted in 1995 and 52.6% in 1996 (Mazzocchi et al. 1997).

Migration

In the U.S., migrating Black Terns use freshwater lakes, rivers, and other interior wetlands, and also forage over plowed fields and coastal wetlands (Dunn and Agro 1995). In fall in arid areas of the West, thousands of Black Terns concentrate at highly productive interior wetlands, such as Malheur NWR, Lower Klamath NWR, and the Salton Sea (Appendix 1). At the latter area, large numbers of terns forage over irrigated fields (D. Shuford pers. obs.). In Europe, the importance of post-breeding molting areas has only recently been recognized (J. van der Winden written comm.). Very few of these sites exist, and only large productive wetlands, mostly with small fish, are suitable. South of U.S., Black Terns are found mainly over offshore marine waters generally where water is 30 to 450 m deep (up to 2000 m) in areas of high productivity, such as the Panama upwelling and edges of Gulf of Mexico currents (Dunn and Agro 1995). During autumn migration, Black Terns in the Gulf of Mexico concentrate over the freshwater plume of the Mississippi River, characterized by low surface water salinity (high freshwater fraction) and high productivity; the terns are more likely to be seen outside of warm-core eddies (Peake 1996, Ribic et al. 1997). Peake (1996) reported mean water depth at Black Tern sightings in the Gulf was 752 m (75-2104, n = 412), and many terns associated with schooling fish. Also from Mexico southward, the terns use freshwater areas and, along marine coasts, salt pans, flooded fields, marshes, estuaries, and brackish swamps (Dunn and Agro 1995).

Winter and Summer Nonbreeding Seasons

At these seasons, Black Terns are found largely in marine waters, mostly within 30 km of land (often less) with occasional records to 3500 km offshore (Dunn and Agro 1995). They also use coastal areas and productive freshwater lakes, usually near coasts.

THREATS

Habitat

Loss, degradation, isolation, and fragmentation of habitat via drainage for agriculture or development are the main factors cited as causes for Black Tern population declines in North America (Appendix 1). In the conterminous United States, 54% of historic wetlands have been lost (Dahl et al. 1997). Net annual wetland loss from 1985 to 1995 averaged 47,370 ha (117,000 acres), a rate 60% lower than from the mid-1970s to the mid-1980s and 74% lower than from the mid-1950s to mid-1970s (Tiner 1984, Dahl et al. 1997). These periods of greatest wetland loss correspond to the period of greatest known declines of Black Terns from the mid-1960s to about 1980 (Peterjohn and Sauer 1997). An estimated 38.8 million ha (95.8 million acres) of freshwater wetlands remain in the U.S., of which 10.1 million ha (25.0 million acres) are freshwater emergent wetlands (Dahl et al. 1997), the main habitat used by breeding Black Terns. Since the 1950s, freshwater emergent wetlands have declined by the greatest percentage - 25% (3.3 million ha) - of any freshwater wetland type. Of the 26 states in the conterminous U.S. with

current or former Black Tern populations (Appendix 1), all have experienced historic wetland loss of ≥20% and 13 of ≥50% (Dahl 1990). Wetland loss in southern Canada appears to be of similar magnitude to that in the U.S. (Gerson 1988).

Rabenold (1987) expressed concern that habitat loss had left many localized marshes that were too small by themselves or were not part of larger marsh complexes, rendering them unsuitable for Black Terns. A strong positive correlation between changes in Black Tern and Mallard numbers in the prairie provinces of Canada supports the contention that regional changes in the availability of suitable habitat is a factor responsible for declines in tern populations (Peterjohn and Sauer 1997). In only a few cases have authors felt that statewide population declines of the Black Tern were not a response to insufficient breeding habitat (e.g., Whitaker et al. 1988, Shambaugh 1996b). Degradation of habitats may occur by succession, raising or lowering water levels, introducing exotic species, and reducing water quality, which may alter both the food web and vegetative structure of wetlands (Novak 1992). In general, competition for scarce water supplies in the arid West may impact potential breeding marshes. In California rice fields, agricultural practices that rapidly draw down water levels have exposed tern nests to Norway rat predation only to later destroy renesting attempts when fields were reflooded to higher than original levels (Lee 1984). Mazzocchi and Muller (1995) felt that as the quantity and quality of nesting habitat declines, the negative impact of factors such as predation, human disturbance, and adverse weather may increase, thereby reducing productivity.

In Europe, population declines of Black Terns are attributed to wetland loss and degradation from pollution, particularly via eutrophication (from excess nitrogen and phosphates from agriculture) and acidification of surface waters (van der Winden et al. 1996, Beintema 1997). Eutrophication led to massive loss of a favored Black Tern nesting substrate, water soldier (*Stratiotes aloides*), and may have led to a loss of insect diversity (notably large insects), leading to increased risk of chick starvation. Acidification may leave wetlands devoid of fish and other organisms rich in calcium, resulting in calcium deficiency that causes malformation and death in chicks. In the Netherlands, causes of declines varied regionally (van der Winden et al. 1996). Little is known about loss or degradation of winter or migratory staging habitat. Nisbet (1997), though, rightly observed that since Black Terns spend 8 to 9 months of the year on salt water and 6 to 7 months on their tropical wintering grounds, factors on the wintering grounds may be equally or more important than ones on the breeding grounds, such as habitat limitation. Overfishing has reduced small fish stocks in the Peru upwelling ecosystem off Peru and Ecuador (Patterson et al. 1992), but its effect on Black Terns is unknown (Dunn and Agro 1995). It also would be valuable to investigate the

effects of fishing pressure in the Gulf of Panama on tuna, which drive larval fishes to the surface where they are preyed on by Black Terns (R. L. Pittman written comm.). Pollution might be another source of concern on the wintering grounds (L. Spear pers. comm.), or at important migratory staging areas, such as the Salton Sea.

Overutilization

Human disturbance is often cited as a potential threat, which can expose Black Tern chicks to adverse weather or destroy nests (Dorr 1976, Novak 1990, Appendix 1), but little information has been gathered to investigate the extent of this problem. Gerson (1988) reported that observed frequencies of presence and absence of Black Terns in Canadian wetlands exposed to varying degrees of human disturbance were similar to expected frequencies, indicating that Black Terns do not tend to select nesting areas free of disturbance. She also felt that Black Terns are fairly tolerant of disturbance as long as it is not prolonged. Hands et al. (1989) reported disturbance recorded at Black Tern colonies surveyed by the Colonial Waterbird Register. Recreational disturbance, such as swimming, fishing, and birding, was observed at nearly 50% of 43 colonies in 4 states; other forms of disturbance, such as low-flying aircraft, were observed much less frequently. Muller et al. (1992) observed motor boats for 66 hours in New York in 1990 but found no evidence of nest swamping from wave action. Other potential, but undocumented, sources of disturbance include turtle trapping, frog hunting, bow hunting for carp, shooting, dog training, and canoeing and other small craft boating (Moen 1991, Seyler 1991, Mazzocchi and Muller 1995, D. Brauning pers. comm.). Human disturbance was not felt to be an important factor at most colonies in Ontario and Vermont (Dunn 1987, Shambaugh 1996b).

Disease or Predation

Black Terns sometimes die of botulism, but this disease or the various parasites harbored by the species do not seem to be major causes of mortality (Hands et al. 1989, Novak 1992, Dunn and Agro 1995). Predation may limit reproductive success, and Brewer (1991) felt that increasing predator populations might be one of the multiple factors responsible for population declines in Michigan.

Inadequacy of Existing Regulatory Mechanisms

Current regulations appear to provide the Black Tern adequate protection throughout its breeding range. 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. The Black Tern is a U.S. Fish and Wildlife Service Migratory Nongame Birds of Management Concern in the United States (USFWS 1995). The Black Tern 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). Table 1 is a summary of the legal status of the species in the states and provinces throughout its breeding range.

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 (Dahl et al. 1997). Incentive programs such as the Wetland Reserve Program offer some breeding habitat protection with wetland easements in perpetuity.

Current regulatory mechanisms are inadequate to protect the species and its habitats on the winter range. Most countries in the wintering range have no legal mechanisms for protecting the Black Tern or its 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.

Other Natural or Manmade Factors

Pesticides or other contaminants

Dunn and Agro (1995) and Weseloh et al. (1997) reviewed the literature on concentrations of contaminants, such as organochlorines, PCBs, and metals, in Black Tern eggs but found no evidence of effects on reproduction. Weseloh et al. (1997) concluded that contaminant levels in Black Tern eggs collected from 1989 to 1996 had declined noticeably from those found in the 1970s and early 1980s and that they were substantially lower than those in other fish-eating colonial nesting waterbirds in the same area. Although eggshell thinning of up to 16% has been reported as recently as 1985 (Davis and Ackerman 1985), no problems have been documented, and most thinning falls below the range of 15% to 20% or more usually associated with reproductive impairment (Weseloh et al. 1997). Dunn and Agro (1995) summarized studies that found thin eggshells in the upper Mississippi River in the 1970s, but eggshell thickness appeared to have recovered to pre-1947 levels by the late 1970s or early 1980s. Faber and Elbert (1996), however, found a significant positive relationship between egg concentrations of chlordane and the percent time spent off the nest in nocturnal incubation.

Dunn and Agro (1995) and Weseloh et al. (1997) concurred that direct chemical toxicity is generally not a problem with Black Terns, but pesticides may reduce favored insect foods. Nevertheless, Weseloh et al. (1997) felt potential problems suggested by Faber and Elbert's (1996) work and eggshell thinning above 10% warranted further investigation. Despite the potential of pesticides to reduce reproduction and survival of birds, current data are inadequate to assess the direct or indirect impacts of agricultural chemicals on wildlife inhabiting wetlands in the Prairie

Pothole region (Grue et al. 1986). But a die-off of 41 Black Terns at Lake Icaria, Iowa, in May 1990 was attributed to exposure to carbamate or organophosphate pesticides used to control insects on farmlands adjacent to marshes (Anon. 1990 in Dinsmore 1996). Brewer (1991) suggested that acid rain or other airborne chemicals might possibly be contributing to declines in Michigan.

King and Sanger (1979) ranked the Black Tern low on a scale of vulnerability to oil pollution in an assessment of various marine birds in the Northeast Pacific because of the species' rarity in the area. A large oil spill, however, where large numbers of terns concentrate during migration or winter might have serious consequences.

Population size and isolation

Very small and localized breeding populations, such as those in the Northeast, are extremely vulnerable to stochastic events, such as storms, habitat loss, or human disturbances (Leberman 1992).

Introduced species

The introduced marsh plant purple loosestrife (*Lythrum salicaria*) crowds out native emergents and forms stands too dense for nesting Black Terns (Seyler 1991). Terns are responding favorably to recent vegetation removal in the Columbia Basin of Washington, where purple loosestrife and phragmites (*Phragmites australis*) have been choking out marshes (R. Friesz, J. Taber pers. comm.).

An increase in a feral Mute Swan (*Cygnus olor*) population at a marsh off Lake St. Clair, Michigan, from 2 adults in 1980 to 100 in 1988 may have caused a sharp decline in numbers of breeding Black Terns, though the mechanism responsible is unknown (E. T. Cox written comm.).

Introduction of a piscivorous predatory fish, peacock bass (*Cichla ocellaris*), to rivers and lakes in Panama in the late 1960s reduced populations of other small fishes preyed on by wintering Black Terns and other species (Zaret and Paine 1973). Anecdotal observations at Gatun Lake suggested that the local Black Tern population was reduced in peacock bass areas, but apparently no follow-up studies have been published. Hence, the overall effect on the wintering Black Tern population is unknown, particularly as the vast majority of the terns winter in marine waters rather than in freshwater habitats harboring the introduced fish.

MANAGEMENT

Recovery of Black Tern populations likely will require a combination of habitat protection and a suite of effective management and restoration techniques to improve habitat conditions and nesting success.

Habitat and Vegetation Management

To provide suitable Black Tern habitat in most regions of North America, managers should maintain or create emergent marshes with an approximate 50:50 vegetation cover:open water ratio with a good

interspersion of vegetation and water. This strategy may not work, though, in areas such as California, where vegetation-to-open water ratios generally are much higher (Shuford 1998). Brown and Dinsmore's (1986) work further suggests that Black Terns would benefit most from creation or restoration of marshes >20 ha or marshes of >5 and <20 ha situated within a wetland complex. Naugle's (1997) research indicates that overall the minimum area requirement for Black Terns is 12.4 ha of semipermanent wetland, but this requirement can be lowered to 6.5 ha in landscapes of high wetland density that contain a mixture of large and small wetlands. Because of ongoing succession, Hands et al. (1989) recognized the need to manage so that some areas are available each year for migrating and breeding terns. For western New York, Hickey (1997) recommended that in impoundments managed for Black Terns that habitat should be in unbroken patches of vegetation >10 ha in area, especially in marsh units <20 ha in area. In large marsh units, habitat patches >20 ha should be encouraged. Patches themselves should have a 50:50 interspersion of vegetation and water. Water levels should be stabilized as much as possible during nesting.

Assuming that managers will want to manage for multiple wetland-dependent species, Naugle (1997) indicated that when the number of area-dependent species in semipermanent wetlands is ≥4, a factor of 1.5 may be used to determine how much larger a wetland of x area must be to support another area-dependent species. For example, a 8-ha wetland containing 8 area-dependent species would need to be only 4 ha larger in area (8 ha X 1.5 = 12 ha) to contain one additional species, whereas a 16-ha wetland would need to be 8 ha larger, twice that for the 8-ha wetland, for an additional species to be present.

Specific management regimes already have been used at certain sites. The Tonawanda complex in western New York is managed for Black Terns by draining and discing to favor burreed, an important nesting habitat, and muskrats, which provide nest sites and open up the marsh vegetation (Adams 1990; Hickey 1992; Seyler 1991, 1993; Hickey 1997; Hickey and Malecki 1997). Marshes are drawn down in May, disced in July or August, and subsequently reflooded. Hickey (1997) recommended that marshes managed for Black Terns should be placed in a 4 to 6 year cycle of drawdown followed by flooding in years 2 to 5. In the first year following flooding, water levels should be kept higher than normal to inhibit undesirable vegetation, such as purple loosestrife, and allow muskrat populations to build up. After intentional or natural removal of water for one or more seasons, Black Terns almost always colonize impoundments the year following reflooding, and peak numbers usually occur in the second and third years after reflooding (Hickey and Malecki 1997). In the first year after drawdown, vegetation responds, muskrat populations grow, and Black Tern nesting is probably limited by lack of suitable nesting substrates. In the second and third year, muskrat feeding

and house-building activities remove vegetation, improving the interspersion of vegetation to water and providing nesting substrates. Muskrats, though, are not present in many areas where Black Terns breed and, hence, different management regimes or cycles may be needed in such areas.

The availability and use of muskrat structures may reflect the processes that foster nest substrate formation (Hickey and Malecki 1997). Floating vegetation mats and rootstalks may form more often in marshes dominated by persistent emergents, such as cattails and bulrushes, as a result of snow accumulation and wind and wave action, the latter perhaps being more of a factor in large lakes and marshes (Seyler 1991, Hickey and Malecki 1997). Muskrats may be attracted to burrow in islands constructed in marshes to enhance waterfowl nest success. This may reduce the extent muskrats would open up vegetation by lodge-building and feeding activities and thereby potentially limit nest substrates for Black Terns (Messier and Virgl 1992, Hickey and Malecki 1997). E. T. Cox (written comm.) questioned the extent to which muskrats are a benefit to Black Terns, noting that muskrats often cut down large areas of protective marsh vegetation, making those areas unsuitable for tern nest sites, and usurp floating nests or artificial nest platforms.

Seyler (1991), Shambaugh (1996b), and Hickey (1997) also felt elevated perches -- used by Black Terns for copulation, resting, and sites for feeding recently fledged young (Novak 1990) -- should be created in potential tern habitat. Day use and roost sites should be within 2 km of nesting marshes and preferably within 0.8 km (Hickey 1997).

In Minnesota, Black Terns colonized a marsh the year following reflooding five years after it was drained, and peak populations occurred in the second and third years after restoration (Delehanty and Svedarsky 1993). Shambaugh (1996b) felt that vegetation management in Vermont might best be accomplished with a five-to-seven-year rotation and periodic opening up of marsh vegetation by mechanical means without draining the entire marsh.

Linz and Blixt (1997) recommended the use of aerially-sprayed herbicides to open up cattail-dominated marshes to manage for wetland features -- roughly equal amounts of open water, live cattails, and floating mats of dead cattails -- that maximize Black Tern abundance on a local scale. They felt aquatic herbicides could be used with a creativity and precision difficult to achieve with other methods, and the time between treatments may be from 8 to 10 years. Also, they suggested that vegetation management treatments should be staggered within and among wetland complexes to diversify successional stages of emergent vegetation to maintain avian diversity on a regional scale.

Other alternatives for vegetation management that should be considered before any is chosen include regulation of muskrat populations, water level control, livestock grazing, prescribed burning, mowing, discing, crushing, excavating, and blasting with explosives (Hickey 1997, Linz and Blixt 1997). Whatever management scheme is selected should be scheduled as best as possible to mimic natural processes and fluctuations (Hickey 1997). Much that may be applicable to Black Tern habitat management can be learned from the extensive literature on wetland management for waterfowl. These efforts emphasize the importance of maintaining long-term productivity of marshes by mimicking natural hydrologic regimes and the need to adapt management techniques to local conditions (e.g., Fredrickson and Taylor 1982, Fredrickson and Reid 1990).

Removal of purple loosestrife by uprooting plants, water-level manipulation, mowing, burning, flooding, or herbicide application can eliminate small and young stands but is costly, requires continued long-term maintenance, and, in the case of herbicides, is nonselective and environmentally degrading (Malecki et al. 1993). An program of biological control by introduction to the U.S. and Canada of four European insects (a root-mining weevil, a flower-feeding weevil, and two leaf-eating beetles) shows promise in controlling, but not eliminating, purple loosestrife in North America (Malecki et al. 1993, Cornell University 1997).

Artificial Nest Platforms

Faber (1996) studied use and reproductive success on artificial nesting platforms along the Mississippi River from 1989 to 1991. Platforms were significantly more successful in hatching young than were natural nests in 1990, but results were equivocal for the combined period 1989 to 1991 (Faber 1996). In northern New York, Mazzocchi and Hickey (1997) found nest success on artificial platforms was higher than on natural substrates in 1995 and lower in 1996. Although nest success was higher on artificial platforms versus natural substrate in some other studies (Faber 1990; Hickey 1992, 1997), they felt more data were needed to make any conclusions on the value of artificial platforms. They suggested, though, that artificial platforms should not be a long-term management tool, but instead may provide data on substrate availability or quality. Reinforcement of fragile nests with foam padding may boost productivity (Mazzocchi and Muller 1995). When platforms are used they should be set out before nest initiation and placed in vegetation characteristic of natural nest sites and in water depths adequate to limit predation (Faber 1992a, Hickey 1997).

Predator Management

Predator control usually is a controversial issue and should be used only as a last resort. Decisions regarding predator management should be made only after documentation of the predators involved and the extent of their effect on Black Terns and after consideration of the alternatives and

likelihood of success in improving the situation (Novak 1992). Modification of deterrent methods, such as monofilament gull exclosures or protective chick shelters used in some Common Tern (*Sterna hirundo*) colonies, might be useful in deterring predators in Black Tern colonies (Hickey 1997).

RECOMMENDATION ON CURRENT STATUS

Although the Black Tern appear to have sharply declined in numbers in North America since at least the beginning of the BBS in 1966, its population appears to have leveled off or risen slightly in the 1990s (Table 3). The species still occupies most of its former range, and the continentwide breeding population still numbers in the low to mid hundreds of thousands. The types and levels of current threats are poorly known. Recent status assessments in Canada did not list the species as threatened (Gerson 1988) or vulnerable (Alvo and Dunn 1996), despite recommendations to the contrary. Nevertheless, because of the severity of the earlier declines, the species still warrants serious concern. Specifically, conservation efforts should be undertaken to monitor the population and to continue to reverse declines.

CONSERVATION PLAN

Recommended conservation actions needed for the Black Tern have been prioritized within each of four main categories: monitoring, research, habitat management and protection, and education. It is important, however, to recognize that the success of recovery and protection efforts will require many individuals and groups working in concert on multiple aspects of Black Tern conservation.

Monitoring

(1) Prepare a catalog, where possible, of breeding sites for the Black Tern, identifying and mapping sites at a coarse scale to select sites worthy of monitoring. Data contained in various regional Black Tern or wetland bird inventories and in many breeding-bird-atlas projects should be useful in initiating this effort. All potential and historical sites should be included since Black Terns may shift breeding sites from year to year in response to changes in hydrologic cycles and emergent vegetation. Map habitats at historic and potential breeding sites using wetland inventory maps, aerial photography, or GIS technology as appropriate (Kibbe 1995, Graetz and Matteson 1996). Habitat availability and suitability should be assessed annually during population surveys, both at wetlands currently and historically occupied, to describe the specific habitat needs of Black Terns, monitor the quality of available habitat, and determine if suitable habitat is a limiting factor in the region surveyed (Graetz and Matteson 1996).

(2) Identify and prepare a catalog of key migratory staging, molting areas, and wintering grounds. Assess the potential of effectively monitoring continental populations at these sites.

(3) Refine monitoring techniques to better detect population trends and determine the causes of these changes. Some recommendations to

enhance continentwide or regional monitoring are:

(a) Increase the precision of BBS trend estimates by expanding survey routes within the Black Tern's North American breeding range.
(b) Implement a separate continentwide survey specific to wetlands that is based on stratified random sampling techniques (Dunn and Agro 1995, Peterjohn and Sauer 1997) and is precise enough to also monitor trends at the state and provincial level, where management efforts are initiated. In this regard, assess the suitability of the multi-species wetland bird surveys in place in Ohio, Illinois, and elsewhere around the Great Lakes as a model for designing a similar continentwide breeding survey.
(c) Measure the reliability of the current regional surveys in assessing trends in Black Tern numbers.
(d) Initiate statewide surveys in those states with small populations, particularly in the arid West where few such surveys have been conducted.
(e) Standardize regional surveys (e.g., Pence 1995), recognizing that techniques used may need to vary according to the size, distribution, and nesting habitats of the population being surveyed.
(f) Coordinate the seasonal and year-by-year timing of Black Tern surveys, particularly as tern populations may fluctuate in response to changes in regional water regimes.
(g) If possible, conduct annual Black Tern surveys, perhaps via multi-species surveys; if not, periodic multi-year surveys may prove adequate for monitoring (Hands et al. 1989, Shambaugh 1996b).
(h) Regardless of the periodicity or methods used, attempt to keep disturbance by surveyors to a minimum (Novak 1992).

Habitat Management and Protection

Because habitat loss and degradation have been identified as the most likely cause of declines in Black Tern populations in North America, it will be important to work with all groups involved in wetland habitat restoration, enhancement, and protection to ensure that strategies to increase Black Tern populations are incorporated in management plans as part of these efforts. It could be especially valuable to work with the coalition of groups involved in the various Joint Ventures of the North American Waterfowl Management Plan and in Partners in Flight to implement the recommended actions:

Management

(1) Adapt wetland management practices throughout the range of the Black Tern, so they can simultaneously benefit waterfowl, Black Terns, and other waterbirds (Hands et al. 1989, Novak 1992, Pence 1994).
(2) Conduct controlled experiments to see which management actions are effective locally in producing habitat suitable for Black Terns.

(3) Evaluate the extent to which management actions can reduce nest and chick losses via predator management and water level regulation (Hands et al. 1989, Novak 1992).

(4) Further evaluate the effectiveness of artificial nest platforms for increasing nest success or densities of Black Terns, emphasizing placement of platforms where nest substrates appear to be limiting or where terns may be encouraged to nest in areas of low disturbance (Hands et al. 1989, Novak 1992)

Protection

(1) Concurrently with management actions, efforts should be pursued vigorously to protect the quantity and quality of available wetland habitat and stem the tide of wetland loss not only on the breeding grounds but also at important migratory staging areas and wintering grounds. A landscape approach needs to be taken in which a whole suite of potential breeding habitats are protected whether each site is used annually or not. Protection of important Black Tern habitat can be accomplished via land acquisition, conservation easements, management agreements, legislative incentives, and enforcement of existing wetland protection regulations (Hands et al. 1989; Novak 1990, 1992).

(2) In states and provinces where the Black Tern is endangered, threatened, or declining rapidly, protect all sites currently in use, regardless of the size of the site or the number of Black Terns present, and all historical sites with ≥5 ha of suitable habitat (Novak 1992). Where less threatened, protect large (>11 ha) wetlands and sites with substantial Black Tern populations.

(3) Maintain water quality in nesting marshes and discourage use of pesticides on state and federal lands to prevent reduction of insect populations and contamination of wetlands (Hands et al. 1989).

(4) Maintain buffer zones to block siltation, pesticide, and fertilizer runoff to wetlands; leave undeveloped nearby fields used for foraging (Novak 1992).

Research

(1) Conduct studies of habitat use, prey availability, and diet at migratory staging and molting areas and wintering grounds to assess possible threats and limiting factors at these sites (Shambaugh 1996, Hickey 1997, Nisbet 1997).

(2) Conduct demographic studies at selected sites across the species' breeding range to identify "source" and "sink" populations and thus the regions most important for maintaining the North American breeding population (Peterjohn and Sauer 1997). Also, study the relationships between tern population demographics and breeding habitat suitability (Peterjohn and Sauer 1997).

(3) Study metapopulation dynamics and demography, focusing on such parameters as survival, age at first breeding, recruitment, dispersal, and the factors that affect them, using color-banded or radio-tagged

birds (Hands et al. 1989, Novak 1992, Pence 1994, Shambaugh 1996b, Hickey 1997, Nisbet 1997).

(4) Investigate aspects of behavioral ecology, such as mate selection, mate fidelity, spacing behavior, coloniality, dispersal, and post-fledging parental care (Nisbet 1997).

(5) Models of nest site selection at the local level may perform poorly for a variety of reasons (Hickey and Malecki 1997). Hence, to better understand the micro- and macrohabitat features important to nest site selection, habitat should be evaluated by a variety of techniques and at multiple scales.

(6) Investigate diet and nutrition in relation to breeding habitat quality and prey populations (Beintema 1997, Nisbet 1997).

(7) Periodically monitor the levels of contaminants in Black Terns and their eggs to assess trends in contamination and determine the effects of contaminants on eggshell thinning, behavioral modification, chick development, nesting success, and juvenile survival (Hands et al. 1989, Novak 1992, Weseloh et al. 1997). Evaluate by biochemical means the species' sensitivity to contaminants (Weseloh et al. 1997).

Education

Education may be a valuable tool for reducing wetland loss and the possible detrimental effects of human recreation (Hands et al. 1989, Novak 1992). Novak (1990) recommended informing fisherman and boaters via brochures of the potential effects of their activities on Black Terns, and Hickey (1997) advised posting and restricting use of nesting areas and other marshes used by newly fledged juveniles. In Maine, high school students have developed a video, interpretive signs, pamphlets, and an outreach program to inform citizens of the need to protect Black Terns (McCollough and McDougal 1996, M. McCollough in Welch 1997). Also, restricting boat speeds and access can reduce the potential impact of waves on tern nests (Novak 1990). Signs, however, may draw attention to colonies and may be ineffective, or even detrimental, when enforcement is not possible (Novak 1992).

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APPENDIX 1. SUMMARIES FOR STATES, PROVINCES, AND TERRITORIES WITHIN THE BREEDING RANGE IN THE UNITED STATES AND CANADA

UNITED STATES

Alaska
California
Colorado
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Maine
Michigan
Minnesota
Missouri
Montana
Nebraska
Nevada
New Jersey
New York
North Dakota
Ohio
Oregon
Pennsylvania
South Dakota
Utah
Vermont
Washington
Wisconsin
Wyoming

CANADA

Alberta
British Columbia
Manitoba
New Brunswick and
Nova Scotia
Northwest Territories
Ontario
Québec
Saskatchewan .
Yukon

UNITED STATES

Alaska

Status and Distribution: Extremely rare vagrant (Gabrielson and Lincoln 1959, Kessel and Gibson 1978, DeSante and Pyle 1986), with only one historical breeding record from Fort Yukon (66°35'N, 145°20'W) (Gabrielson and Lincoln 1959). Records of 1 to 2 Black Terns in the upper Tanana Valley in June or July for three consecutive years, 1994 to 1996 (NASFN 48:331, 49:964, 50:984), suggest that the species rarely may breed in the vast lake and marsh-covered sections of the eastern interior of the state (see account for Yukon).

Major Populations: NA

Population Trends: NA

Research/monitoring: NA

State Status: No status assigned.

Natural Heritage Rank: Accidental Nonbreeder.

Habitat Conditions: NA

Threats: NA

California

Status and Distribution: Formerly a locally common breeder in two distinct geographic areas: (1) the Modoc Plateau region and mountain valleys of the northeastern portion of the state and (2) the lowlands of the Sacramento and San Joaquin valleys of the greater Central Valley (Grinnell and Miller 1944).

Currently the species still nests widely in northeastern California. Surveys there in 1997 estimated 1940 pairs of Black Terns nested at 60 sites and reached their upper elevational limit of breeding at 2000 m (6560 ft) at Boot Lake, Lassen County (Shuford 1998). Because of massive habitat loss, the species no longer nests at most wetlands in the Central Valley where it was recorded historically, though this has been compensated to an unknown degree by colonization of cultivated rice fields (Grinnell and Miller 1944). Surveys of the Central Valley in 1998 found Black Terns breeding widely but patchily in an extensive area of rice fields in the Sacramento Valley and in a limited area of this habitat in the San Joaquin Valley near Merced, Merced County, and in Fresno County just south of Dos Palos, Merced County (PRBO unpubl. data). The species also was breeding at eight scattered colonies elsewhere in the San Joaquin Valley, primarily in agricultural fields flooded by runoff from the previous winter's near record precipitation. In the Central Valley away from rice fields, the species appears to breed only irregularly in

years of very high runoff, as noted for 1998. Other examples of wet year-breeding were in 1983 and 1997, when nesting occurred, respectively, at the South Wilbur Flood Area (G. Gerstenberg pers comm.) and Hacienda Ranch (R. Hansen pers. comm.), both Kings County.

Major Populations: The center of abundance appears to be in northeastern California, particularly in Modoc County. Surveys in this region in 1997 found about 71%, 22%, and 8% of the population in Modoc, Lassen, and Siskiyou counties, respectively (PRBO unpubl. data). Key sites included Barnum Flat, Siskiyou County; Weed Valley, Widow Valley, Bucher Swamp, Boles Meadow, Egg Lake, and Taylor Creek wetlands, Modoc County; and Ash Valley, Red Rock Lakes complex, and Eagle Lake, Lassen County. Small's (1994) report of "the largest regular concentration (1000+) in northern California" in the Klamath Basin is unsubstantiated. Estimates of the size of the breeding population in the Central Valley based on 1998 surveys are not yet available, although it is clear that the Sacramento Valley rice fields hold the largest breeding population in the Central Valley (PRBO unpubl. data).

Crucial staging areas in fall include the Salton Sea, Riverside and Imperial counties, and Tule Lake NWR, Siskiyou and Modoc counties, where "tens of thousands" and "up to 10,000" have been reported, respectively (Small 1994). Estimates of the number of Black Terns staging at Tule Lake from 15 July to 4 August 1997 ranged from about 1000 to 6000 birds (Shuford 1998).

Population Trends: BBS data are too few for trend analysis (Peterjohn and Sauer 1997). Anecdotal evidence suggests the statewide population has declined substantially, primarily in the San Joaquin Valley where, away from limited areas of rice fields, the species now breeds only irregularly in very wet years. Cogswell (1977) felt that numbers declined in the Central Valley with loss of marshlands, increased with the expansion of rice culture, and declined again "recently," perhaps from pesticide accumulation. J. Snowden (written comm.) counted Black Terns annually in late June or early July, 1976 to 1992, in Butte County in the northern Sacramento Valley while conducting roadside pheasant brood surveys. In most years, numbers ranged from 0.30 to 0.58 terns/mi, except from 1983 to 1987, a period of relatively low acreage of flooded rice, when they ranged from 0.12 to 0.36 terns/mi.

Black Terns formerly nested at Lake Tahoe, primarily at Rowlands Marsh near the mouth of the Upper Truckee River (Orr and Moffitt 1971), but no longer do so (Cogswell 1977, D. Shuford pers. obs.). The Rowlands Marsh colony once held over 100 pairs, and prior to 1920 colonies of 4 to 5 pairs bred at marshes near the mouth of Emerald Bay, at Meeks Bay, and near Tahoe Vista; "a few pairs" also formerly nested annually at a marsh west of Tallac, at the mouth of Taylor Creek (Orr and Moffitt

1971). Gould (1974) expressed concern about the future effects of continued development and increased disturbance on waterbirds breeding at Eagle Lake, Lassen County. Estimates of the number of Black Terns breeding at Eagle Lake have ranged from 300 and 150 in 1970 and 1971, respectively (Gould 1974), to 46 in 1974 (Lederer 1976), to 224 (112 pairs) in 1997 (Shuford 1998). These numbers may reflect year-to-year variation in the size of the nesting population, perhaps mirroring changing patterns of emergent vegetation in response to lake levels (G. Gould pers. comm.), rather than a population decline followed by recovery.

Research/monitoring: Gould (1974) gathered data on habitat use, nest site characteristics, and hatching success of Black Terns as part of a broader study of various piscivorous birds at Eagle Lake. In the Sacramento Valley, Greenberg (1972) conducted censuses along two road transects through rice fields near Robbins, Sutter County, and Elverta, Sacramento County, from 1969 to 1971, and Lee (1984) studied nesting biology at six colonies in this general area in 1976 and 1977. Broadscale surveys of Black Terns were conducted in northeastern California in 1997 (Shuford 1998) and in the Central Valley in 1998 (PRBO unpubl. data).

State Status: Species of Special Concern.

Natural Heritage Rank: Imperiled.

Habitat Conditions: Breeds in freshwater marshes, ponds, lake borders, rice fields (Grinnell and Miller 1944, Lee 1984), and flooded fallow fields (J. Snowden pers. comm., D. Shuford pers. obs.). At Eagle Lake, Gould (1974) found all nests in lake-fringing *Juncus* beds, frequently in shallow water near shore where reed and algal debris accumulated. Nests were constructed of loosely aggregated fragments of *Juncus* and built on supporting structures. Of 40 nests, 13 were placed on floating boards or logs, 13 on muskrat rafts, 8 on abandoned nests of grebes or Forster's terns, and 6 on reed or algal debris. Average water depth at nests was 35.3 cm (5.1-91.4; n = 24) in 1970 and 67.3 cm (25.4-106.7; n = 21) in 1971. Distances of nests from shore averaged 13.3 m (1.2-45.7, n = 24) in 1970 and 23.0 m (7.6-38.1, n = 18) in 1971. At Rowlands Marsh, Lake Tahoe, most nests observed were in "rather open water" in pond lily and water smartweed (*Polygonum amphibium* var. *stipulaceum*), though some were in growing marsh grass (Orr and Moffitt 1971).

Of 60 breeding sites in northeastern California in 1997, 52 had marshes dominated by low (<1 m) emergents and 6 by a mixture of tall (>1 m) and low emergents (Shuford 1998). At lower Klamath NWR, Black Terns nested in shallowly-flooded units dominated by barley stubble, remaining after harvest, and algae mats; these units lacked any significant amount of live emergent vegetation. At Boot Lake, Lassen County, breeding habitat was dominated by the floating yellow pond-lily (*Nuphar luteum* spp.

polysepalum). Of the 58 sites with emergent vegetation, 50 (86.2%) were dominated or co-dominated by low emergent spikerush (*Eleocharis* spp.) or *Juncus* spp., 7 (12.1%) by a mixture of tall emergents (such as *Scirpus* spp. or *Typha* spp.) and low emergents, and 1 (1.7%) with the low emergent composite *Arnica* spp. Percent cover of emergent vegetation was >80% at 41 (68.3%) of the 60 breeding sites, between 60% to 80% at 9 (15.0%) sites, 40% to 60% at 3 (5%), 20% to 40% at 0 (0%), and 0% to 20% at 7 (11.7%). All of the 7 sites with <20% cover, except Lower Klamath NWR, were open-water lakes or reservoirs with fringing marsh vegetation. If vegetative cover estimates had been limited to actual Black Tern breeding sites, rather than the entire wetland, the proportion of total sites with >80% cover would have been higher. Most of the floating nests found in northeastern California were over water about 25 to 40 cm deep, and nests were supported by emergent vegetation, abandoned grebe nests, floating cowpies, or, rarely, small earthen hummocks (D. Shuford unpubl. data).

Historically in the Central Valley, various observers noted Black Terns nesting in areas of natural overflow of rivers and lakes (Mailliard 1904, Tyler 1913, van Rossem 1933). At Los Banos in 1903, these terns were nesting in ephemeral marshes created by flood irrigation of pasturelands using flows from the San Joaquin River (Chapman 1908). Today, the massive system of dikes, levees, and reservoirs that services and protects agriculture lands and urban centers keeps rivers within their banks, except during extreme flood events after which the water is usually drained or pumped back into river channels, leaving few areas of shallow water in the breeding season. An exception is the closed Tulare Basin of the southern San Joaquin Valley, where excess flood waters are stored in years of unusual rainfall and may remain through the summer, providing Black Tern breeding habitat on an irregular basis (R. Hansen pers. comm., D. Shuford pers. obs.). Currently Black Terns are known to breed annually in the Central Valley only in cultivated rice fields. In Sacramento Valley rice fields, Lee (1984) visited 27 nests, all of which were built on top of dirt mounds about 10 cm high that were unintentionally created during field preparation. Water depths at these nests ranged from 5 to 15 cm before farmers raised water levels in July.

Threats: The Central Valley has lost over 90% of its historic wetlands (Frayer et al. 1989), and recent efforts at habitat restoration, which focus primarily on habitat for the valley's wintering waterfowl (USFWS 1990), are unlikely to benefit Black Terns. Development and lowering of water levels eliminated breeding terns at Lake Tahoe (Orr and Moffitt 1971). In northeastern California, losses of wetland habitat, particularly in the Klamath Basin, may have been partially offset in the Modoc Plateau by historic increases of habitat from creation of shallow reservoirs for livestock grazing and recent efforts to increase waterfowl habitat (T. Ratcliff, G. Studinski pers. comm.). Agricultural practices that rapidly

draw down water levels in rice fields have exposed tern nests to rat predation only to later destroy renesting attempts when fields were reflooded to higher than original levels (Lee 1984). Three egg yolks collected from a colony in rice fields in the Sacramento Valley in 1969 had 8.0, 9.1, and 11.8 ppm DDE (Greenberg 1972), but there is no evidence of any deleterious effects of pesticides or other agricultural chemicals on Black Terns breeding in rice fields.

Colorado

Status and Distribution: Cooke (1897) termed the Black Tern a "not uncommon" summer resident that nested "quite abundantly" at a few localities and was found on both sides of the Rockies almost anywhere natural conditions were suitable. Sclater (1912) felt the species was a "not very uncommon" resident breeding chiefly in the eastern plains. Bailey and Niedrach (1965) described the Black Tern as a summer resident, ranging from the plains into the Transition Zone, that was found regularly in "considerable numbers" over lakes and reservoirs of the eastern prairies and less commonly in the western part of the state. They knew of comparatively few nest records despite considerable field work (see also Rockwell 1911). Kingery (1988) reported breeding evidence from 13 (7 definite, 6 likely) of Colorado's 28 latilongs, mostly in the eastern part of the state; overall status was "rare" (<10 records/latilong). Andrews and Righter (1992) considered the species a "rare to uncommon" summer resident locally in mountain parks and on eastern plains. During the Colorado Breeding Bird Atlas (1987-1994), breeding evidence for the Black Tern was obtained for 24 blocks: 11 (0.6%; 10 possible, 1 confirmed) of 1745 priority blocks plus 13 non-priority blocks (H. Kingery written comm., Colorado BBA preliminary data). Of these, 10 were from the eastern plains (6 South Platte R. valley, 4 Arkansas R. valley), 9 from the San Luis Valley, 4 from North Park, and 1 from the west slope of the Rockies. Breeding confirmations came only from San Luis Lake SWA and Alamosa and Arapaho NWRs.

Major Populations: Largest numbers during the Colorado Breeding Bird Atlas were found in the San Luis Valley (H. Kingery pers. comm.).

Population Trends: Rockwell (1911) concluded that the construction of numerous large reservoirs in Colorado, with consequent seepage and marshland, had increased suitable breeding grounds for terns, citing the Barr Lake region as an example. Andrews and Righter (1992) felt "it was once more common as a breeder, at least in some localities," but supported this only with anecdotal evidence of apparent declines in the Barr Lake area, Adams County. D. Nelson in H. Kingery (written comm.) also felt there had been historical declines, but he too supported this conclusion with very limited anecdotal evidence.

Research/monitoring: No known research projects but local monitoring programs at Alamosa and Arapaho national wildlife refuges (S. Jones

State Status: Endangered.

Natural Heritage Rank: Critically Imperiled.

Habitat Conditions: Black Terns in Illinois use freshwater marshes and shallow ponds and lakes with ample cover and open water; nests are placed amid live or dead marsh vegetation or on floating mud mats or bogs, cattail rootstocks, muskrat lodges, or boards (Nelson 1877, Herkert 1992).

Threats: Wetland alteration and drainage from urban development and agriculture have rapidly eliminated suitable habitat. Human disturbance also may be a problem (Bohlen 1989, Herkert 1992).

Indiana

Status and Distribution: Formerly a locally common summer resident and breeder north of the Kankakee River (Butler 1897), suggesting the state's historic breeding population was probably of modest size (see account for Ohio). Rabenold (1986) summarized old records and found evidence of Black Terns breeding at 15 historic sites in 8 counties. The Indiana Breeding Bird Atlas (1985-1990) recorded the species in four non-priority blocks (all confirmed) near the northern border in Lake, LaPorte, and Steuben counties (Keller and Keller 1998). These data primarily reflect Rabenold's (1986, 1987, 1988) surveys of historic, recent, and other potential nesting sites throughout Indiana at which she found 8 to 11 pairs/year breeding at 2 to 3 sites in LaPorte (Horseshoe Lake, Orr Lake) and Lake (Calumet River) counties. Whitaker et al. (1988) listed nesting records for 10 counties, all but 1 of which were from the northern part of the state. Since 1988, Black Terns are known to have bred in 1991 at the Calumet River and the DuPont site, Lake County, and from 1990 to 1995 at Horseshoe Lake, where 3 to 7 nests and 4 to 17 adults were present annually (J. Castrale and R. Hellmich written comm.). In 1996, Black Terns were not detected breeding anywhere in Indiana (Keller and Keller 1998, J. Castrale in. litt.), but in 1997 a pair and a nest was located at Horseshoe Lake (J. Castrale written comm.).

Major Populations: Highest numbers reported historically were 45 adults at Dewart Lake, Kosciuski County, in 1949, 40 nests at Wolf Lake, Lake County, in 1926, and about 20 nests at Jimmerson Lake, Steuben County, in 1940 (Mumford and Keller 1984, Rabenold 1986). More recently, the highest numbers were at Horseshoe Lake, where Rabenold (1988) found 5 to 8 nests annually from 1986 to 1988.

Population Trends: The limited historic information available and summarized by Rabenold (1986) suggests that numbers had declined greatly by at least the 1960s or 1970s. Population totals from the first statewide surveys from 1986 to 1988 averaged 9.3 pairs, and a continuing decline to the present (see above) leaves the species vulnerable to

imminent extirpation from the state as a breeding bird.

Research/monitoring: Rabenold (1986, 1987, 1988) conducted statewide population surveys and estimated nesting success at the few active colonies in the 1980s. Since then no statewide surveys have been conducted, but the only known remaining colony at Horseshoe Lake has been monitored annually since 1990 (J. Castrale written comm.).

State Status: Endangered.

Natural Heritage Rank: Critically Imperiled.

Habitat Conditions: Rabenold (1986, 1987, 1988) described shallow-water nesting habitat ranging from cattail marshes in oxbows of the Calumet River, to marshy islands dominated by cattail and reeds in large lakes, to small ponds almost choked over with spatterdock and water lilies. The sites used in 1986 and 1987 had a roughly 50:50 mix of open water and emergent vegetation; the vegetation was distributed irregularly across the water subdividing the surface into many small pools. By contrast, in 1989 emergent vegetation covered >80% of one site and <10% of the other (in a 10-15 m band around the border of the lake). Of Rabenold's (1986) sample of eight nests, all were on "muck islands" or floating vegetation mats, and nest placement averaged 45.4 m (SE = 3.9) from shore; water depth at 7 nests averaged 1.0 m (SE = 0.1). Of a total of 24 nest platforms distributed equally among three locations in 1988, one was used at a site with limited natural substrate in which one other nest was located, none were used at one site with six nests in abundant natural nesting substrate, and none were used at one site with no prior evidence of nesting but abundant natural nesting substrate. Nesting platforms have been provided at Horseshoe Lake annually since 1988 and have been readily used (J. Castrale written comm.).

Threats: Rabenold (1987) expressed concern that habitat loss had left many localized marshes that were too small by themselves or were not part of larger marsh complexes, rendering them unsuitable for Black Terns (Brown and Dinsmore 1986). Whitaker et al. (1988), though, felt that many of the habitats that supported Black Terns in the 1950s appeared unchanged today.

Iowa

Status and Distribution: Anderson (1907) described the Black Tern as "nesting commonly in suitable localities in the northern half of the state," which was echoed by DuMont (1933). Dinsmore et al. (1984) considered the species a "locally common nester in the northern half of Iowa, uncommon nester elsewhere." The Black Tern is currently an uncommon breeder in north-central and northwestern Iowa (Dinsmore 1996, Kent and Dinsmore 1996), but as recently as the 1960s, the species also nested regularly in central Iowa (see below). Dinsmore (1996) felt the species

probably never was a very abundant bird, but cited several references that described the species as a common breeder in northern and northwestern Iowa in the first half of the 20th century. During the Iowa Breeding Bird Atlas (1985-1990), the Black Tern was recorded in 46 (34 possible, 5 probable, and 7 confirmed) of 339 (335 completed) priority and 522 (276 completed) standard blocks (Dinsmore 1996). Good coverage of some of the normally best wetland regions coincided with the dry years of 1988 and 1989, when suitable habitat was limited (J. Dinsmore written comm.). Most probable and confirmed records were from the Des Moines Lobe (Wisconsin glaciated) region of northwestern and north-central Iowa, whereas many reports from southern Iowa were probably late migrants or non-breeders.

Major Populations: Few data are available on the location of major populations other than the general regions of occurrence noted above.

Population Trends: Dinsmore et al. (1984) cited anecdotal reports "in recent years" of a lack of the large concentrations found a few years ago, but they were unsure if this represented a real decline in numbers, a cyclical decline, or a lack of observers. Numbers currently seem reduced from the mid-1970s (Dinsmore 1996, Kent and Dinsmore 1996). Declines have been documented at a few sites with a historical record: 156 nests were found at two central Iowa wetlands from 1958 to 1962 (Weller and Spatcher 1965), but now the species seldom breeds there (Dinsmore 1996); at Dewey's Pasture, Clay County, Provost (1947a) found 15 nesting pairs in a 13-acre kettlehole in 1942 and Weller (1979) recorded an average of 16.8 (4-28) nests per year in 156 acres of wetlands from 1968 to 1974, but recently only a few birds have nested there (Dinsmore 1996); and two lakes in north-central Iowa that averaged 66 nests from 1966 to 1968 (Bergman et al. 1970) held 12 nests in 1988 (Bernstein 1988). BBS data are too few for trend analysis (Peterjohn and Sauer 1997). The species now appears to be "very abundant" in migration in Iowa, but no reliable quantitative data are available from earlier times (T. Kent written comm.).

Research/monitoring: No known research projects or statewide monitoring programs.

State Status: Species of Special Concern.

Natural Heritage Rank: Imperiled.

Habitat Conditions: Black Terns in Iowa nest in marshes and lakes with emergent vegetation (Dinsmore et al. 1984). Brown and Dinsmore (1986) found Black Terns preferred marshes >20 ha in size and only rarely used smaller marshes (5 ha min.) unless part of larger wetland complexes.

At Dewey's Pasture, Provost (1947a) found nests of these terns clustered at the edge of bulrushes and burreed over water 58 to 79 cm deep. Most nests there were on wet plant remains on floating algal mats or decaying muskrat platforms, feeding platforms, or bunches of green cuttings; one nest was on a recently abandoned American Coot nest. Nests at Goose Lake, Hamilton County, were often in open areas but usually protected from wave action by emergent vegetation and placed on deteriorated muskrat houses or feeding platforms or built on floating plant debris or rootstocks or dense beds of submerged, rooted aquatics; occasional nests were on floating boards (Weller and Spatcher 1965). Of 156 nests at Goose and Little Wall lakes, 72% were on muskrat houses. Of 197 nests at two sites in north-central Iowa, 104 (53%) were on floating cattail rootstalks, 50 (25%) were on inactive muskrat lodges, 22 (11%) were on dead floating emergent vegetation, and 21 (11%) were on muskrat feeding platforms; usually the rootstalks and rafts of emergent vegetation were lodged between standing vegetation (Bergman et al. 1970). Nest sites varied between the two wetlands according to the availability of nesting substrates, and at other sites in Iowa these terns sometimes placed their nests on floating boards held in place by emergent vegetation. Bergman et al. (1970) found Black Terns nesting in a variety of vegetative situations from dense stands of cattails to "open water," where nests were protected from wave action by submergent or emergent plants. At one site, 38 nests were on either deteriorated muskrat lodges or muskrat feeding platforms in open water areas created by muskrats. Floating vegetation was most abundant around nest sites that were protected from wave action by emergent vegetation.

Threats: Black Terns in Iowa undoubtedly have suffered from the overall loss of wetlands (Dinsmore 1996), but recent declines of the species have occurred despite the availability of seemingly suitable habitat (J. Dinsmore written comm.). The species may be susceptible to the chemicals used to control insects on farmlands adjacent to marshes, as indicated by a die-off of 41 Black Terns at Lake Icaria, Adams County, in May 1990 that was attributed to exposure to carbamate or organophosphate pesticides (Anon. 1990 in Dinsmore 1996). Davis and Ackerman (1985) found thin shells in a sample of 7 eggs from Iowa, but the eggs were apparently healthy.

Kansas

Status and Distribution: Has long been considered a rare and local summer resident or breeder in central Kansas (Goss 1891, Goodrich 1946, Johnston 1964, Thompson and Ely 1989). Nesting was first confirmed in the state at Cheyenne Bottoms, Barton County, in 1961 (Parmelee 1961). Black Terns have also nested at Quivira NWR, Stafford County, and possibly in Douglas and Sedgwick counties (Johnston and Klaas 1961, Thompson and Ely 1989, J. Horak and M. Thompson written comm.). Terns may have nested at Cadillac Marsh in Wichita in the 1950s (Holmes 1958), but the marsh has been heavily impacted by residential

development (M. Thompson pers. comm.). During the Kansas Breeding Bird Atlas (1992-1997), Black Terns were recorded in only 16 (2.1%; 12 possible, 3 probable, 1 confirmed) of 774 blocks (741 priority, 33 non-priority) (W. Busby written comm.). The confirmed record was from Cheyenne Bottoms, the only site in Kansas where the species breeds regularly (i.e, most years). The probable breeding records were from Edwards, Linn, and Smith counties. Most of the possible and probable records likely represent non-breeding birds (W. Busby written comm.).

Major Populations: Small populations nest regularly only at Cheyenne Bottoms and Quivira NWR (J. Horak and M. Thompson written comm.).

Population Trends: No relevant data.

Research/monitoring: No known research projects or statewide monitoring programs.

State Status: Species in Need of Conservation.

Natural Heritage Rank: Critically Imperiled.

Habitat Conditions: Breeds in marshes where nests are placed on floating parts of emergent green plants in shallow water (Johnston 1964).

Threats: None reported.

Kentucky

Status and Distribution: Black Terns formerly nested commonly near Louisville (probably 1808 to 1810) where Audubon found more than 70 nests at one time (Mengel 1965; Palmer-Ball 1991, 1996; Monroe 1994). Since then, breeding has been suspected only at McElroy Lake, Warren County, in 1927 and 1935. Suitable breeding habitat has been destroyed, and nesting is no longer likely (Palmer-Ball 1996).

Major Populations: Formerly near Louisville

Population Trends: NA

Research/monitoring: NA

State Status: NA

Natural Heritage Rank: Extirpated.

Habitat Conditions: NA

Threats: Habitat loss apparently responsible for extirpation (Palmer-Ball 1991, 1996), as extensive marshlands around Louisville were drained to

reduce malaria infection in humans (B. Palmer-Ball pers. comm.).

Maine

Status and Distribution: Nesting was first documented in Maine in 1946 at Lake Messalonskee, Belgrade, Kennebec County (Palmer 1949). The first established breeding in New Brunswick in 1940 and an increase in records in Maine since 1934 suggested that the species had bred in "the northeast" for some years. By 1983, nesting had been documented at seven additional sites in the state (see Lucey 1979, Pierson 1983, and Novak 1992). During the Maine Breeding Bird Atlas (1978-1983), the Black Tern was recorded in 7 (1.1%; 1 possible, 1 probable, 5 confirmed) of 615 breeding bird atlas blocks (Adamus 1987). In 1989 and 1990, Black Terns were surveyed at historical breeding sites and found at three new ones during surveys of various aquatic birds at 60 wetlands in southern, central, and eastern Maine (Gibbs and Melvin 1990). From 1991 to 1997, surveys of the state's 10 known colonies have been conducted via a cooperative effort of Nakomis Regional High School and the Maine Department of Inland Fisheries and Wildlife (McCollough and McDougal 1996, M. McCollough written comm.). During this period estimates of the state's breeding population ranged from 36 to 90 pairs (n = 7, ave. = 65.6, SE = 6.7; M. McCollough written comm.).

Major Populations: Most breeding sites are clustered in central Maine. Numbers at individual sites fluctuate, and the relative importance of sites to terns varies. From 1991 to 1997, population estimates averaged 19.6 pairs (8-33, SE = 3.0) at Great Moose Lake, 12.6 (3-25, SE = 3.3) at Douglas Pond, and 12.4 (6-22, SE = 2.1) at Messalonskee Lake, the site with the longest record of occupancy (M. McCollough written comm.).

Population Trends: Annual statewide estimates of breeding pairs for the last six years indicate a relatively stable or perhaps slightly increasing population (M. McCollough written comm.).

Research/monitoring: Statewide population monitoring has occurred annually since 1989, and recent efforts have also included placement of artificial nesting platforms, which have received minimal use (McCollough and McDougal 1996). Studies that began in 1997 at the University of Maine will investigate population demography and viability, habitat suitability, and foraging ecology of terns (F. Servello written comm.).

State Status: Endangered.

Natural Heritage Rank: Imperiled.

Habitat Conditions: These terns nest in marshes, bogs, or wet meadows on the borders of freshwater lakes and ponds and slow-moving rivers and streams (Pierson 1983). Gibbs and Melvin (1990) reported that all

wetlands used by Black Terns in Maine were greater than 25 ha and had extensive areas of water ≥0.1 m in depth dissected by numerous channels and potholes; numerous hummocks of scrub, sedge, and old muskrat caches of cattails were used as nest sites. These wetlands on average had a greater extent of fine-leaved emergents, submerged and floating vegetation, scrub vegetation, open water, and flooded timber, and a higher vegetative (life-form) diversity than did wetlands not used by terns. Vegetation at breeding sites ranged from dense, broad-leaved cattails to sparse, fine-leaved emergents; at least five colonies were associated with large floating bog mats. Seneca (1996) reported that vegetation at most nesting sites consisted of emergent cattails, pickerelweed, rushes, sedges, or grasses, but at two sites was a mixture of shrubs and grasses on a bog mat.

Threats: Human disturbance from boaters may expose eggs and chicks to adverse weather or predators or wave action may inundate or break up nests (Dorr 1976). Factors contributing to nest failure in recent studies include water level fluctuations and predation (McCollough and McDougal 1996).

Michigan

Status and Distribution: Brewer (1991) speculated that the Black Tern formerly may have occupied mostly Great Lakes marshes and river mouths and later colonized interior marshes as human settlers replaced forests with croplands and pastures. Barrows (1912) considered the species "abundant" in suitable habitat, at least throughout the Lower Peninsula. Van Tyne (1938) and Wood (1951) reported that the species bred north to Chippewa County but was "common" only in the southeastern quarter of the state. Payne (1983) felt it was a "common" summer resident, but drew no distinctions as to geographic variation in abundance. Chu (1994) considered the species a "common migrant and local summer resident" along the shores of the Great Lakes and "fairly common" inland.

During the Michigan Breeding Bird Atlas (1983-1988), the Black Tern was recorded in 172 (9.1%; 67 possible, 58 probable, 47 confirmed) of 1896 townships (Brewer 1991). Although patchily distributed, it was about equally well represented in the three major subdivisions of the state (southern Lower Peninsula, northern Lower Peninsula, Upper Peninsula); about 50% of blocks with breeding evidence were along Great Lake shores.

Major Populations: Wood (1951) listed various Michigan breeding sites; the largest populations reported were "50 pairs" and "100 birds," respectively, at Stoney and Portage lakes, Jackson County, and "100 pairs" at Lone Tree Island in Saginaw Bay, Huron County. Scharf and Trapp (1991) surveyed marshes of the Great Lakes and found a total of 317 nests at 47 colonies in Michigan; 116 nests were at 16 colonies along

the St. Mary's River. Chu (1994) considered important breeding areas in recent years to be the extensive marshes associated with Higgins and Houghton lakes, Roscommon County; Lake St. Clair; Saginaw Bay; the Straits region; and river marshes of Musekgon, Ottawa, and Allegan counties. Most of the state's colonies have fewer than 30 pairs, with the largest on record being 200 pairs.

Population Trends: The state's breeding population appears to have been reduced historically (Brewer 1991, Chu 1994) but few data are available on the timing or extent of decline. Anecdotal evidence indicates population declines have been most noticeable inland (Adams et al. 1988 in Chu 1994), in Cheboygan County (Einsweiler 1988), and in the southeastern part of the state (Kelley 1978, Brewer 1991). E. T. Cox (written comm.) reported a decline at a marsh off Lake St. Clair from up to 250 adults and 81 nests in 1980 to 4 adults and 0 nests in 1990.

Other areas, though, with sizeable and apparently stable or increasing populations are the St. Mary's River, Chippewa County (80-90 nests each year, 1989 to 1991; W. C. Scharf written comm.); Seney National Wildlife Refuge, Schoolcraft County; lakeshore marshes in Delta and Mackinac counties; Dingman's marsh, Cheboygan County; Houghton Lake WA, Roscommon County; marshes around Saginaw Bay; and Allegan and Ottawa counties and the St. Clair Flats in the southern Lower Peninsula (R. Adams written comm.).

Research/monitoring: No specific monitoring conducted, and BBS data are too few for trend analysis (Peterjohn and Sauer 1997).

State Status: Species of Special Concern.

Natural Heritage Rank: Vulnerable.

Habitat Conditions: In Michigan, Black Terns favor marshes where extensive reedbeds, usually of cattail or bulrush, mix with open water; large marshes appear to be preferred over smaller ones (Cuthbert 1954, Chu 1994).

At Indian River Marsh, Cheboygan County, the terns appeared to prefer areas of low thin marsh vegetation for nesting; typical sites had thinly scattered bulrushes within a meter or so of water, though two were in dense cattails about 4.5 to 6 m from open water (Cuthbert 1954). Of 27 nests, 23 were on floating platforms over water at least 0.6 m deep. Of floating nests, 11 were on thin mats of dead plant material lodged amid stems of marsh vegetation, 5 on floating logs and boards, 5 on bulrushes cut by muskrats, and 2 on stems of broken-down bulrushes. Of non-floating nests, 1 was an extensive pile of old bulrushes and 3 were flattened old muskrat houses. At marshes on the St. Mary's River water

depth at 16 nests averaged 24.8 cm (W. C. Scharf written comm.). Nests there were always on windrows of floating broken-down bulrush or cattail (Scharf 1989). From 1979 to 1987, Black Terns at North Marsh of Metro Beach Metropark off Lake St. Clair, Macomb County, nested mostly on floating vegetation mats in small areas of open water and also occasionally on old floating logs, boards, or old muskrat houses; water depths at nests ranged from 40-60 cm (E. T. Cox written comm.).

Threats: Loss, alteration, and isolation of wetlands appear to be the main causes of population declines (Einsweiler 1988, Brewer 1991, Chu 1994), but the effects of acid rain, other airborne chemicals, or increasing predator populations may be contributing factors (Brewer 1991). An increase in a feral Mute Swan population at a marsh off Lake St. Clair from 2 adults in 1980 to 100 in 1988 may have caused a sharp decline in numbers of breeding Black Terns, though the mechanism responsible is undocumented (E. T. Cox written comm.).

Minnesota

Status and Distribution: A common to abundant and widely distributed breeder (Roberts 1877, 1932; Green and Janssen 1975; Janssen 1987; Baker and Hines 1996b). Roberts (1932) claimed the Black Tern was the most "generally and abundantly distributed" waterbird in the state. In fact, Minnesota's breeding population is likely the largest in the north-central United States and perhaps in the entire United States (Baker and Hines 1996b). Janssen (1987) reported it was a summer resident throughout most of the state except in the northeast, where it was absent from all of Lake, Cook, and parts of St. Louis and Koochiching counties, and in the southeast, where it was rare to absent away from the Mississippi River. Baker and Hine's (1996a) solicitation of observations from 1990 to 1995 yielded sightings from 454 locations, including 63 where nesting was confirmed. The species was observed in 71 of the state's 87 counties; nesting was confirmed in 35 (with prior data the total is 48). The few reports from most of the agricultural areas of southern and western Minnesota probably reflected the loss of 90% of that region's historic wetlands. The breeding distribution mapped by Baker and Hines (1996b) compared favorably with that of Janssen (1987), with the exception that the former authors had fewer nesting records from southern and western agricultural regions and more from northern and central wetland and lake regions. More data are needed to determine if these differences are real.

Major Populations: Baker and Hines (1996b) reported concentrations of sightings in west-central (Becker, Otter Tail, Douglas, Kandiyohi, and Meeker counties) and north-central (Beltrami, Itasca, Cass, Aitkin, and Crow Wing counties) Minnesota that coincided with an abundance of lakes and wetlands. Few quantitative estimates are available for particular sites, but minimum counts of flying adults from late May roadside surveys at Agassiz NWR, Marshall County, in northwestern Minnesota from 1992

to 1994 ranged from 798 to 1459 (Maxson 1994).

Population Trends: Few data are available on population trends. Janssen (1987) reported the Black Tern was decreasing as a breeding bird in the Mississippi River Valley, and Baker and Hines (1996b) implied there had been declines in the state's prairie and prairie-forest transition regions of southern and western Minnesota. Trends on BBS routes from 1966 to 1979 (-5.6%/yr), 1966 to 1996 (-2.4%/yr), and 1980 to 1996 (4.9%/yr) were not significant (Peterjohn and Sauer 1997). Delehanty and Svedarsky (1993) documented rapid colonization by Black Terns of a restored marsh in northwestern Minnesota.

Research/monitoring: No specific statewide monitoring program is in place, but distributional data gathered from 1990 to 1995 could serve as a basis for developing such a program (Baker and Hines 1996b). BBS data are adequate for trend analysis (Peterjohn and Sauer 1997). Powell (1991) found problems with sample design and timing of the survey when evaluating the advisability of adapting USFWS waterfowl breeding pair counts to monitor Black Tern populations. Various studies have been conducted on habitat use, reproductive success, use of nesting platforms, nocturnal behavior, and contaminants in eggs (Faber and Nosek 1985; Dulin 1990; Faber 1990, 1996; Faber and Elbert 1996; Moen 1991; Powell 1991; Brewer 1992; Maxson 1992, 1993, 1994).

State Status: No status assigned.

Natural Heritage Rank: Unranked.

Habitat Conditions: Generally breeds in marshy lakes and sloughs where nests are placed on broken-down muskrat houses, floating debris, driftwood, or hummocks of mud (Roberts 1877, 1932). Eddy (1961) found 51 nests built mostly on dead bulrushes over water 15 to 79 cm deep. In northwestern Minnesota, Brewer (1992) found Black Terns breeding in areas where open water was interspersed with low open emergent vegetation dominated by cattails and bulrushes, and secondarily horsetails (*Equisetum* spp.), wild rice, reed-canary grass, and sedges. Twelve nests there were placed on floating mats of dead vegetation or clumps of vegetation and mud at water depths averaging 65 cm (28-132); cover within 0.3 m of nests tended to be less in sheltered areas (open water <5 m across) than in larger open water areas. Terns were not found in any area smaller than 20 ha. At 67% of 289 nests at Agassiz NWR the dominant vegetation around nests was cattails, at 17% bulrushes, at 10% sedges, at 5% a mixture of emergents, and at <1% grasses (Maxson 1992, 1993, 1994). Preliminary analysis indicates in comparison to 400 random sites nest sites had higher water depths, a shorter distance to open water, greater nest visibility, and tallest vegetation (within 1 m) was shorter (Maxson 1993, 1994).

In the Minnesota Valley NWR area, Dulin (1990) found most tern colonies in bulrush stands interspersed with open water. The vast majority of 113 nests there were placed on residual bulrush stalks, but 6 were on large mats of mud and compressed vegetation, 1 was on an old flattened muskrat house, and 1 was on an abandoned Pied-billed Grebe nest. Vegetation cover near nests was moderately dense, and mean water depths at nests at 5 colony sites ranged from 32 to 72 cm; colony sites with lowest and highest average water depths had the greatest (n = 155) and fewest (n = 7) nesting attempts, respectively. Also at Minnesota Valley NWR, after a flood Moen (1991) found 26 of 37 nests located on large mats of dead bulrushes and debris caught in snags; a few nests were on muskrat feeding platforms, small mats of dead bulrush, or on an island of mud and compressed vegetation exposed by receding floodwaters. Percent cover of emergent vegetation within 1 m of 34 nests averaged 26% (SD = 21). In Polk and Kandiyohi counties, Powell (1991) found nesting colonies on semipermanent wetlands roughly 15 to 50 ha in size; open water ranged from 5% to 95% of these areas, and emergent vegetation occurred in dense patches or diffuse open stands. Colonies were located in clumps of sparse bulrushes patchily distributed in interior portions of ponds within larger wetland complexes. Vegetation around nests was primarily bulrushes, and nests were built on mats of dead bulrushes and cattails. At Rice Lake NWR, Lapp (1991, 1992, 1993) found most nests in emergent aquatic plants, primarily bulrushes, arrowhead, pickerelweed, and wild rice.

Along the Mississippi River in Minnesota and Wisconsin, Faber (1990) found most nests in tall emergents, such as giant burreed *(Sparganium eurycarpum*), three-square bulrush (*Scirpus americanus*), or cattails, bordering water; a few nests were in short emergents, such as arrowhead or pickerelweed. In this area from 1991 to 1993, mean minimum water depths at nests ranged from 44.5 to 62.4 cm and mean maximum depths from 57.9 to 133.7 cm (Faber 1996). In 1991 and 1992, nests that failed to hatch had significantly lower minimum depths than those that successfully hatched young: 39.9 vs 49.6 cm in 1991 and 46.6 vs 53.6 cm in 1992 (Faber 1996). Only 4 of 21 nests with minimum depths less than 30.5 cm successfully hatched young. From 1989 to 1991, 30 artificial nesting platforms produced 23 nesting attempts with a hatching rate of 65.2%, whereas 185 natural nesting attempts had a 44.3% hatching rate. Artificial nesting platforms were significantly more successful in hatching young than were natural nests in 1990, but results were equivocal for the combined period 1989 to 1991 (Faber 1996).

Threats: Habitat loss or alteration appears to be the main cause of apparent population declines, though water level fluctuations, storms, predation, and contaminants may be contributing factors (Faber 1990, 1992a; Dulin 1990, Moen 1991, Brewer 1992, Baker and Hines 1996b). Faber and Nosek (1985) found that Black Tern eggs from the Mississippi

River had relatively low levels of PCBs, DDE, dieldrin, and other contaminants; mean eggshell thickness was not significantly different than a pre-1947 mean. Faber and Elbert (1996) documented a significant positive relationship between egg concentrations of chlordane and the percent time spent off the nest in nocturnal incubation.

Missouri

Status and Distribution: The Black Tern formerly was a "fairly common" breeder in Missouri, but it apparently was already rare by the turn of the century (Robbins and Easterla 1992). After 1900 there are very few breeding records for the state; the last known nesting record was of a pair at a marsh at Marais Temps Clair in 1950.

Major Populations: NA

Population Trends: See above.

Research/monitoring: NA

State Status: Extirpated.

Natural Heritage Rank: Extirpated.

Habitat Conditions: NA

Threats: NA

Montana

Status and Distribution: Saunders (1921) considered the Black Tern a summer resident that bred mainly in the northern part of the state. Current status poorly known because of inadequate survey data (F. Prellwitz written comm.). The Montana Bird Distribution Committee (1996) had breeding evidence for 26 of the state's 47 latilong blocks, but their data set of known breeding sites is probably incomplete (F. Prellwitz written comm.). "Historic" (pre-1991) breeding evidence was available for 22 (12 confirmed, 10 unconfirmed) of 47 latilong blocks and recent (1991-1995) breeding evidence for 15 (9 confirmed, 6 unconfirmed) latilong blocks and 17 (10 confirmed, 7 unconfirmed) quarter-latilong blocks (MBDC 1996). The combined maps from the Montana Natural Heritage Program Point Observation Database (A. Dalton written comm.) and from observations by T. McEneaney (written comm.) show at least 28 breeding sites in 17 counties, mostly in the northern part of the state. Partial statewide surveys in the high-water year of 1997, visiting 45 water bodies, found about 320 Black Terns at 16 sites; terns were found at 5 of 8 sites previously identified by the MNHP database (Rauscher 1997). The prairie pothole region of northeastern Montana was not surveyed in 1997.

Major Populations: The largest colony in Montana was formerly at 6605 feet elevation at the River Marsh of Red Rock Lakes NWR, which prior to

the mid-1980s hosted 1000+ Black Terns; a dramatic decline in numbers followed the installation there of a new dam structure circa 1987 (T. McEneaney written comm.). Currently, most of the state's colonies are small and shift with changing wetland and water conditions (F. Prellwitz written comm.). In 1997, 78% of 320 birds found on a partial statewide survey were at 4 locations: Benton Lake NWR (30-40 birds), Freezout WMA (30-40 birds), an unnamed pothole east of Browning (30-40 birds), and Blackfoot WPA (about 100 adults and juveniles) (Rauscher 1997). The next largest count was of 20 to 30 birds at Ninepipe NWR, with the remainder ranging from 1 to 17. These estimates appear to be too low based on independent surveys at Freezout WMA in 1997 by K. DuBois (written comm.). Although she did not estimate the whole population or find all nests, she monitored about 30 nests and saw over 50 adults in the air at one time. Similarly, S. Martin (written comm.) estimated 35 to 40 nests at Benton Lake NWR in 1997, and thorough nest searches there in June 1994 found 51 active nests. T. Fondell estimated 51 nests at Blackfoot WPA in 1996, and G. Neudecker observed 10 nests at Kleinschmidt Lake WPA in 1997 (fide S. Martin written comm.).

Population Trends: Limited data available. BBS data too few for trend analysis (Peterjohn and Sauer 1997).

Research/monitoring: Limited research at Freezout Lake WMA and Benton Lake NWR in recent years (DuBois 1997). Monitoring occurs at National Wildlife Refuges, including Benton Lake, Bowdoin, and Ninepipe (S. Jones pers. comm.). A partial statewide survey was conducted in 1997, and continued surveys and other studies are planned for 1998 (Rauscher 1997).

State Status: Species of Special Concern.

Natural Heritage Rank: Vulnerable.

Habitat Conditions: Breeds at various lakes, ponds, reservoirs, and marshes with emergent vegetation, such as bulrushes, cattails, *Juncus* spp. and various other sedges, rushes, reeds, and grasses (Montana Nat. Heritage Program). Black Terns have nested on floating submergent vegetation at Bowdoin NWR (F. Prellwitz written comm.). At Freezout Lake WMA nests were located in alkali bulrush over 0.5 to 1 m of standing water (DuBois 1997). In 1997, of 16 sites where Black Terns were detected on a partial statewide survey, 13 were either state or federal refuges, lakes, or unimproved wetlands and 3 were irrigation reservoirs.

Threats: Habitat loss is probably the main threat to survival (DuBois 1997).

Nebraska

Status and Distribution: Bruner et al. (1904) considered the Black Tern a

"rather common breeder in suitable localities" and reported that "great numbers" bred in the lakes of Cherry County. Rapp et al. (1958) termed the species a "common breeder in the Sandhill Lakes region." Ducey (1988) described it as a "regular nester" with few records and mapped the pre-1920 (2 north-central counties, 3 SEern counties), 1921 to 1960 (2 NWern counties), and post-1960 (3 NWern counties) breeding records. He also indicated historically it could have been expected statewide and today throughout the Sandhills. Johnsgard (1996) considered it a "common summer resident, primarily in the Sandhills but locally elsewhere." The Nebraska Natural Heritage Program (J. Dinan written comm.) has mapped breeding records from 1965 to 1992 from 12 sites in 7 counties in northwest to north-central Nebraska. During the Nebraska Breeding Bird Atlas (1984-1989), breeding evidence was recorded in 55 (19 Possible, 30 Probable, 6 confirmed) of 440 blocks, and the species was considered an uncommon and local breeder (W. Mollhoff written comm.). Breeding was concentrated in the western Sandhills and was more patchy in the eastern Sandhills; breeding in the Rainwater Basin in south-central Nebraska south of the Platte River occurs very locally during high-water years. The pre-settlement range was probably similar to that of today.

Major Populations: Sandhills wetlands (see above).

Population Trends: BBS data too few for trend analysis (Peterjohn and Sauer 1997). The state's breeding population has probably declined historically from drainage of wetlands, particularly in the Rainwater Basin and eastern Sandhills in the last 30 years (J. Dinan, W. Mollhoff written comm.). Rosche (1994) reported a "drastic" and steady decline in numbers of terns staging in fall at Keystone Lake and Lake McConaughy, where high counts in August in the late 1970s to mid-1980s ranged from about 150 to 180.

Research/monitoring: No known research projects devoted to Black Terns and no statewide monitoring program in place. Surveys of Black Terns have been conducted in conjunction with waterfowl surveys at Valentine NWR (L. McDaniels pers. comm. fide J. Dinan) and at Crescent Lake NWR once to twice per month, May-June, in 14 years since 1978 (M. French pers. comm.).

State Status: No status assigned.

Natural Heritage Rank: Vulnerable.

Habitat Conditions: Johnsgard (1996) reported breeding occurs on small to large marshes with a combination of open water and stands of emergent vegetation. W. Mollhoff (written comm.) described nesting habitat as lakes with extensive emergent vegetation, particularly where large areas

of scattered bulrushes intersperse with dense stands of bulrushes and cattails and extensive open water. Such lakes are usually bordered by thick stands of bulrushes and cattails 100 ft or more in width and have soft bottoms of decaying vegetation. Of two nests found in the atlas project, one was on a floating mat of dead bulrushes and the other on a mass of floating cattail roots; both were over water about two feet deep in fairly open areas protected from the wind by dense patches of cattails and bulrushes (W. Mollhoff written comm.). Harris (1931) described nests at Inland Lagoon near Hastings located in a clearing in the rushes where the water was covered with a portion of the broken down rushes from the previous year. Of three nests at Valentine NWR, one was on floating debris lodged in a clump of bulrushes, one was on a floating mat of decaying vegetation, and one was on a mound of decaying vegetation rising from the bottom (J. Farrar written comm.).

Threats: Drainage of wetlands and habitat alteration are the main threats in the state (S. Jones pers. comm.).

Nevada

Status and Distribution: Linsdale (1936) reported the Black Tern was "present in summer" and listed records mostly from the northern portion of the state. Alcorn (1988) considered the species a summer resident in northern and western Nevada but cited records of confirmed breeding only from Ruby Lake, Elko County, and Carson Lake, Churchill County. Besides at Carson Lake, where nesting is irregular, nesting has also been confirmed elsewhere in the Lahontan Valley in 1994 at S-line and Harmon reservoirs (L. Neel written comm.); nesting has almost certainly occurred at Stillwater NWR, Churchill County, but no confirmed records are available. Nesting was also confirmed in 1987 and 1997 at an oxbow of the Humboldt River near Halleck, Elko County (P. Bradley written comm.) and in 1993 at Quinn Lakes, Humboldt County (L. Neel written comm.), and juveniles were seen at Franklin Lake, Elko County in 1997 (P. Bradley pers. comm.). Other suspected breeding areas are: Washoe, Duck, and Mosquito lakes, Washoe County; Sheldon NWR, Washoe and Humboldt counties; Reese River near Austin, Lander County; Wild Horse Reservoir, Franklin Lake, and South Fork Reservoir, Elko County; Humboldt Valley near Iron Point and Sleeper Mine wetlands (now defunct), Humboldt County; Mason Valley, Lyon County; Tonkin and J.D. reservoirs near Eureka, Eureka County; and Silver Creek near Baker, White Pine County (Linsdale 1936, Alcorn 1988, P. Bradley written comm., M. Gregg pers. comm., L. Neel pers. comm.).

Major Populations: The largest concentration apparently occurs at Ruby Lake, where rough population estimates since the 1970s have ranged from 50 to 500 adults (J. Mackay written comm.).

Population Trends: Data on population trends very limited. BBS data too few for trend analysis (Peterjohn and Sauer 1997). P. Bradley (written

comm.) felt that Black Tern numbers had declined along the Humboldt River system in the last 15 years, presumably from long-term losses of thousands of acres of marsh habitat. L. Neel (pers. comm.) felt populations in the Lahontan Valley had declined since the 1980s, but had increased in the mid-1990s.

Research/monitoring: No specific research projects or statewide monitoring programs are in place. BBS data too few for trend analysis (Peterjohn and Sauer 1997).

State Status: No status assigned.

Natural Heritage Rank: Imperiled/Critically Imperiled.

Habitat Conditions: At Ruby Lake, Black Terns nest in emergent marshes, where nests are placed on floating mats of vegetation, usually bulrush wads (J. Mackay written comm.). In northwestern Nevada, the species may nest in spikerush marshes (L. Neel pers. comm.).

Threats: Habitat loss and poor water quality appear to be the main threats to breeding populations in Nevada (P. Bradley written comm., L. Neel pers. comm.).

New Jersey

Status and Distribution: Although there is no historical evidence of breeding in New Jersey (Stone 1937, Leck 1984), Novak (1992) reported a coastal nesting record for Cape May Point, Cape May County, in 1984, but observers active in the area at the time consider the record dubious (V. Elia pers. comm.). The species currently is a rare spring and uncommon fall migrant in the state (Leck 1984). Although numbers vary considerably from year to year, there has been a decline in fall migrants on the coast since the 1930s; maximum 600 in 1923 (Stone 1937) and 25+ in 1989 (Sibley 1993).

Major Populations: NA

Population Trends: See above for trends in numbers of migrants.

Research/monitoring: NA

State Status: NA

Natural Heritage Rank: NA

Habitat Conditions: NA

Threats: NA

New York

Status and Distribution: Bull (1974) described the Black Tern in New York as a "locally numerous breeder on and near the Lake Ontario plain, rare elsewhere." He mapped 32 locations where the species was known to have bred and considered it most plentiful in Jefferson County, along the Lake Ontario shore in Oswego and Monroe counties, the region south and west of Oneida Lake, and in the Montezuma Refuge and Oak Orchard Swamp (now WMA). Elsewhere it was very local and sporadic; a rare breeder (2 localities) in the Adirondacks. Carroll (1988b) reported 56 historical breeding sites prior to 1980. During the New York Breeding Bird Atlas (1980-1985), the species was recorded in 73 (29 possible, 17 probable, 27 confirmed) of 5323 atlas blocks (Spahn 1988). Atlasers found Black Terns primarily in marshes of the southern and eastern shores of Lake Ontario, along the nearby St. Lawrence Plains, and in the extensive marshes in and adjacent to Montezuma NWR and the Oak Orchard WMA-Iroquois NWR complex. Scattered atlas records elsewhere included historically occupied breeding sites on the west end of Oneida Lake, Oswego County, and at Tupper Lake, Franklin County, in the Adirondacks. At other newly reported sites in Genesee and Tompkins counties, to the east of Oneida Lake, and at the south end of Lake Champlain breeding evidence was circumstantial and may have represented birds dispersing from nesting areas elsewhere. Statewide surveys in 1989, 1990, 1991, and 1994 estimated 235, 215, 284, and 244 nesting pairs, respectively, at a total of 35 sites (Novak 1990, Muller et al. 1992, Mazzocchi and Muller 1995).

Major Populations: Bull (1974) and Carroll (1988b) reported four colonies that formerly held 100 or more pairs: Montezuma NWR, Seneca County (200, 1960), Eightmile Creek west of Oswego, Oswego County (100, 1960s), Lakeview WMA [at confluence of Sandy (formerly Big Sandy) and South Sandy creeks], Jefferson County (150, 1903), and Perch River WMA, Jefferson County (100, 1957). Carroll (1988b) indicated colonies at Montezuma NWR had declined from a high of 2000 birds in 1958, but did not include this number in her Table 2 of pre- and post-1980 colony data throughout New York. Hess (1989) summarized historical use of Montezuma NWR by Black Terns and reported high population estimates of 2500 individuals on 20 May 1952 and 2500 on 15 June 1958. Hagedone (in Eaton 1910) felt there were probably 1000 terns in 1905 in the Big Sandy Creek marshes (now Lakeview WMA), but this estimate has not been repeated by other authors (Bull 1974; Carroll 1988b; Spahn 1988). From 1989 to 1994, only 5 sites averaged 20 or more pairs: Dexter Marsh WMA (23.8), Lakeview WMA (20.0), Perch River WMA (24.0), and Wilson Bay Marsh (60.2), Jefferson County, and the Tonawanda WMA-Iroquois NWR-Oak Orchard WMA (Tonawanda) marsh complex (31.5), Genesee, Niagara, and Orleans counties (Mazzocchi and Muller 1995). Over 65% of the statewide breeding population was in northern New York with the remainder along the southern shores of Lake Ontario or in western New York (Mazzocchi et al. 1997).

Population Trends: During the first half of this century numbers increased and colonies were established at several places, including Oak Orchard Swamp (now Oak Orchard WMA) in 1937 and Tifft Farm in Buffalo, Erie County, in 1946 (Spahn 1988). Subsequently, numbers declined and by the late 1980s an estimated 31 colonies held roughly 200 to 300 pairs; 22 former colonies no longer existed, and most viable ones held less than 10 pairs (Carroll 1988b). Numbers on four statewide surveys from 1989 to 1994 have been relatively stable (see above). Hickey (1997), using an age-structured population model, found the population growth rate for Black Terns in western New York was -0.17, indicating a declining population, but the size of the colony appeared stable or possibly increasing.

Carroll (1988b) reported a marked decline in numbers of Black Terns during fall migration along the upper Niagara River, Ontario and New York, from the 1960s to early 1970s. The rapidity of the decline, from 3000 to 4000 in 1970 to 200 in 1972 (no count in 1971), suggests, though, that part of the decrease may reflect a shift in areas used by the terns. In recent years, the highest fall migration count was in 1991 when 479 Black Terns were counted on Point Peninsula shoal, Jefferson County, on Lake Ontario (Mazzocchi and Hickey 1997).

Research/monitoring: Statewide surveys have been conducted four times from 1989 to 1994 (Novak 1990, Muller et al. 1992, Mazzocchi and Muller 1995). Recent research in western and northern New York has focused on breeding success, ecology, nesting habitat, and use of artificial nest platforms, contaminants, and banding of adults and chicks (Hickey 1997, Hickey and Malecki 1997, Mazzocchi et al. 1997 and references therein).

State Status: Species of Special Concern.

Natural Heritage Rank: Critically Imperiled.

Habitat Conditions: Black Tern colonies in New York are found in marshes at the mouths of rivers (especially those entering Lake Ontario), in ponds, along shores of large lakes, and at large inland marsh complexes (Carroll 1988b). Bull (1974) described nests sites in New York as often being placed in cattails or among other aquatic vegetation, especially where matted down; muskrat houses were used for nesting in 10 of 32 known nesting localities. Hyde (in Bull 1974) described a colony of 14 birds in North Pond, Oswego County, with nest sites in rushes in stagnant water, on small mounds of wet decaying vegetation, and on higher heaps of dead broken cattail stalks; a few Black Tern nests were floating directly on shallow water, on the mud bottom, or on partially submerged logs. At another locality one or two nests were placed on floating boards and other

debris. Most nests at Yanty Creek Marsh were in small clearings within cattails, with some adjacent to open water, and placed on floating mats of piles of dead vegetation (mostly cattail leaves) over a dense growth of cattail roots (Firstencel 1987). Other nests were on a submerged log in shallow water or small mud "islands" about 1.5 m in diameter.

Novak (1990) in 1989 studied habitat features at nests at three sites in New York. Cattail was one of the dominant plants within 2 m of 80% of all nests (n = 40); burreed was a dominant at 80% of nests (n = 10) at Perch River WMA Lower Pool. Water depths at nests averaged 0.29 m (0.15-0.64, n = 9), 0.46 m (0.10-1.00, n = 10), 0.85 m (0.61-1.04, n = 10), and 0.74 m (0.70-0.87, n = 11) at Salmon River, Lakeview WMA, Perch River WMA Lower Pool, and Perch River WMA Middle Pool, respectively. Distances to open water at these sites, respectively, were 25.3 m (6-50), 1.9 m (0-5), 0.1 m (0-1), and 0.3 m (0.1-1.5). None of the nest sites were on a muskrat structure. At Salmon River 4 of 9 nests were on floating logs or boards, and at Perch River WMA most nests on the Lower Pool were on floating stalks and roots of burreed and on the Middle Pool on floating mats of muck. Novak (1990) also felt exposed perch sites -- used for copulation, resting, and sites for feeding recently fledged young -- may be an important component of favorable nesting habitat.

Of 20 sites with breeding Black Terns during statewide surveys in 1990 and 1991, two (Point Peninsula and Wilson Bay marshes) were shrub-swamp communities dominated by buttonbush-willow shrub swamps and the remainder were emergent marshes dominated by cattail, sedges, arrowhead, and grasses (Muller et al. 1992). Common to all sites were an interspersion of water and emergent vegetation and exposed perches. Dominant emergent plants within 2 m of 160 nests at 10 sites in New York, 1990 to 1991, were cattail (62.5%), arrowhead (36.3%), sedge (28.1%), grasses (23.8%), water lily (*Nuphar* or *Nymphae* spp.) (19.4%), buttonbush (9.4%), burreed (6.9%), pickerelweed (6.3%), and bulrush (5.0%).

Of 39 nests at the Tonawanda marsh complex in 1991, water depth averaged 45.2 cm (20.0-78.8; n = 36) and the height of tallest vegetation within 2 m averaged 115.6 cm (71.3-195.0; n = 36) (Seyler 1991). Dominant vegetation within 2 m of nests (n = 37) was burreed (81.1%), cattail (13.5%), and willow (5.4%); 67.5% of nests were in pure burreed patches, and burreed occupied 5.7% of the marsh complexes and totaled 26.0% of the emergent vegetation (Seyler 1991). Dominant vegetation at nests at the Tonawanda complex in 1992 (n = 29) and 1993 (n = 34), respectively, was 79.3% and 90.0% burreed and 20.7% and 10.0% cattail (Hickey 1992, Seyler 1993). Hickey (1992) felt that a preference of burreed over cattails was likely based on selection for a certain vegetation height, density, and water dispersion rather than a certain plant species. Muskrat structures accounted for 67% (n = 31), 81% (n = 37), 57% (n =

29), and 57% (n = 28) of Black Tern nests at Tonawanda in 1990, 1991, 1992, and 1993, respectively (Seyler 1993). The nest substrate for other nests in 1992 was 21.4% unidentified mounds of vegetation/mud, 14.3% artificial platforms, and 7.1% logs (Hickey 1992). Hickey and Malecki (1997) developed a model for the Tonawanda complex in 1994 and 1995 to examine nest site selection with the significant model variables being vegetation density, horizontal cover 0.5 m above the water, cover:water ratio, and mean water level. The model correctly classified 77.2% of all plots, and 84.5% of all nests were in sparse to moderately dense vegetation. Horizontal cover 0.5 m above water level was ≤50% in 84.6% of nest plots versus 58.1% of random plots, indicating nest sites were located in more open areas of vegetation. Cover:water ratio was medium (40-60% cover) in 65.4% of nest plots; random plots were evenly distributed among low, medium, and high cover:water ratio categories. Mean water level at nests was 48.2 cm (n = 26, SE = 2.8) and 42.1 cm (n = 24, SE = 2.8) (most 40-60 cm) in 1994 and 1995, respectively, similar to random plots. For both years, of 50 nests sampled 86% were in burreed and 14% in cattail. Of 103 nest sites in 1994 and 1995, 44.7% were on muskrat lodges, 33.0% on muskrat feeding platforms, 13.6% on floating vegetation mats, 3.9% on artificial platforms, 2.9% on old grebe or coot nests, and 1.9% on logs (Hickey 1997). Black Terns used Highly Favorable Habitat (HFH; model predicted ≥0.50 probability of nest site and suitable nest mats available) more than expected and used 75.5% of the total area of HFH in nesting marshes and 51.4% of total area of HFH in all marshes within the study site in 1995 (Hickey and Malecki 1997). For other non-model variables, vegetation height at 88% of nests (n = 50) was 26 to 100 cm (50% 26-50 cm, 38% 51-100 cm), nest plots were >100 m from large open water and farther than non-random plots from a permanent marsh edge, mean distance of nests to nearest vegetation was <0.5 m, and nests were surrounded with vegetation within 1 m on 3 of 4 sides.

At Wilson Bay Marsh -- dominated by bottonbush associated with swamp loosestrife (*Decodon verticillatus*), arrowhead, and arrow-arum (*Peltandra virginica*) -- the terns nested on lower branches and roots of buttonbush, small debris mats around emergent vegetation, mudflats on water, and on wood (Hickey 1992, Muller et al. 1992). In 1995, of 5 Wilson Bay nests, 80% were in swamp loosestrife and 20% were in arrow-arum (Hickey and Malecki 1997). Hickey and Malecki's (1997) habitat model accurately predicted 40.0% of the nest sites at Wilson Bay in 1995.

Knutson (1991) concluded that Black Terns at Lakeview WMA, which is about 20% to 25% open water, prefer shallow emergent marsh/sedge meadow rather than deep emergent cattail marsh (90% of vegetative cover) for nesting and appear to prefer nest sites near open water. Water depth of the marsh edge (ave. = 0.6 m) was greater than at Black Tern nest

sites (ave. = 0.4 m), vegetation in the marsh was taller (ave. = 1.6 m) than in nesting areas (ave. = 1.0 m), and the marsh edge had less mud exposed (ave. = 1%) than nest sites (ave. = 6%). There was no significant difference in percent vegetative cover between the marsh edge (ave. = 77%) and nest sites (ave. = 78%). By contrast, the dominant plants near nest sites were arrowhead and sedges, whereas the sampled marsh edge was dominated by narrow-leaved cattail (*Typhus angustifolia*). Nests were built on floating mats of vegetation, predominantly arrowhead, sedges, bulrush, and smartweed.

Mazzocchi et al. (1997) reported on nest habitat characteristics of Black Terns in northern New York at Perch River WMA, Jefferson County, in 1995 and 1996. The dominant emergent vegetation at 37 nests was 45.9% cattail, 18.9% pickerelweed, 16.2% burreed, 13.5% grass, 2.7% smartweed, and 2.7% sedge. The density of dominant vegetation at most nests was sparse (40.5%) to moderately dense (43.2%). Height of emergent vegetation at 54.1% of nests was 26 to 50 cm tall, at 29.7% was <26 cm, and at 16.2% (all in 1996) was 51 to 100 cm. Four-meter radius nest plots in 1995 and 1996, respectively, averaged 37.0% and 36.5% open water, 45.5% and 41.8% emergent vegetation, and 17.0% and 21.8% floating or submergent vegetation, and 0.5% and 0.0% shrubs. Mean distance to large open water areas was 35.9 m and 20.0 m, respectively; i.e., nests were often on the edge of vegetation patches near expanses of open water (Mazzocchi and Hickey 1997). Hickey and Malecki's (1997) habitat model accurately predicted 70.0% of the nest sites at Perch River WMA in 1995 and 52.6% in 1996 (Mazzocchi et al. 1997). Of 151 nests in 1995 and 1996, 57.6% were on floating vegetation mats, 16.6% on artificial platforms, 13.9% on abandoned muskrat houses, 9.9% on uprooted pickerelweed stalks, 1.3% on Pied-billed Grebe nests, and 0.7% on floating logs.

Threats: Population declines in New York appear to have been caused by human disturbance, habitat loss from draining of marshes for agriculture or development, invasion of marshes by purple loosestrife, and raising of water levels, particularly along Lake Ontario (Carroll 1988b; Spahn 1988). The introduced marsh plant purple loosestrife, which began to invade Montezuma NWR in the late 1950s, crowds out native emergents and forms stands too dense for nesting Black Terns (Carroll 1988b, Seyler 1991). Novak (1990) felt waves from boat wakes may be an important source of nest failure where such traffic is heavy, but Muller et al. (1992) found no evidence of swamping during 66 hours of motor boat observation in 1990. Canoeists and other small craft boaters were felt to have a higher potential for disturbance because they may be able to enter protected breeding areas; biologists performing nest surveys were probably the most serious human disturbance events observed. Human disturbance may also come from frog hunters, turtle trappers, and shooting (Seyler 1991, Mazzocchi and Muller 1995). Firstencel (1987)

found concentrations of organochlorines, PCBs, and other contaminants in eggs and chicks from Yanty Creek Marsh, Monroe County, along Lake Ontario in 1983 and 1984, but Dunn and Agro (1995) and Weseloh et al. (1997) reviewed this and other studies and found no evidence linking contaminants to impairment of reproduction. Similarly, concentrations of DDE and PCBs found in four Black Terns (1 adult, 3 chicks) collected at three sites in New York in 1991 were below levels expected to cause mortality or reproductive problems (Muller et al. 1992).

North Dakota

Status and Distribution: Wood (1923) described the Black Tern as an "abundant summer resident in all suitable habitats throughout the state." Stewart (1975) considered it "common" throughout the Prairie Pothole Region and the Turtle Mountains; "uncommon and local" in the Agassiz Lake Plain Region, on the Cocteau Slope, and in the northeastern portion of the Little Missouri Slope (NEern McKenzie Co.); and "rare and local" elsewhere on the Little Missouri Slope and on the Missouri Slope.

Major Populations: See above.

Population Trends: Stewart and Kantrud (1972) estimated the total state breeding population in 1967 to be about 272,000 (118,000-425,000) pairs. Igl and Johnson (1997) repeated the Stewart-Kantrud surveys and found a significant decline in Black Tern numbers from 1967 to 1992-1993. Using a slightly smaller sample size (128 vs. original 130), they estimated that the Black Tern population was 254,000 (101,000-408,000) pairs in 1967, 86,000 (0-192,000) in 1992, and 83,000 (28,000-139,000) in 1993. This decline paralleled a significant average decline of 5.7%/yr on BBS routes in North Dakota from 1967 to 1993 and a loss of 27% of the state's wetlands during that period. A recent analysis of BBS data, however, showed a significant average decline of -13.0%/yr from 1966 to 1979, but no significant trend from 1980 to 1996 or 1966 to 1996 (Peterjohn and Sauer 1997). Igl and Johnson (1997) suggested that increases in populations of wetland species from 1992 to 1993 corresponded with amelioration of long-term drought conditions, but Black Terns numbers did not increase in these years. Hence, the conflicting trend data from the Igl-Johnson and BBS surveys leaves doubt as to the true population status of the Black Tern in North Dakota.

Research/monitoring: No known research projects or specific monitoring programs. BBS data are adequate for trend analysis (Peterjohn and Sauer 1997).

State Status: No status assigned.

Natural Heritage Rank: Unranked.

Habitat Conditions: Black Terns in North Dakota use natural ponds, shallow river impoundments, and occasional large stock ponds with stands of emergent vegetation adjacent to open water areas (Stewart 1975). From 1961 to 1970, H. A. Kantrud (in Stewart 1975) recorded the types of natural wetlands occupied by 612 breeding pairs of Black Terns: 77% were on semipermanent ponds and lakes (including 63% on slightly brackish types, usually dominated by cattails and hardstem bulrush, *Scirpus acutus*), 18% on seasonal ponds and lakes; 3% on permanent ponds and lakes, and 1% on fen ponds. Crude densities of Black Terns (n = 428 pairs) on surveys from 1965 to 1969 were 44.9/km^2 on semipermanent wetlands, 19.0/km^2 on seasonal wetlands, 17.2/km^2 on fen ponds, 5.8/km^2 on temporary ponds, and 3.3/km^2 on permanent wetlands (Kantrud and Stewart 1984). Nests are usually placed on floating vegetative debris, such as algae, submerged vascular plants, or prostrate leaves and stems of emergent marsh plants, and may be located in fairly dense emergent cover, in semi-open cover, or on open water without cover (Stewart 1975). Water depths at 41 nests averaged 43 cm (10-86).

Overall, Linz et al. (1994) found a significant positive relationship between Black Tern numbers and hectares of open water and dead emergent vegetation in wetlands, but a lack of clear statistical differences in tern densities between wetlands with different treatments by herbicides and hence varying proportions of live vegetation, dead vegetation, and open water. Linz and Blixt (1997) found positive correlations between Black Tern numbers and hectares of open water, hectares of dead cattails, and numbers of Mallards, Blue-winged Teals, and, especially, Redheads and Yellow-headed Blackbirds.

Threats: Kantrud and Stewart (1984) concluded that tracts of grassland containing complexes of seasonal and semipermanent wetlands must be preserved to avoid drastic declines in marsh-dwelling birds in North Dakota.

Ohio

Status and Distribution: Historically nested along western Lake Erie in marshes in Lucas, Ottawa, Sandusky, and Erie counties and on North Bass, Middle Bass, and Kelley's islands (Peterjohn and Rice 1991). No historical estimates are available, but the population must have numbered in the hundreds of pairs and remained fairly stable through the 1960s. Until 1960, bred accidentally away from western Lake Erie in Ashtabula, Mahoning, Cuyahoga (Cleveland), and (perhaps) Lorain counties.

By the late 1970s, nesting terns were restricted to only two to three marshes in some years and four to six in others depending on habitat conditions (Peterjohn 1989). The Ohio Breeding Bird Atlas (1982-1987) recorded Black Terns at only seven locations along western Lake Erie and Sandusky Bay in Lucas, Ottawa, and Sandusky counties; recorded in 4

(0.5%; 2 probable, 2 confirmed) of 764 atlas blocks (Peterjohn and Rice 1991). Some sites were occupied annually, others only when water levels were suitable; population size fluctuated annually from 10 to 25 to 25 to 40 pairs. As of 1996, the species is known to breed at only two sites: Cedar Point NWR and Winous Point Shooting Club (G. Tori pers. comm.).

Major Populations: Historically, very limited data available on specific breeding concentrations. For example, periodic surveys at Winous Point Shooting Club indicate a maximum population size of 26 pairs between 1880 to 1960 (Peterjohn 1989, B. Peterjohn written comm.). Similar data are unavailable for other locations. During the Ohio atlas, Cedar Point NWR held 3 to 6 colonies and 10 to 25 breeding pairs (Peterjohn and Rice 1991); see above for general areas of historical concentration.

Population Trends: The statewide population apparently remained stable through the early 1960s, declined markedly between 1965 and 1975, and remained at low levels through the 1980s (Peterjohn 1989, Peterjohn and Rice 1991). BBS data too few for trend analysis (Peterjohn and Sauer 1997).

Research/monitoring: The Wetland Breeding Bird Survey needs to be refined to provide adequate data for monitoring Black Terns (G. Tori pers. comm.).

State Status: Endangered.

Natural Heritage Rank: Imperiled.

Habitat Conditions: Generally breeds in only large, diverse, undisturbed marshes where permanent open water is interspersed with patches of tall emergent vegetation, such as cattails and bulrushes (Peterjohn 1989, Peterjohn and Rice 1991). Nests are usually placed on old decaying muskrat houses or on floating vegetation a few inches above the water's surface (Ligas 1952).

Threats: Threats to Black Terns in Ohio include habitat degradation and loss and possibly contaminants, such as PCBs, which have affected other species, including Bald Eagles and Common Terns (Peterjohn 1989, G. Tori pers. comm.).

Oregon

Status and Distribution: Gabrielson and Jewett (1940) reported that the Black Tern bred "abundantly" in the great swamps of Klamath, Lake, and Harney counties and in many scattered small swamps in these and probably other counties. Similarly, Gilligan et al. (1994) termed the species a "locally common" summer resident in the large marshes of Harney, Lake, and Klamath counties and a "locally fairly common"

summer resident in smaller marshes elsewhere east of the Cascades. Small numbers also breed inland west of the Cascades in western Oregon's interior valleys. Observers found six nests in 1963 in a small marsh near Corvallis, Benton County, and 1 nest (12 nests estimated) in 1992 at Fern Ridge Reservoir, Benton County, where nesting was suspected since at least 1948; the species also formerly bred near White City at Hoover's Lakes and the Game Ponds, Jackson County (Papish 1993). Breeding season sightings in several years in the early 1970s also suggest the possibility of nesting at Baskett Slough NWR, Polk County, and at Ankeny NWR, Marion County (Papish 1993). Nesting was suspected along the Willamette River near Salem, Benton County, in 1981 (Gilligan et al. 1994). Preliminary data (1995-1996) from the Oregon Breeding Bird Atlas so far match the patterns described above (P. Adamus written comm.).

Major Populations: Largest breeding populations in Harney, Lake, and Klamath counties but apparently few population data are available for specific sites. From 1982 to 1984, Sycan Marsh, Lake and Klamath counties, held about 200 to 400 pairs (M. Stern written comm.). Other important sites are Klamath Marsh NWR and Upper Klamath Lake, Klamath County; Malheur NWR, Harney County: and Chewaucan marshes and the Warner Valley, Lake County (M. Stern pers. comm.). When water depths are "normal" in fall, Malheur Lake serves as an important staging area, where "in the past" up to 6000 Black Terns have congregated (Littlefield 1990).

Population Trends: BBS data too few for trend analysis (Peterjohn and Sauer 1997), and anecdotal evidence shows no clear patterns.

Research/monitoring: Site tenacity, mate retention, and sexual dimorphism of Black Terns have been studied at Sycan Marsh, Lake County (Stern 1987, Stern and Jarvis 1991). No known current research projects or statewide monitoring programs. Black Terns are surveyed annually in early to mid-July at Upper Klamath Lake as part of multi-species censuses (R. Anglin written comm.).

State Status: No status assigned.

Natural Heritage Rank: Vulnerable.

Habitat Conditions: Black Terns breed in alkaline marshes and swampy lakes where they build their nests on floating mats of vegetation or boards (Gabrielson and Jewett 1940).

At Sycan Marsh, Lake County, nesting habitat includes sites with water depths of 40 to 60 cm in hardstem bulrush, 15 to 30 cm in broadleaved sedges and rushes, and <15 cm in tufted hairgrass (Stern 1987). Nest

success and fledging rates did not differ among habitats of varying vegetative composition and water depth (Stern et al. 1985). Of 332 nests in 1982, 42.5% were in bulrush marsh, 35.2% in hydric sedge-rush marsh, 18.7% in mesic sedge-rush marsh, and 3.6% in hairgrass-rush marsh (Stern 1982). Of 130 nests in bulrush marsh, 91.5% were built on floating mats of hardstem bulrush and 8.5% on floating mats of *Carex rostrata*; dominant vegetation at 97.7% of sites was *Scirpus acutus* and at 2.3% was *Carex rostrata*. Nest platforms at 191 nest sites in sedge-rush or hairgrass-rush marsh consisted of residual and new-growth emergent vegetation folded over into a mat; a few nests were located on pedestalled hummocks. In hydric sedge-marsh, 68 nest sites were dominated by *Juncus nevadensis* and 49 by *Carex vesicaria*. In mesic sedge-rush marsh, 36 nest sites were dominated by *Juncus balticus* and 26 by *Carex nebraskensis*. Mean water depth at nest sites during incubation was 58.9±7.6 cm in bulrush marsh, 19.6±6.1 cm in hydric sedge-rush marsh, 10.9±6.0 cm in mesic sedge-rush marsh, and 11.1±7.4 cm in hairgrass-rush marsh. Fledged young and adults left nest sites and gathered in habitat characterized by pond lily (*Nuphar polysepalum*); the location of these post-fledging flocks is apparently determined by the presence of a deep-water (50-70 cm) site, suitable perch sites, and an abundant food resource.

Black Terns at Fern Ridge Reservoir breed within or on the edges of stands of bulrush bordering on extensive beds of reed-canary grass; nests are placed on floating stems of dead bulrush and cattail (Papish 1993, Lewis 1995). At Malheur NWR, burreed marshes are preferred (G. Ivey pers. comm.).

Threats: Loss of wetland habitat appears to be the main threat to the state's population (M. Stern pers. comm.). Local threats include (1) possible oilspills at Upper Klamath Lake from traffic on adjacent roads and railroad or from boats involved in algae harvest (R. Anglin pers. comm.) and (2) possible impact on late nesters in Harney Basin from early dewatering of hay fields for harvest (G. Ivey pers. comm.).

PENNSYLVANIA

Status and Distribution: Historically and currently, nesting has been confined to the Eastern Lake and Glaciated sections of northwestern Pennsylvania (Leberman 1992, Brauning et al. 1994). Hence, the species was never a common or widespread breeding bird in the state. It was first confirmed breeding in about 1910 near Conneaut Lake, Crawford County, though earlier nesting has been suggested. Known colonies were located in large emergent wetlands in western Crawford County (Conneaut Lake, Conneaut Lake outlet, Pymatuning Reservoir, Hartstown Marsh, and Smith's Marsh) and in Erie County (Horseshoe Pond in Presque Isle). The largest reported colonies were of about 50 pairs on Pymatuning Lake in 1934 and 25 to 30 pairs at Hartstown Marsh in 1940. The Presque Isle colony of 15 pairs persisted only a few years until the area was disturbed

by dredging activities (Leberman 1992).

During the Pennsylvania Breeding Bird Atlas (1983-1989), nesting terns were recorded in only 11 (<1%; 4 possible, 3 probable, 4 confirmed) of 4928 blocks, all at historic sites, and few birds were present at any location (Leberman 1992). All breeding colonies, except Smith's Marsh, were on managed state wildlife areas. Because of constantly changing habitat conditions, such as water levels, probably no individual site was occupied annually during the atlas period. The largest colony remaining at Hartstown Marsh supported three pairs in 1988 but was reduced to one pair in 1991 and 1992 (Leberman 1992, Brauning et al. 1994). Currently, there are only one to two active nest sites. In 1996, statewide surveys found only three pairs and one nest at Hartstown Marsh (Brauning et al. 1997). In 1997, 10 adults and 3 nests were located at Hartstown Marsh and 4 adults at the Upper Reservoir Area of Pymatuning State Park (Teats et al. 1998).

Major Populations: No major populations currently exist; see above for areas of historical importance.

Population Trends: Although statewide populations were always small, since the 1930s and 1940s the species has declined to a point close to extirpation (see above). The declines have taken place in the absence of corresponding habitat loss or obvious habitat change (Kibbe 1995). In fact, suitable habitat has been increased by the creation of large impoundments with extensive shoreline marshes, which were colonized by breeding terns.

Research/monitoring: Statewide surveys of the species are conducted irregularly (D. Brauning pers. comm.). Bush (1989) conducted a preliminary assessment of nest site selection, but the small sample of birds available for study limited his ability to make strong conclusions.

State Status: Endangered.

Natural Heritage Rank: Critically Imperiled.

Habitat Conditions: Breeds only in the region's more extensive marshes and marsh complexes, where the emergent vegetation includes cattails, spatterdock, water lily, bulrushes, and various grasses and sedges (Leberman 1992). Of 20 nest platforms placed in marshes in 1988, only 1 was used by nesting terns (Bush 1989, W. Bush written comm. to D. Brauning).

Threats: Currently the main threats to Black Terns in Pennsylvania appear to be general human disturbance and dog training activities (now stopped) in tern nesting areas (Leberman 1992, Kibbe 1995, D. Brauning

pers. comm., C. Bier written comm.). The current very small and localized breeding population leaves it extremely vulnerable to stochastic events such as storms, habitat loss, or human disturbances (Leberman 1992).

South Dakota

Status and Distribution: The South Dakota Ornithologists' Union (1991) considered the Black Tern a "common" summer resident in the eastern and an "uncommon" summer resident in the western portion of the state, except where absent from the Black Hills. During the South Dakota Breeding Bird Atlas (1988-1993; drought during 4 of 6 yrs), the species was recorded as having probable (28) or confirmed (9) breeding colonies in 37 locations (34 of 415 blocks, 3 "casual"). Of these, 84% were located in the eastern portion of the state, i.e., east of the Missouri River (Peterson 1995).

Major Populations: Most colonies located in eastern South Dakota, where in 1995 to 1996 average colony size at 24 sites was 12 (2-40) adults. In 1996 two unusually large nesting colonies of 500+ terns were found in large semipermanent wetlands in southern Bennett and Shannon counties, where the northern extent of the Nebraska Sandhills reaches into western South Dakota (D. E. Naugle unpubl. data).

Population Trends: BBS data show a significant average decline of -31.4%/yr from 1966 to 1979 and an average increase of 14.3%/yr from 1980 to 1996; a decline of -2.7%/yr from 1966 to 1996 is not significant (Peterjohn and Sauer 1997).

Research/monitoring: No monitoring program other than BBS (see Peterjohn and Sauer 1997). Recently research has been conducted on the landscape features of critical habitat for Black Terns in South Dakota (Naugle 1997; see Habitat Conditions).

State Status: Species of Concern.

Natural Heritage Rank: Vulnerable.

Habitat Conditions: In South Dakota, Black Terns nest mostly in semipermanent ponds and lakes (Naugle 1997). Nest searches indicate that Black Terns breed in <1% of seasonal wetlands but use these habitats extensively for foraging.

Naugle (1997) used GIS technology to develop a model of important Black Tern habitat in eastern South Dakota, and he also found the terns nesting in larger basins and wetland complexes. Using the 50% probability of occurrence (from logistic regression analysis) as a conservative estimator, he delineated the minimum area requirement of the Black Tern as a semipermanent wetland basin of 12.4 ha. Using this

minimum area requirement criteria, Naugle subjectively ranked the Black Tern as moderately area dependent in relation to other wetland-dependent species whose probability of occurrence also increased significantly with increasing wetland area. Black Terns were found in 1 of 3 semipermanent wetlands surveyed, and the smallest basin in which they nested was 0.3 ha.

Naugle (1997) also found that the area requirements of the Black Tern varied in response to the structure of the wetland landscape. Black Terns did not widely use wetland landscapes with a low density of primarily small wetlands, where few nesting wetlands occurred and potential food sources were spread over large distances. In contrast, their wetland area requirements were small (6.5 ha) in high wetland density landscapes with a mixture of large and small wetlands compared to 32.6 ha in landscapes of predominately large wetlands or 15.4 ha in landscapes with mostly small wetlands. Black Terns also were more likely to occur in wetlands whose surrounding grasslands were <50% tilled for agriculture (Naugle 1977).

Threats: None reported.

Utah

Status and Distribution: Hayward et al. (1976) and Behle et al. (1985), respectively, considered it a "common" and "uncommon" summer resident of northern Utah, where it breeds in small colonies around Great Salt Lake; Utah Lake, Utah County; and in the Uinta Basin in the Pelican Lake area, Uintah County. Walters and Sorensen (1983) termed it a "fairly common" breeder and listed breeding evidence for 4 (3 documented, 1 undocumented) of Utah's 23 latilongs. Also breeds in northern Utah at Ouray WA along the Green River (K. Stone pers. comm., E. Sorensen written comm.) and the Bear River near Randoff or Woodruff (E. Sorensen written comm.), and was first confirmed breeding at Fish Springs NWR in western Utah in 1990 (J. Engler fide J. Banta). In 1987 when Great Salt Lake reached record water levels, five pairs of Black Terns nested in a bulrush marsh that grew in agricultural fields inundated by floodwaters of the Jordan River Delta (E. Sorensen written comm.).

Major Populations: See above. Marshes at Great Salt Lake also may be an important staging area for migrants, as counts at Bear River Migratory Bird Refuge in 1996 topped 1000 individuals in mid-May and 950 in late August (V. Roy written comm.).

Population Trends: Creation of reservoirs, such as Pelican Lake, may somewhat have balanced habitat loss from other human endeavors (Hayward et al. 1976). Utah Division of Wildlife Resources (1997) concluded that populations appeared to be declining, apparently as reflected in habitat loss, but provided no supporting documentation.

Research/monitoring: No known research projects or statewide monitoring programs. BBS data too few for trend analysis (Peterjohn and Sauer 1997).

State Status: Species of Special Concern.

Natural Heritage Rank: Imperiled.

Habitat Conditions: No published accounts of breeding habitat other than "marshes" (e.g., Hayward et al. 1976).

Threats: Utah Division of Wildlife Resources (1997) considered habitat loss to agricultural and commercial development to be the main threat to the species.

Vermont

Status and Distribution: The Black Tern was not known as a nesting species in New England as of the early 1920s. It is unclear, however, if the species expanded eastward into New England and maritime Canada or if improved field work led to its rather recent addition to the breeding avifaunas of Maine, New Brunswick, and Vermont (Ellison 1985). The species was first documented breeding in Vermont in 1937 via a photograph of a nest at Lake Champlain where a "fairly large colony" was reported in 1950. The species was first reported in 1949 from the South Bay of Lake Memphremagog, where breeding was confirmed in 1963.

Currently the Black Tern's breeding distribution in Vermont is limited primarily to the extensive marshlands in the Lake Champlain and Memphremagog basins along the northwestern and northcentral Vermont borders, respectively (Ellison 1985, Shambaugh 1996b). Breeding colonies are clustered in three main areas: (1) the north end of Lake Champlain at Missisquoi NWR and Mud Creek WMA, (2) south end of Lake Champlain, mostly at Dead Creek WMA, and (3) South Bay WMA at Lake Memphremagog (Shambaugh 1996b). Within these areas, there is considerable year-to-year variation in the location of colonies and in the numbers of breeding pairs at particular colonies (Shambaugh 1992, 1996b). During the Vermont Breeding Bird Atlas (1976-1981), the species was recorded in 7 (4%; 1 possible, 6 confirmed) priority blocks; colonies were found at 8 general locations. Of 13 atlas records, 11 were from the Champlain lowlands and 2 were from Lake Memphremagog. Surveys in the 1990s found Black Terns breeding in the same general areas as they had during the atlas period, though three former sites no longer held breeding terns (Shambaugh 1996b).

The Vermont Breeding Bird Atlas made a rough statewide population estimate of 180 to 300 pairs (Ellison 1985). From 1990 to 1997, population estimates from surveys of most of the state's known breeding sites ranged from 44 to 94 pairs (n = 7, ave. 66.6, SE = 6.0) (Shambaugh

and Parren 1997, N. Shambaugh written comm.).

Major Populations: During the Vermont atlas, more than half of the pairs bred at Missisquoi NWR (Ellison 1985). From 1990 to 1997, population estimates averaged 53.9 pairs (34-75, SE = 4.8, n = 8) at Missisquoi NWR/Mud Lake WMA, 10.1 (1-18, SE = 2.6, n = 7) at Dead Creek, and 3.9 (2-5, SE = 0.4, n = 7) at Lake Memphremagog (Shambaugh and Parren 1997, N. Shambaugh written comm.).

Population Trends: As noted above, the appearance of the Black Tern in Vermont in 1937 may have reflected either an extension of the breeding range eastward into New England and maritime Canada or an increase in field work leading to a discovery of a previously established population. Kibbe (1989) found six adults at Lake Memphremagog in 1989 and concluded there had been a significant population decline there over the previous decade. No reliable statewide population estimates exist prior to 1990. Nevertheless, the 180 to 300 pair general estimate from the 1976 to 1981 Vermont atlas and the 59 to 94 pair estimates from 1990 to 1996 statewide surveys suggest that populations have declined in the last twenty years. Declining numbers from 74 pairs in 1994 to 44 in 1996 may primarily reflect the effects of record or near record water levels in Lake Champlain in 1994 and 1996 and near record low levels in 1995 (Shambaugh and Parren 1997).

Research/monitoring: Population monitoring has been conducted almost annually since 1990 (Shambaugh 1996b, Shambaugh and Parren 1997). Since 1994, research has focused on quantification of habitat needs, placement of artificial platforms to supplement nest substrate and thereby gauge habitat limitation, and assessment of mechanical methods to open up marshes (Shambaugh 1994, 1996b; Shambaugh and Parren 1997).

State Status: Threatened.

Natural Heritage Rank: Imperiled.

Habitat Conditions: Colonies are established in lake-fringing or riverine marshes and diked wetland impoundments, primarily in state or federal refuges (Shambaugh 1995, 1996b). Virtually all colonies are associated with either impoundments or the disturbed areas around roads or dikes where natural flow regimes are disrupted, leaving slow-moving water conducive to the growth of emergent vegetation. Preferred habitat is a roughly even mix of open water and emergent vegetation of cattails, burreed, and bulrush (Shambaugh 1996b, Shambaugh and Parren 1997), though habitat characteristics vary considerably among sites (Shambaugh 1992). In years of high water levels when much suitable emergent vegetation is flooded, many terns have nested in buttonbush-willow shrub swamps, a habitat used much less frequently in other years (Shambaugh

and Parren 1997). They seem to prefer a combination of large pools and sparse emergent vegetation for foraging and somewhat denser vegetation for nesting (Shambaugh 1995, 1996b; Shambaugh and Parren 1997). The terns seem to prefer nests sites allowing easy access of chicks and adults to water even after vegetation density has increased with seasonal growth; dense homogenous stands are avoided for nesting.

Nest sites are usually near the edge of open water (Shambaugh 1996b), and nests are placed on floating mats of decaying vegetation and mud, muskrat lodges or feeding platforms, and logs (Shambaugh 1992). After use of a cattail-cutting "cookie cutter" boat as a management tool to open up marshes, three of four nests at one site were located on mats of mud, chopped cattail stalks and roots, and sparse regrowing cattail stalks (Shambaugh and Parren 1997). Snags or other suitable perches are used by adults when not foraging or tending young, and muskrats are beneficial because their feeding activities maintain patches of open water and their feeding platforms and abandoned lodges often serve as tern nesting substrates (Shambaugh 1996b).

Threats: Evidence on the effects of habitat changes or destruction in Vermont are equivocal. Shambaugh (1996b) felt that Black Terns may have expanded their range and population in response to the creation of impoundments in state and federal refuges from the 1930s to 1970s; he also reported a large increase in Black Tern activity at Dead Creek WMA for several years after it was last drained for vegetation control. Conversely, colonies at Burlington Intervale and Stevens Brook WMA have apparently been lost to habitat changes via plant succession (Shambaugh 1996b). Low nesting numbers at various sites in 1996 when many areas of previously used emergent vegetation were flooded also suggests that habitat may, at least locally, be limited (Shambaugh and Parren 1997). Nevertheless, based on a current understanding of suitable nesting habitat, Shambaugh (1996b) felt there was not a shortage of suitable habitat either within marshes with existing tern colonies or in Vermont in general.

Water level fluctuations may flood nests, but boat wakes and other forms of human disturbance do not appear to be important factors at most Vermont colonies (Shambaugh 1996b).

Washington

Status and Distribution: Jewett et al. (1953) considered the Black Tern a "common" summer resident that doubtlessly nested on all suitable bodies of water of the Upper Sonoran and lower part of the Transition Zone in eastern Washington. They described the limits of the summer range as north to Moses and Brook lakes and Colville, south to Washtucna Lake, east to Pullman, and west to the Yakima Valley. Smith et al. (1997) described the species as an "uncommon" breeder in eastern Washington, mostly east of the Okanogan and Columbia rivers; also occurs irregularly

at Conboy Lake NWR, Klickitat County, in the south-central portion of the state. Core zones of occurrence include steppe zones within the range, all forest zones below Subalpine Fir in northeastern Washington, and, very locally, Ponderosa Pine and Interior Douglas-fir zones in Klickitat County.

Major Populations: Most numerous in northeastern counties (Ferry, Stevens, and Pend Oreille), with "hundreds" at Turnbull NWR, Spokane County (Smith et al. 1997). More common in the Three-tip Sage and Ponderosa Pine zones than in the hotter and drier Central Arid Steppe; less common in Potholes area, and does not breed in the very arid and hot lower Columbia Basin.

Population Trends: BBS data too few for trend analysis (Peterjohn and Sauer 1997). Numbers appear to have declined in the Columbia Basin where purple loosestrife and phragmites are choking out marshes, but the terns are responding favorably to recent vegetation removal efforts (R. Friesz, J. Taber pers. comm.). Numbers in northeastern Washington have increased from the late 1970s to mid-1990s, apparently in response to improved conditions following the end of an extended drought (R. Friesz, J. Hickman pers. comm.).

Research/monitoring: No known research projects or statewide monitoring programs.

State Status: State "monitor" species.

Natural Heritage Rank: Apparently Secure.

Habitat Conditions: Breeds on freshwater ponds, lakes, sloughs, and marshes (Jewett et al. 1953, Smith et al. 1997). In northeastern counties, breeds in major river valleys and in suitable habitats up to at least 3000 ft elevation. Nest sites include in vegetation over four feet of water, on nests of grebes and coots, on mud near the shore, and on dry ground near water (Jewett et al. 1953).

Threats: Alteration of habitat from the spread of purple loosestrife and phragmites may reduce suitable Black Tern habitat (J. Tabor, B. Tweit pers. comm.).

Wisconsin

Status and Distribution: Kumlien and Hollister (1951) described the Black Tern as a "very common resident in all inland ponds, sloughs, wet marshes and lakes but seldom found on Lake Michigan..." Robbins (1991) considered the Black Tern a "common summer resident south and east; fairly common summer resident west and north." Although widely distributed, he felt the species was most numerous east of a line from La Crosse to Marichette. Tilghman (1980) conducted a limited statewide

survey and found Black Terns at more than 205 wetlands. Scharf and Trapp (1991) surveyed Great Lakes marshes and found 30 nests at 6 colonies along the Wisconsin shore of Lake Michigan.

Major Populations: In 1979, highest Black Tern populations were located at marshes along the west Green Bay shoreline, Collins Marsh, Crex Meadows WMA, Horicon Marsh, Killsnake and Manitowoc rivers, and Crescent Lake, Oneida County (Tilghman 1980). Of over 248 sites surveyed by an intensive technique, only 29 held more than 20 Black Terns. Mossman (1983) listed 11 sites at which a maximum of 25 or more Black Terns had been recorded on roadside surveys from 1980 to 1982; during these years the number of stops on which terns were recorded ranged from 120 to 127. State and federal refuges accounted for 53% of the terns counted on roadside surveys, despite only 21% of the survey stops being on these lands. Estimated peak breeding season populations of terns at Horicon NWR were 1600 and 1270 in 1995 and 1996, respectively (Shively 1995, Ramsay 1996).

Population Trends: Kumlien and Hollister (1951) had already noted declines, which have continued to this day (Robbins 1991, Muschitz et al. 1996). Faanes (1979) reported a decline from 42 to 18 breeding pairs from 1975 to 1977 at 7 wetlands in St. Croix and Polk counties; 22 pairs nested at these sites in 1980 (Mossman 1980). McCabe (1983) documented the abandonment of Brazee Lake by Black Terns after the lake was drained in 1955; the number of tern nests at the lake had ranged from 8 to 56 per year from 1947 to 1951.

Total numbers of Black Terns detected on standardized roadside surveys declined 65% between 1980 to 1982 and 1995 to 1996 (Muschitz et al. 1996). Comparisons of the mean numbers of terns for each individual route across both time periods showed a significant difference, and the decrease averaged about 40%. By contrast, nest search surveys for Columbia County (n = 45 sites), the area with the best comparative data, showed an 8% increase in mean nesting pairs from 1980-1982 to 1995-1996, despite a 45% decline in the total number of sites where terns nested. Mean number of pairs at all survey sites decreased from 180 in 1980-1981 to 139 in 1995-1996. In 1996, for the first time since initiation of surveys in 1980, no terns were detected nesting along the Wisconsin shore of Lake Superior. None of the BBS trends for Wisconsin for 1966 to 1979 (-1.8%), 1980 to 1996 (1.0%), or 1966 to 1996 (-2.3%) were significant (Peterjohn and Sauer 1997).

Research/monitoring: Tilghman (1980) initiated statewide roadside surveys and intensive field surveys in 1979. This lead to establishment of standardized roadside surveys and nest searches, which have been conducted in 1980, 1981, 1982 (partial), 1995, and 1996 (Graetz and Matteson 1996, Muschitz et al. 1996). Features of nesting habitat,

reproductive success, and nocturnal incubation of Black Terns have been studied at Trempealeau NWR (Custer and Custer 1996a, b). Nest site characteristics, reproductive success, and use of artificial platforms have been studied at Horicon NWR (Fevold 1998). BBS data for Wisconsin are adequate for trend analysis (Peterjohn and Sauer 1997).

State Status: Species of Special Concern.

Natural Heritage Rank: Vulnerable.

Habitat Conditions: In Wisconsin, Black Terns breed primarily in permanent and semipermanent freshwater wetlands and lakes, though marshy stream edges and flooded sedge meadows are also used. Dominant plants in marshes and around nest sites include bulrushes, cattails, sedges, arrowhead, water lily, burreed, and wild rice (Hoffmann 1954, Faanes 1979, Tilghman 1980, Mossman 1981). Tilghman (1980) found emergent vegetation covering 51% to 75% of the area of 29 prime breeding sites; in over 85% of sites there was some open water. In Winnebago Pool lakes in east-central Wisconsin, Black Terns nest in marshes with a mixture of emergent vegetation (especially burreed), mud flats, and shallow open water (Mossman et al. 1988).

Bailey (1977) found 143 nests at Rush Lake, of which 71 were placed on floating cattail rootstocks, 29 on cattail islands, 20 on bulrush beds (mostly floating stems), 13 on algae mats, and 10 on lumber. Most nests there were found in and around large bulrush beds; nests were never closer than 25 m from shore or more than 1 to 2 m from open water. Also at Rush Lake, Mossman et al. (1988) found 173 nests, of which 127 were on bulrush (mostly) or cattail rhizomes, 15 on Forster's Tern nest platforms, 15 on mats of residual bulrush or cattail stems, 13 on floating boards, 5 on algae mats, and 3 on inactive grebe nests. Faanes (1979) found 52 nests, of which 51 were on mats of floating vegetation (45 on bulrushes or cattails, 6 on mats of submerged aquatic plants) and 1 was on a muskrat house. Tilghman (1980) found 23 nests, which were built either on floating peat mats, muskrat feeding platforms, dead floating cattails, or floating cattail rootstocks. From statewide surveys, Mossman (1981) found that nests were usually placed 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. Most nests in water over 1.2 m deep were on floating mud islands, whereas some nests in flooded meadows or large stable sedge mats were in water as shallow as 16 cm. Initial water depth of 57 nests at Trempealeau NWR averaged 58 cm (40-70; Laurent 1993).

Threats: Habitat loss or alteration appears to be the principal cause of population declines, though wetland succession, human disturbance, and water level fluctuations may be contributing factors (Graetz and Matteson

1996, Muschitz et al. 1996). Eggs of Black Terns from Lake Michigan have been contaminated with organochlorine pesticides, PCBs, PBBs, PCSs, and mercury, but not at levels likely to cause adverse effects (Faber and Hickey 1973, Heinz et al. 1985). The 14.8% decrease in average eggshell thickness from a pre-1947 sample (0.155 mm) to a 1970 sample (0.132 mm) of Black Tern eggs from Lake Michigan (Faber and Hickey 1973) is slightly below the range of 15% or above usually associated with reproductive impairment (Weseloh et al. 1997). By 1976, average eggshell thickness in Wisconsin apparently had recovered to 0.149 mm (Bailey 1977), remaining 3.9% below the average pre-1947 thickness.

Wyoming

Status and Distribution: Henninger (1915) provided the first confirmation of nesting for the state "near Bamforth Lake" (perhaps Carroll Lake, Albany Co.; Oakleaf et al. 1996). McCreary (1937) considered the species a summer resident in the southeastern part of the state; an absence of records from the western part of the state was thought to reflect a lack of observers. Limited exploration continued until the mid-1980s when surveys were conducted for various colonial larids, including the Black Tern (Findholt 1994); surveys have been continued sporadically to the present (Oakleaf et al. 1996, A. Cerovski written comm.). Black Terns have now been documented breeding at 6 sites in Wyoming (assuming "near Bamforth Lake" = Carroll Lake): Caldwell Lake, Carroll Lake, Hutton Lake NWR, Kay Ranch, and Pilger Lake, Albany County, and Bear River Marshes, Lincoln County (Findholt 1994, Oakleaf et al. 1996). Most of these areas, except Bear River Marshes, are not reliable breeding sites during years of drought or high water conditions (A. Cerovski written comm.). Dorn and Dorn (1990) considered the species an "uncommon" summer resident and listed breeding evidence from 7 (2 confirmed, 5 suspected) of Wyoming's 28 latilong blocks.

Major Populations: Bear River Marshes hosted 500+ pairs in 1982 and 100 to 150 pairs in 1984 (Lockman and Serdiuk 1984), but the highest count there since has been 7 pairs in 1990 (A. Cerovski written comm.).

Population Trends: Findholt (1994) felt populations trends were unknown because most colonies had been monitored for too few years, and the Bear River Marshes had not been surveyed since 1984. Only partial surveys have been conducted of this site since 1994 (A. Cerovski written comm.).

Research/monitoring: Annual surveys of the most important breeding habitat for Black Terns and other colonial nesting waterbirds in Wyoming, including Bear River Marshes and the Laramie Plains lakes, were initiated in 1994; partial counts are obtained in most years because of the difficulty of surveying the Bear River Marshes (A. Cerovski written comm.).

State Status: Species of Special Concern.

Natural Heritage Rank: Critically Imperiled.

Habitat Conditions: No published information on habitat use in the state.

Threats: The main threats to the species in Wyoming appear to be loss of suitable breeding habitat from human disturbance and climatic extremes (Oakleaf et al. 1996, A. Cerovski written comm.).

CANADA

Alberta

Status and Distribution: During the Alberta Breeding Bird Atlas (1987-1991), breeding evidence was obtained for the Black Tern in 502 (182 possible, 103 probable, 217 confirmed) of 2209 atlas blocks surveyed (Semenchuk 1992, T. Wiens written comm.). The species was distributed widely, and greatest concentrations were in the Parkland (44% of surveyed squares) and Boreal Forest (31%) natural regions; smaller concentrations were found in the Canadian Shield (19%), Grassland (10%), Foothills (10%), and Rocky Mountain (4%) regions.

Major Populations: See above.

Populations Trends: Semenchuk (1992) concluded the species' exact status in Alberta was unknown. Peterjohn and Sauer (1997), however, presented BBS data showing an average population decline of -3.2% per year in Alberta from 1980 to 1996; trends for the periods 1966 to 1979 (0.3%/yr) and 1966 to 1996 (-0.3%/yr) were not significant.

Research/monitoring: None known except BBS.

Provincial Status: Yellow list; concern over long-term declines.

Natural Heritage Rank: Apparently Secure.

Habitat Conditions: Inhabits shallow lakes, marshes, sloughs, ponds, and wet meadows with extensive shallows and moderate amounts of emergent vegetation; requires large open areas of water in the period just prior to nesting and after young have fledged (Semenchuk 1992). Nests built on rafts of aquatic vegetation, whether floating, and often anchored to emergents, or on marshy hummocks; other sites include muskrat houses, old grebe nests, or raised mud patches.

Threats: None reported.

British Columbia

Status and Distribution: Breeds widely but locally in much of southern, central, and northeastern British Columbia east of the Coast Ranges and south of the Fraser Basin region (Campbell et al. 1990, Cooper and Campbell 1997). Also, a very small colony occurs on the south coast at

Pitt Lake, near Vancouver (Campbell 1970, Cooper and Campbell 1997). The western breeding limit is at Old Man Lake near Smithers. The number of active colonies is unknown, but probably is in the hundreds (Cooper and Campbell 1997).

Major Populations: Heart of breeding distribution is in the Central Interior, southern Sub-Boreal Interior, and southern Boreal Plains ecoprovinces, and the Creston Valley in the Southern Interior Mountains ecoprovince (Cooper and Campbell 1997). Historically largest colonies have occurred in large wetlands in the Creston Valley, Peace River lowlands near Fort St. John and Dawson Creek, and near Prince George, though more colonies and larger overall populations occur in smaller wetlands of the Central Interior. Largest reported colonies from Tachick Lake near Vanderhoof (90 pairs 1978) and Cecil Lake east of Fort John (100 pairs 1945) (Campbell et al. 1990). The largest known local population is from the Creston Valley, where numbers of breeding adults ranged from 600 in 1981 to 300 in 1984 (Chapman Mosher 1986, Campbell et al. 1990). A cluster of five satellite colonies at Swan Lake (Vernon) totaled 114 pairs in 1937 (Campbell et al. 1990).

Population Trends: The population at Creston Valley WMA increased steadily from the 1950s then decreased from 1981 to 1984 (Chapman Mosher 1986). Cannings et al. (1987) felt that a decline in the Okanagan Valley, from 200 pairs between 1925 to 1940 to a few pairs in 1978, was likely caused by normal population fluctuations, perhaps in response to drought, rather than to human disturbance. Campbell et al. (1990) concluded that up to that time trends for B.C. as a whole were generally unknown. Cooper and Campbell (1997), however, concluded that during the last few decades the species' breeding distribution has expanded northward and westward and, although declines were better documented than increases, the provincial population is stable or increasing. They noted that breeding terns have colonized newly built shallow wetlands with stable water levels created for waterfowl. Still, they reported that some local populations have declined or been extirpated, particularly in areas with high rates of urbanization. Finally, they cautioned that variation in survey methods and effort and the considerable fluctuations in the number of breeding pairs at most sites underscored the difficulty of assessing populations of the species, particularly as it responds quickly to changing environmental conditions.

Research/monitoring: In the wet year of 1996, Cooper and Campbell (1997) surveyed 32 active nesting colonies, representing an unknown but very small percentage of those in the province, at which they estimated 501 breeding pairs (from 957 flying adults and 133 nests). BBS data are too few for trend analysis (Peterjohn and Sauer 1997).

Provincial Status: Yellow List; some conservation concern for local

populations.

Natural Heritage Rank: Apparently Secure.

Habitat Conditions: Nests on shallow freshwater lakes, marshes, sloughs, and ponds (in open and forested regions) with still waters and emergent vegetation or waterlilies (Campbell et al. 1990). Nesting colonies occur from 61 to 1220 m (200-4000 ft) above sea level and range from 3 to 100 pairs (n = 57; 66% have 11-50 pairs). Ninety-one percent of nests (n = 218) were in openings in or at the edges of emergent vegetation (cattail, bulrush, marsh horsetail) over water ranging from 0.1 to 1.7 m. Nests were either floating platforms anchored to emergents or built on mats of floating debris, muskrat clippings, old grebe nests, muskrat lodges, and floating boards or logs.

At Creston Valley WMA, Black Terns nested in marshes of three types: (1) predominately of marsh horsetail and beaked sedge (*Carex rostrata*) with sparse common cattail (*Typha latifolia*), (2) largely of reed-canary grass with patches of hardstem bulrush and common cattail, and (3) rings of common cattail and hardstem bulrush (Chapman Mosher 1986). At Elizabeth Lake near Cranbrook, tern habitat consisted of large areas of open water with predominant vegetation being hardstem bulrush. At Creston Valley WMA, Black Terns tended to nest in areas averaging about 25% standing vegetation (for blocking waves and providing cover for chicks), 42% matted vegetation (for nesting substrate), and 33% open water (for nearby foraging areas and access to nests) (Chapman Mosher 1986). They did not nest in areas when the proportion of standing vegetation was <10% or >70% (Chapman Mosher 1986). The terns nested where the area occupied by vegetation stalks on the water surface at the end of the season varied from 10 to 50 cm^2/m^2 (Chapman Mosher 1986). Experiments showed that nests surrounded by vegetation or on platforms suffered the least from wind and wave action or fluctuating water levels. Nests in *Phalaris* survived water level fluctuations better than those in other habitats, and fledging success was greatest in areas with the shortest plants, *Equisetum*.

Threats: Urbanization may destroy nesting habitat (Cooper and Campbell 1997), and use of lakes for irrigation may drastically alter water levels, making marshes less suitable for breeding (Cannings et al. 1987). Water level fluctuations, whatever the cause, can be the main factor limiting hatching success (Chapman Mosher 1986).

Manitoba

Status and Distribution: A numerous breeder in southern Manitoba north regularly to The Pas and Pikwitonei Lake and locally and irregularly near Churchill (Salt and Salt 1976, Godfrey 1986). The single nesting record at Churchill may be erroneous (fide R. Koes).

Major Populations: Numbers are greatest in the Prairie Pothole and Parkland area, decreasing northward into the Boreal Forest (Gerson 1988).

Populations Trends: Trends of Black Terns on BBS surveys in Manitoba from 1966 to 1979 (-7.8%/yr), 1980 to 1996 (-1.1%), and 1966 to 1996 (-6.5%) were not significant (Peterjohn and Sauer 1997).

Research/monitoring: None known except BBS.

Provincial Status: No status assigned.

Natural Heritage Rank: Vulnerable/Apparently Secure.

Habitat Conditions: Breeds in emergent vegetation of sloughs, ponds, and marshes (Thompson 1891).

Threats: Drainage of wetlands continues to be a threat, but these losses have been offset to some degree by wetland restoration (e.g, Oak Hammock Marsh north of Winnipeg) and creation of sewage lagoons (R. Koes written comm.). De Smet and Shoesmith (1988) found organochlorine and PCB contamination in eggs of Black Terns in Manitoba, but at levels below those associated with reproductive impairment (Weseloh et al. 1997).

New Brunswick and Nova Scotia

Status and Distribution: Breeds locally along the lower St. John River, New Brunswick, and the New Brunswick-Nova Scotia border marshes (Erskine 1992). During the Maritimes Breeding Bird Atlas (1986-1990), the Black Tern was recorded in only 14 (7 confirmed, 3 probable, 4 possible) breeding bird atlas squares (Erskine 1992); of 1682 squares, 1573 had at least minimal coverage and somewhat over 1200 had good coverage (A. J. Erskine pers. comm.). Population estimates were 130 pairs for New Brunswick and 20 pairs for Nova Scotia (Erskine 1992). In Nova Scotia, small numbers nest at the Missaguash River marsh, at Amherst Point Bird Sanctuary, Cumberland County, and at other marshes near Amherst (Tufts 1986, A. J. Erskine pers. comm.). In 1997, surveys of the vast majority of wetlands in Maritimes tallied 199 individuals (D. Amirault written comm.). Of these, 171 were at 23 wetlands (primarily along the Saint John's River) in New Brunswick and 28 at one wetland (Amherst Point) in Nova Scotia.

Major Populations: See above.

Populations Trends: Appears to be a relatively recent arrival to the Maritimes. Not known to breed east of Ontario and New York until first documented nesting at Big Timber Lake, New Brunswick, in 1940 following sightings there each year, 1937 to 1939 (Peters 1941, Erskine 1992). Although breeding is irregular and unpredictable at many sites, the

species has been seen in the Maritimes nearly annually in the last 50 years (Erskine 1992). Black Terns were first detected in 1966 in the New Brunswick-Nova Scotia border area, where both habitat in new impoundments and sightings of terns have increased in succeeding years (Erskine 1992). Nesting first confirmed at Missaguash River marsh in 1975 and at Amherst Point Bird Sanctuary in 1977 (Tufts 1986). Most terns are now nesting in the St. John River marshes near Grand Lake (A. J. Erskine pers. comm.).

Research/monitoring: BBS data too few for trend analysis (Peterjohn and Sauer 1997). A graduate research project on habitat selection and breeding success as a measure of habitat quality for Black Terns along the Saint John River floodplain, New Brunswick, is in progress (L. Bernard written comm.), and future surveys of Black Terns are planned for the New Brunswick-Nova Scotia border area (D. Amirault written comm.).

Provincial Status: No status assigned.

Natural Heritage Rank: Unranked.

Habitat Conditions: Breeds in highly productive marshes and lakes. Black Terns were quick to colonize new water impoundments created by Ducks Unlimited Canada, but apparently as these impoundments age they lose productivity and the terns use them less regularly (A. J. Erskine pers. comm.). In years when Black Terns breed at Eddy Marsh, they nest in an area of wild rice production (A. J. Erskine pers. comm., D. Amirault written comm.).

Threats: Status considered precarious because of small population size (Erskine 1992).

Northwest Territories

Status and Distribution: Sirois and Fournier (1993) reviewed the status of the Black Tern in the Northwest Territories and considered the species fairly common in the southwestern portion of the province. Sightings, including four confirmed breeding records, were concentrated at sites on or around Great Slave Lake and the Slave Delta, with additional colonies south to Wood Buffalo National Park and west to the Nahanni National Park Preserve in the southwest Mackenzie District. The species is accidental on islands in Hudson and James bays, from which there is only one confirmed breeding record.

Barrett and Kay (1997) reported the most northerly breeding site in Canada (and the Nearctic) at the Brackett Lake wetland complex in a valley of the Franklin Mountains (65°06'N, 125°19'W), 300 km north of the previously known northern breeding limit on the north shore of Great Slave Lake (62°31'N, 115°00'W). These authors believed that further exploration by qualified observers would find additional northerly

breeding colonies in remote wetlands of the Taiga Plains region of the Northwest Territories.

Major Populations: Sirois et al. (1995) felt that thousands of Black Terns may nest near Great Slave Lake based on the extensive and apparently optimal, but largely unexplored, breeding habitat and the number of birds observed on the lake after the nesting season (e.g., 400 juveniles and 30 adults in one area in August 1995).

Population Trends: Limited data from the past 10 to 20 years precludes accurate mapping of distribution and assessment of population trends (Sirois and Fournier 1993, Barrett and Kay 1997).

Research/monitoring: BBS data too few for trend analysis (Peterjohn and Sauer 1997), and no other monitoring is being conducted (Sirois and Fournier 1993). Eggs collected at Great Slave Lake in 1995 are being analyzed for contaminants (M. Fournier pers. comm.).

Provincial Status: No status assigned.

Natural Heritage Rank: Unranked.

Habitat Conditions: Breeds in emergent vegetation of high-boreal marshes. At Brackett Lake, terns nested in a dense bed of hardstem bulrush in a wetland remnant of a larger lake with 50% open water and an extensive (>300 m) sedge marsh periphery (Barrett and Kay 1997).

Threats: No immediate threats identified, but industrial development in the upper Mackenzie watershed, in northern Alberta and British Columbia, could affect Great Slave Lake's wildlife in the future (Sirois et al. 1995).

Ontario

Status and Distribution: Historically, the Black Tern was "common to abundant" in many areas of Ontario, particularly in southern Ontario. Recently, James (1991) considered the breeding status to be locally uncommon to common in the south and rare to uncommon in the north, as far north as Sandy Lake and Fort Albany. During the Ontario Breeding Bird Atlas (1981-1985), it was reported in 52 (38%; 10 possible, 11 probable, 31 confirmed) of 137 blocks throughout Ontario and 315 (17%; 82 possible, 78 probable, 155 confirmed) of 1824 squares in southern Ontario (Dunn 1987). For squares with abundance estimates, observers judged that 95% held fewer than 100 pairs and 63% no more than 10 pairs. From atlas data, Austen (1994) estimated the southern Ontario breeding population at roughly 2873 to 14,996 pairs.

Major Populations: Populations concentrate in the southern Canadian Shield, the margins of the Great Lakes, and along the St. Lawrence and

Ottawa rivers (Dunn 1987).

Populations Trends: The present breeding distribution of the Black Tern in Ontario remains much as it was in the past (Peck and James 1983, Dunn 1987). Dunn (1987) felt it was difficult to assess changes in abundance, because the species commonly abandons breeding sites when vegetation and water level changes, but nevertheless it was likely that tern numbers had decreased in the past several decades. Austen and Cadman (1994) provided the details (largely anecdotal; summarized in Austen 1994) of historical declines, mostly in the 1980s, and voiced similar concerns about the difficulty of assessing changes in Black Tern abundance. M. Richardson (pers. comm.) felt there were historical declines in northeastern Lake Ontario but the lack of extensive and thorough surveys precluded an accurate assessment of numbers in the last 20 years.

Declines in tern numbers in certain wetlands may have been compensated to some degree by numerous wetland enhancement projects. This is certainly true for northeastern Lake Ontario, where Black Tern numbers in Ducks Unlimited wetland impoundments may be far greater than ever occurred in similar-sized natural wetlands; in southern Ontario there are hundreds of Black Terns at Ducks Unlimited wetlands (M. Richardson written comm.). The aggregate effect of these projects is not well understood but is probably significant (H. Blokpoel pers. comm.). The 1991 to 1992 Colonial Marshbird Census compiled baseline data of about 584 pairs of terns at 81 colonies in marshes of the Great Lakes (Austen et al. 1996). These surveys in many cases did not include all available habitat, where many terns were found from 1994 to 1996 (M. Richardson pers. comm.). Black Tern numbers on BBS surveys in Ontario declined significantly by an average of -13.2% per year from 1966 to 1979, but trends from 1980 to 1996 (1.6%/yr) and from 1966 to 1996 (-3.2%/yr) were not significant (Peterjohn and Sauer 1997).

Research/monitoring: Dunn (1979) studied the breeding biology of Black Terns at Long Point on Lake Erie. At Presqu'ile Provincial Park on Lake Ontario others have surveyed breeding populations annually since 1990 and studied the use of artificial platforms for nesting (Gurr 1994, Pouliot 1993, Teeuw 1995). Richardson (1996) surveyed nesting populations in northeastern Lake Ontario in 1994 and 1995 and studied habitat characteristics, nest platform occupancy, and the use of social attractants to stimulate breeding. Weseloh et al. (1996) studied colony size, nest site characteristics, use of artificial nesting platforms, clutch size and hatching success, and contaminants in eggs at Bay of Quinte, southern Ontario, in 1994 and 1995 and at four other wetlands in 1996. In 1997, R. Alvo and H. Blokpoel (in prep.) evaluated the use by Black Terns of three types of nest platforms at one site in southeastern Ontario. Also in 1997, D. V. C. Weseloh and G. Barrett (written comm.) placed radio transmitters on young Black Terns at two sites to investigate departure

from the colony and to aid in location of a large pre-migratory staging area in western Lake Erie. The Colonial Marshbird Census conducted baseline surveys of populations breeding along the shores of the Great Lakes in 1991 to 1992 (Austen et al. 1996).

Provincial Status: No status assigned, but recommended for listing as Threatened (Austen 1994, Austen and Cadman 1994).

Natural Heritage Rank: Vulnerable.

Habitat Conditions: Breeds most commonly in cattails, bulrushes, and sedges in marshes, marshy borders of lakes, rivers, and ponds, and marshy islands and islets (Dunn 1979, 1987; Peck and James 1983). Breeds also in wet heath bogs and flooded willows with some marsh vegetation and rarely on drier sites among grasses and marsh vegetation (Peck and James 1983). Predominant vegetation in some nesting habitats is common reed grass, wild rice, horsetails, leatherleaf, and sweet gale. Nests on Lake Ontario were located primarily in cattails (Dunn 1979, Richardson 1996). Water clarity at nesting and foraging sites also may be an important habitat need (Richardson 1996).

At Long Point, Dunn (1979) found 75% of nests (n = 24) were built on floating dead vegetation, 17% on floating boards or logs, and 8% on cattail rootstock. Muskrat-built structures, though abundant, were not used, whereas they accounted for 22% to 33% of nest substrates in three other studies cited. The majority of substrates were floating in water 1 to 1.2 m deep, and nests averaged 4 m (0.5-12) from open water . Some nests, generally on boards or rootstock, were in large pools, where they depended less on emergent vegetation for support. Nests in cattail were generally in moderately dense new growth (projecting at least 1 m above water, but dispersed enough to force a canoe through); a few were in thin new growth, but were rare in dense old stands. A few nests in a nearby marsh were on isolated patches of soft mud.

Richardson (1996) studied a sample of nest sites on northeastern Lake Ontario, of which 45 were free floating and 6 were anchored. Twenty-one nests were built on upturned cattails, 14 on muskrat feeding platforms or lodges, 13 on broken down cattails, 10 on floating vegetation, 4 on cattail islands, 3 on mud, and 2 on boards; sites on mud may be more frequent in low-water years (M. Richardson written comm.). Among five sites, average percent cover of open water ranged from 31% to 82% and emergent vegetation from 15% to 68% (Richardson 1996).

For Ontario in general, Peck and James (1983) reported nests were most frequently on unanchored or anchored floating bases (n = 405) versus more solid bases (n = 143). Most floating nests were on mats of dead vegetation, but others were on boards and doors (n = 26) or logs (n = 14);

one set of eggs was laid directly on a lily pad. Solid-base nests were on raised mud patches (n = 59), piles of non-floating vegetation (n = 44), muskrat houses (n = 39), and among upturned tree roots with attached vegetation (n = 1). Water depths at nests ranged from 7.5 to 122 cm.

Use by Black Terns of artificial nest platforms placed in Ontario marshes has been mixed (Pouliot 1993, Gurr 1994, Teeuw 1995, Richardson 1996, Weseloh et al. 1996, R. Alvo and H. Blokpoel in prep.).

Threats: Dunn (1987) and Austen and Cadman (1994) concluded that alteration and destruction of marsh habitat was likely an important cause of the decline of the Black Tern in Ontario. Overall, about 70% of southern Ontario's historic wetlands have been converted to other uses, mainly agriculture (Snell 1982 in Gerson 1988). Another factor in declines may be a reduction in the amount of hemi-marsh from succession, siltation, reduced water fluctuation (at least on Lake Ontario), increased water turbidity, and decreased muskrat populations (M. Richardson written comm.). Management draw downs of impoundments to reduce the amount of emergent vegetation may have short-term negative effects but long-term positive ones, as for part of the cycle the impoundments reach the hemi-marsh conditions favored by terns (H. Blokpoel pers. comm.). Dunn (1987) felt human disturbance from recreational activities apparently was minimal because tern nesting habitat was unsuitable for swimming, boating, and fishing. This is not the case at all sites, and introduction of jet skis may have a greater impact than boats with outboard motors (M. Richardson written comm.). At Long Point in recent years, marshes may have been more exposed to wind and wave action, which reduces the amount of floating debris available for nesting (McCraken in Austen and Cadman 1994). Similarly, at Bay of Quinte, Lake Ontario, wave action, lack of floating vegetation, and decreased wetland suitability may have impacted terns (Richardson 1996). Frank et al. (1975) and Weseloh et al. (1997) found Black Tern eggs in Ontario contaminated with organochlorine pesticides, PCBs, etc., but they reported no evidence of reproductive impairment. The maximum eggshell thinning recorded in Ontario in the period 1993 to 1996 of 12.2% (ave. 9.0% thinner than pre-1947 levels) was below the range of 15% or more usually associated with reproductive impairment (Weseloh et al. 1997).

Québec

Status and Distribution: Breeds in southern Québec in the Central St. Lawrence lowland, particularly along the St. Lawrence, Ottawa, and Richelieu rivers, and in the Appalachians; also breeds sparingly in the Abitibi and Lac-Saint-Jean regions (Messier and Rail 1996). Nesting evidence was obtained from only 75 (3%; 28 possible, 14 probable, 33 confirmed) of 2464 breeding bird atlas squares in southern Québec from 1984 to 1989.

Major Populations: See above.

Populations Trends: Lacombe's (1995) analysis of birders' checklists in Québec for the period 1970 to 1991 indicated that Black Terns are less than one-fifth as abundant as they were and are observed one-fourth as often. Steady declines in both the percentage of checklists on which terns were recorded and the annual mean abundance per checklist, while numbers remained steady where the species was present, suggests the terns are disappearing from many areas. An alternative interpretation is that the results in part may reflect a change in birdwatching patterns in Québec over the last 20 years (M. Gosselin in Alvo and Dunn 1996). Messier and Rail (1996) speculated that the species was probably more abundant in Québec in the 19th century than now despite a lack of quantitative data from the earlier period. BBS data are too few for trend analysis (Peterjohn and Sauer 1997).

Research/monitoring: None known.

Provincial Status: No status assigned.

Natural Heritage Rank: Vulnerable.

Habitat Conditions: Nests in marshes and swamps, and along lakes, ponds, and rivers, generally in fresh, but sometimes brackish, water where the dominant vegetation consists of cattails, rushes, or sedges (Messier and Rail 1996).

Threats: Species is sensitive to wakes from the increasing number of pleasure and sport fishing boats on Québec's lakes and rivers (Messier and Rail 1996). Weseloh et al. (1997) found Black Tern eggs in Québec contaminated with organochlorine pesticides, PCBs, etc., but they reported no evidence of reproductive impairment. The maximum eggshell thinning recorded in Québec in the period 1989 to 1993 of 9.7% (ave. 3.2% thinner than pre-1947 levels) was well below the range of 15% or more usually associated with reproductive impairment (Weseloh et al. 1997).

Saskatchewan

Status and Distribution: A common summer resident of central and southeastern Saskatchewan, uncommon in the Northern Boreal Region (north to Jackfish Creek, Haultain River, and Reindeer River), and uncommon and perhaps local in southwestern portion of province (Smith 1996). A summer record from Milton Lake in the Subarctic Region is best regarded as an accidental occurrence. Recorded as breeding in 215 (30%; 134 possible, 43 probable, 38 confirmed) of 724 blocks (mapsheets) in the (historical) Atlas of Saskatchewan Birds (Smith 1996).

Major Populations: See above.

Populations Trends: BBS data show a significant average population

decline in the province of -6.6% per year from 1966 to 1979 and -4.3% from 1966 to 1996; a decline from 1980 to 1996 (-1.7%/yr) was not significant (Peterjohn and Sauer 1997).

Research/monitoring: None known except BBS.

Provincial Status: No status assigned.

Natural Heritage Rank: Apparently Secure.

Habitat Conditions: Black Terns breed in emergent vegetation in marshes, ponds, and sloughs; nests are built on residual floating vegetation (Pittman 1927). They appear to prefer "the wettest and most inaccessible marshes" (Houston and Street 1959). In the prairies, Black Terns apparently spend considerable time foraging in agricultural lands by following plows and coursing over grain fields (Pittman 1927).

Threats: None reported.

Yukon

Status and Distribution: Four records prior to first breeding established in 1996: one bird at Swan Lake near Whitehorse on 3 June 1978, one at Big Salmon Lake on 1 June 1989, two at Big Salmon River on 2 June 1989, and one at Yukon River, Whitehorse, on 23 June 1994 (C. Eckert written comm.). Nesting was first documented at Blind Lake in southeastern Yukon from 16 to 18 June 1996 with the observation of 44 adults and 25 nests in a marsh on the south shore and 5 adults and 1 nest in a smaller marsh on the northeastern shore (Eckert 1996). Observations of Black Terns at Blind Lake during the three previous years by a fish farm operator (fide C. Eckert) indicate that the lake had not been colonized by terns displaced from traditional colonies in northern British Columbia by high water levels in 1996 (NASFN 50:987). More nesting colonies are likely to be found as remote regions are explored by qualified observers (see Barrett and Kay 1997).

Major Populations: See above.

Population Trends: NA

Research/monitoring: NA

Provincial Status: No status assigned.

Natural Heritage Rank: Unranked.

Habitat Conditions: Main nesting colony at Blind Lake in "an expansive bed of relatively sparse bulrushes in 1 to 2 meters of water," and nests built on "loose floating mats of dead bulrush" (Eckert 1996).

Threats: None reported.

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