

South Dakota Statewide Colonial and Semi-colonial Waterbird Inventory with a Plan for Long-term Monitoring

Final Report

Appendices A - F



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Nancy Drilling
Rocky Mountain Bird Observatory
P.O. Box 1232
Brighton, CO 80601
www.rmbo.org



ROCKY MOUNTAIN BIRD OBSERVATORY

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Contact Information:

Nancy Drilling
nancy.drilling@rmbo.org

Rocky Mountain Bird Observatory
P.O. Box 1232
Brighton, CO 80601
303-659-4348

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APPENDIX A. Target species for the Colonial Waterbird Inventory Project and related South Dakota Department of Game, Fish and Parks (2005) priority, South Dakota Wildlife Action Plan (WAP) (2006) priority, South Dakota All Bird Conservation Plan (Bakker 2005) priority, count technique, parameter used to define an “active” breeding attempt, and measured parameter. See text for definitions of project Tier (survey effort) levels.

Common Name	Scientific Name	I&M Priority	SD WAP Priority	SD Bird Plan Priority	Count Protocol	“Active” determination	Measured Parameter
TIER 1 species							
Great Blue Heron	<i>Ardea herodias</i>	high		Level II	total nest count	active nest	nests
Little Blue Heron	<i>Egretta caerulea</i>	high			total nest count	active nest	nests
Tricolored Heron	<i>Egretta tricolor</i>	high			total nest count	active nest	nests
Green Heron	<i>Butorides virescens</i>	high			total nest count	active nest	nests
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	high		Level I	adult flush count, total nest count	active nest	nests, adults
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>	high			total nest count	active nest	nests
Great Egret	<i>Ardea alba</i>	high			total nest count	active nest	nests
Snowy Egret	<i>Egretta thula</i>	high			total nest count	active nest	nests
White-faced Ibis	<i>Plegadis chihi</i>	high			adult flush count	active nest	nests, adults
American White Pelican	<i>Pelecanus erythrorhynchos</i>	high	greatest	Level II	aerial photos	active nest	nests
California Gull	<i>Larus californicus</i>	high			adult flush count	active nest	nests, adults
Franklin's Gull	<i>Larus pipixcan</i>	high		Level I	adult flush count	active nest	nests, adults
Common Tern	<i>Sterna hirundo</i>	high		Level III	adult flush count, total nest count	active nest, brood	nests, adults
Caspian Tern	<i>Hydroprogne caspia</i>	N/A			adult flush count, total nest count	active nest	nests, adults
Black Tern	<i>Chlidonias niger</i>	high	greatest	Level I	adult flush count, total nest count	active nest, brood, carrying food	nests, adults
Clark's Grebe	<i>Aechmophorus clarkii</i>	high			total count	active nest, brood	nests, broods
Horned Grebe	<i>Podiceps auritus</i>	high		Level I	total count	active nest, brood	nests, broods
Red-necked Grebe	<i>Podiceps grisegena</i>	high		Level III	total count	active nest, brood	nests, broods
Black-necked Stilt	<i>Himantopus mexicanus</i>	high			total count	active nest, brood	nests, broods

APPENDIX A (cont.)

Common Name	Scientific Name	I&M Priority	SD WAP Priority	SD Bird Plan Priority	Count Protocol	“Active” determination	Measured Parameter
TIER 2 species							
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	moderate			total nest count	active nest	nests
Ring-billed Gull	<i>Larus delawarensis</i>	low			adult flush count	active nest	nests, adults
Forster’s Tern	<i>Sterna forsteri</i>	high			adult flush count, total nest count	active nest, brood, carrying food	nests, adults
Least Tern	<i>Sternula antillarum</i>	high	greatest	Level II	adult flush count	active nest, brood, carrying food	nests, broods
Eared Grebe	<i>Podiceps nigricollis</i>	moderate		Level II	total count	active nest, brood	nests, broods
Western Grebe	<i>Aechmophorus occidentalis</i>	moderate		Level III	total count	active nest, brood	nests, broods
American Avocet	<i>Recurvirostra americana</i>	moderate		Level II	adult flush count, total nest count	active nest, brood	nests, broods
Marbled Godwit	<i>Limosa fedoa</i>	moderate	greatest	Level I	total count	active nest, brood	nests, broods
Willet	<i>Tringa semipalmata</i>	moderate	greatest	Level I	total count	active nest, brood	nests, broods
Wilson’s Phalarope	<i>Phalaropus tricolor</i>	moderate	greatest	Level I	total count	active nest, brood	nests, broods
Piping Plover	<i>Charadrius melodus</i>	high	greatest	Level II	total nest count	active nest, brood	nests, broods
TIER 3 species							
Cattle Egret	<i>Bubulcus ibis</i>	low			total nest count	active nest	nests
Pied-billed Grebe	<i>Podilymbus podiceps</i>	low			total count	active nest, brood	nests, broods
Bufflehead	<i>Bucephala albeola</i>	high			total count	active nest, brood	nests, broods
Hooded Merganser	<i>Lophodytes cucullatus</i>	high			total count	active nest, brood	nests, broods
Common Merganser	<i>Mergus merganser</i>	high			total count	active nest, brood	nests, broods
Trumpeter Swan	<i>Cygnus buccinator</i>	N/A			total count	active nest, brood	nests, broods
Spotted Sandpiper	<i>Actitis macularius</i>	low			total count	active nest, brood	nests, broods
Wilson’s Snipe	<i>Gallinago delicata</i>	low			total count	active nest, brood; courtship displays	adults, nests, broods
American Bittern	<i>Botaurus lentiginosus</i>	moderate		Level I	taped callback	calling adult, active nest, brood	adults, nests, broods

APPENDIX A (cont.)

Common Name	Scientific Name	I&M Priority	SD WAP Priority	SD Bird Plan Priority	Count Protocol	“Active” determination	Measured Parameter
TIER 3 species (cont.)							
Least Bittern	<i>Ixobrychus exilis</i>	high		Level III	taped callback	calling adult, active nest, brood	adults, nests, broods
Yellow Rail	<i>Coturnicops noveboracensis</i>	high			taped callback	calling adult, active nest, brood	adults, nests, broods
King Rail	<i>Rallus elegans</i>	high			taped callback	calling adult, active nest, brood	adults, nests, broods
Virginia Rail	<i>Rallus limicola</i>	moderate		Level I	taped callback	calling adult, active nest, brood	adults, nests, broods
Sora	<i>Porzana carolina</i>	moderate			taped callback	calling adult	adults, nests, broods
Bald Eagle	<i>Haliaeetus leucocephalus</i>	high	greatest		incidental observation	active nest	nests
Osprey	<i>Pandion haliaetus</i>	high	greatest		incidental observation	active nest	nests

APPENDIX B. Sites with ≥ 200 breeding pairs of colonial waterbirds in at least one year or > 5 colonial waterbird species confirmed breeding in at least one year. Dashed lines indicate sites that were not visited in that year. Species (next page) are listed in order of decreasing abundance; species in bold are those of special conservation concern (Bakker 2005, SD Game, Fish, and Parks 2006).

Site	County	Total No. Breeding Pairs			Total No. Species			Ownership	Historical Colony?
		2005	2006	2007	2005	2006	2007		
Bitter Lake & GPA	Day	11,529	19,117	22,488	13	12	15	state, private	yes
Lake Albert Island GPA	Kingsbury	1,466	1,943	919	6	6	6	state	yes
Lacreek NWR	Bennett	845	2,437	650	7	5	5	federal	yes
Four mile Clubhouse Slough	Marshall	515	1,113	691	3	3	4	state	no
East Hecla GPA	Brown	272	986	602	3	3	6	state	yes
Blythe Slough GPA	Clark	1,273	681	704	6	6	5	state	yes
Renziehausen GPA	Brown	32	657	698	4	11	7	state	no
Goose Lake & GPA	Codington	731	545	18	8	6	1	state	yes
Dry Lake No. 2 & GPA	Clark	294	533	231	5	3	3	state	yes
Putney Slough & GPAs	Brown	4	686	262	3	14	9	state, private	yes
Orman Dam & Owl Creek	Butte	390	487	375	4	3	4	state, private	no
Sand Lake NWR	Brown	276	72	1,126	5	7	12	federal	yes
Drywood Lake	Roberts	--	4 ¹	387	--	3	5	private, tribal	yes
Krause Farm GPA	Day	329	324	352	2	2	2	state	yes
Kettle Lake	Marshall	118	168	312	1	1	3	private	yes
private Lake	Day	438	381	232	2	2	2	private	no
Oakwood Lakes State Park	Brookings	186	225	215	2	3	4	state	yes
private Lake (3 colonies)	Day/Clark	367 ²	691	440	3	3	3	private	no
private pond	McCook	265	202	37	3	3	3	private	yes
Red Lake	Brule	11	0	375	2	0	8	private	yes
Simon/Schmidt WPA, Alkali Lake	Edmunds	0	296	1	0	1	1	federal, private	yes
Herman-Jutzy WPA	Edmunds	80	295	13	1	3	1	federal	no
Morlock GPA	McPherson	--	230	2	--	1	1	state	no
James River	Brown	1	247	172	1	3	3	private	no
private marsh	Brown	--	--	177	--	--	6	private	no
private pond	Roberts	--	--	151	--	--	6	private	no

¹ Tree-nesting colonies not counted in 2006

² Only northernmost colony (at 151 St.) counted in 2005

APPENDIX B (cont.)

Site	Species Confirmed Breeding at Site (decreasing order of abundance)
Bitter Lake & GPA	Amer. White Pelican , Ring-billed Gull, D-C Cormorant, Great Egret, Cattle Egret, Franklin's Gull , Snowy Egret, Eared Grebe , Western Grebe , White-faced Ibis, California Gull, Forster's Tern, Common Tern , Caspian Tern, Black Tern , Great Blue Heron , Black-crowned Night-Heron , Amer. Bittern , Amer. Avocet
Lake Albert Island GPA	Great Egret, D-C Cormorant, Cattle Egret, Snowy Egret, Great Blue Heron , Black-crowned Night-Heron
Lacreek NWR	AW Pelican , D-C Cormorant, GB Heron , Cattle Egret, B-C Night-Heron , Amer. Bittern , Sora, Virginia Rail
Four mile Clubhouse Slough	Double-crested Cormorant, Great Egret, Great Blue Heron , Black-crowned Night-Heron , Amer. Avocet
East Hecla GPA	Double-crested Cormorant, Great Egret, Great Blue Heron , Western Grebe , Sora, Virginia Rail
Blythe Slough GPA	D-C Cormorant, Great Egret, Cattle Egret, Snowy Egret, Ring-billed Gull, B-C Night-Heron , GB Heron
Renziehausen GPA	Franklin's Gull , Cattle Egret, Black-crowned Night-Heron , White-faced Ibis, Western Grebe , Snowy Egret, Forster's Tern, Black Tern , Sora, American Bittern , Eared Grebe , Virginia Rail , Pied-billed Grebe
Goose Lake & GPA	Cattle Egret, Black-crowned Night-Heron , Eared Grebe , Western Grebe , Great Egret, Snowy Egret, Double-crested Cormorant, Great Blue Heron , Little Blue Heron
Dry Lake No. 2 & GPA	D-C Cormorant, Great Blue Heron , Great Egret, Forster's Tern, Sora, Western Grebe
Putney Slough & GPAs	D-C Cormorant, Eared Grebe , Western Grebe , Forster's Tern, Great Blue Heron , Black Tern , Pied-billed Grebe, White-faced Ibis, Virginia Rail , Sora, American Bittern , Least Bittern , Bald Eagle
Orman Dam & Owl Creek	California Gull, Ring-billed Gull, Great Blue Heron , Common Tern , American Bittern
Sand Lake NWR	Franklin's Gull , Cattle Egret, Black-crowned Night-Heron , White-faced Ibis, Forster's Tern, Snowy Egret, Western Grebe , D-C Cormorant, Virginia Rail , Sora, American Bittern , Eared Grebe , Little Blue Heron
Drywood Lake	Double-crested Cormorant, Great Blue Heron , Western Grebe , Sora, Pied-billed Grebe, Bald Eagle
Krause Farm GPA	Double-crested Cormorant, Great Blue Heron
Kettle Lake	Double-crested Cormorant, Great Blue Heron , Great Egret
private Lake	Double-crested Cormorant, Great Blue Heron
Oakwood Lakes State Park	Double-crested Cormorant, Great Blue Heron , Great Egret, Cattle Egret
private Lake (3 colonies)	Double-crested Cormorant, Great Blue Heron , Great Egret, Sora
private pond	Double-crested Cormorant, Great Egret, Great Blue Heron
Red Lake	Cattle Egret, Black-crowned Night-Heron , White-faced Ibis, Double-crested Cormorant, Snowy Egret, Great Egret, Great Blue Heron , American Avocet , Sora
Simon/Schmidt WPA, Alkali Lk	Eared Grebe , American Avocet
Herman-Jutzy WPA	Eared Grebe , American Avocet , Marbled Godwit
Morlock GPA	Eared Grebe , American Avocet , Wilson's Phalarope
James River	Double-crested Cormorant , Great Blue Heron , Bald Eagle
private marsh	Franklin's Gull , Cattle Egret , White-Faced Ibis , Black-crowned Night-Heron , Sora , American Bittern
private pond	D-C Cormorant, Great Blue Heron , Great Egret, Red-necked Grebe , Pied-billed Grebe, Western Grebe

APPENDIX C: Active colonies which subsequently experienced total failure within the same season.

Site	Date of Failure	No. Nests Abandoned or Destroyed	Species Impacted	Cause of Failure
Sand Lake NWR Brown Co.	June '05	~ 10	Double-crested Cormorant	ground nests flooded
private Lake Day Co.	June '05	267	Double-crested Cormorant, Great Egret, Snowy Egret	abandoned because of human disturbance
Black Slough Marshall Co.	June '05	2+	Western Grebe	reedbeds flooded
Goose Lake Codington Co.	July '05	217	Black-crowned Night- heron, Little Blue Heron, Great Egret, Snowy Egret, Cattle Egret	abandoned, suspect human disturbance
Odessa #1 GPA McPherson Co.	July '05	2+	Eared Grebe	nests flooded
Sand Lake NWR Brown Co.	August '05	230-400	Snowy Egret, Cattle Egret, White-faced Ibis, Little Blue Heron, Black- crowned Night-heron	reedbeds flooded
Sand Lake NWR Brown Co.	May '06	1+	Forster's Tern, Double- crested Cormorant	marsh dried out, nests abandoned
private Lake Day Co.	June '06	405	Double-crested Cormorant, Great Blue Heron, Great Egret	abandoned because of human disturbance
Sand Lake NWR Brown Co.	July '07	~830	Franklin's Gull, Double- crested Cormorant, White- faced Ibis, Cattle Egret, Black-crowned Night- heron, Forster's Tern	reedbeds flooded

APPENDIX D. Species Accounts.

Explanation of Species maps, figures, and tables.

Maps. Maps present the location of all known colonies that were active in at least one year of the survey. Colony size is the number of breeding pairs of that species recorded during the survey. If a colony had different counts in different years, the mapped colony size is the highest count of any year.

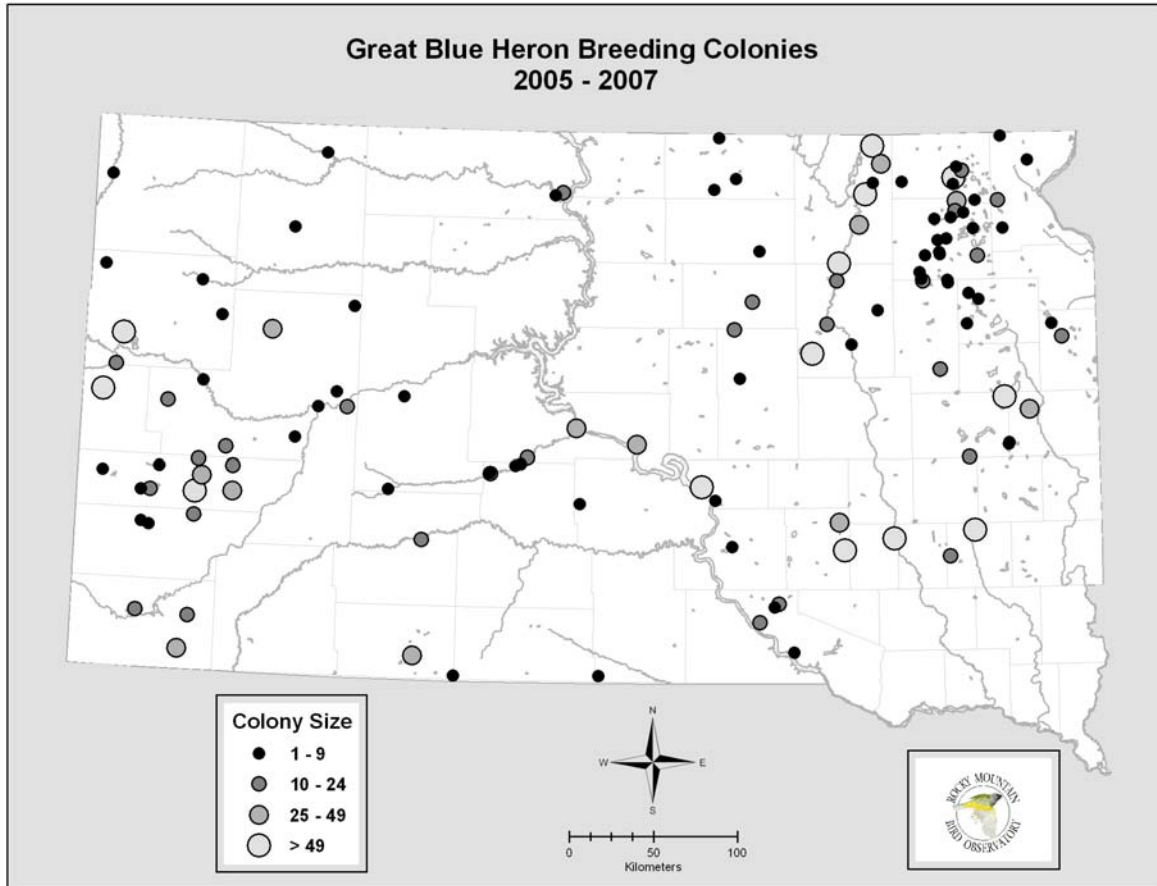
Tables. For most species, a summary table presents statistics on all known active colonies visited each year. Visited known colonies included active colonies known from previous years as well as colonies newly-discovered in that year. Usually, an apparent increase in population size between years was a result of our discovery of unknown colonies, not an actual population increase, unless otherwise noted. Colony size refers to number of confirmed breeding pairs, as measured for that species (Appendix A).

For species found in more than five locations, an additional table provides a list of counties with the highest number of known colonies of that species by year (Table B).

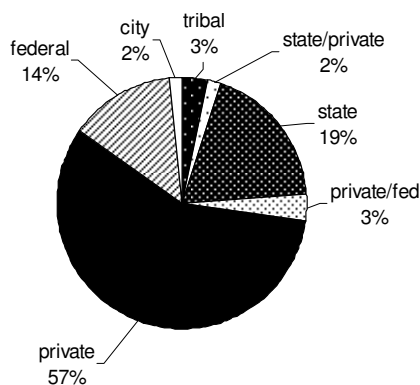
Ownership. Owners of the area where a colony was located were determined from county plat maps and from the SD Game, Fish, and Parks public lands web site (www.sdgfp.info/Wildlife/PublicLands/PubLand.htm, accessed October 2007). For this report, ownership of land where colonies were located was classified into four categories - privately owned, tribal, federal public lands (non-tribal), and state public lands. In some cases, a colony or wetland straddled two or more properties and these were classified as having two ownership categories.

GREAT BLUE HERON

This bird was the species found breeding at the most locations in the state and was the most widely distributed breeding colonial waterbird in West River. Of 78 historical colony sites that were surveyed during this project, 22 (28%) were still active and an additional 8 historical colonies (10%) were active at the beginning of this survey but were not active by the end. Slightly more than half (54%) of the historical colony sites had no evidence of heron breeding during this survey.



Colony Site Ownership



GREAT BLUE HERON	2005	2006	2007
No. of known active colonies to date	62	91	83
Number active colonies that subsequently failed	0	1	0
Number of inactive colonies	9	11	19
Number counties with active colonies	33	34	34
Total no. of known breeding pairs	905	1,691	1,335
Average colony size	16	18	16
Median colony size	9.5	8	8
Colony size range	1 - 123	1 - 151	1 - 97

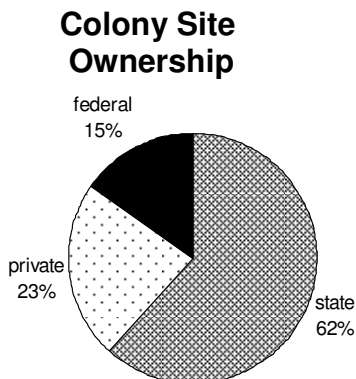
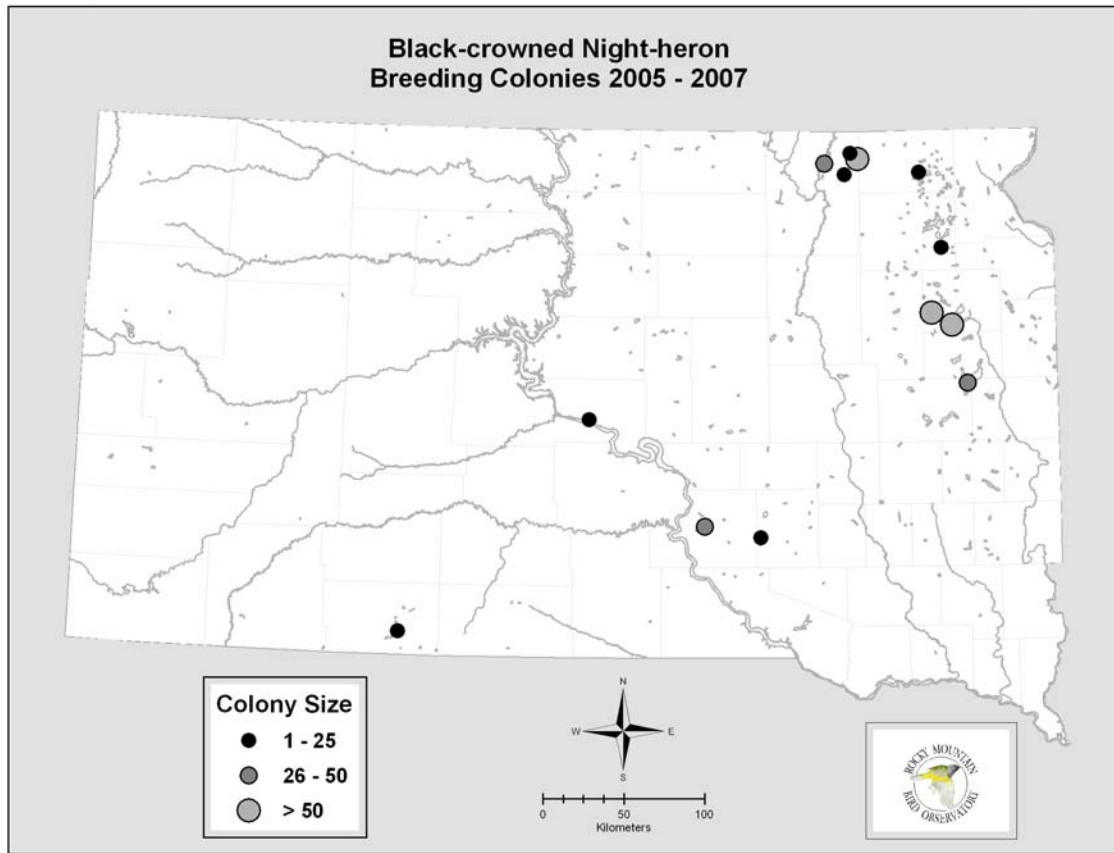
Great Blue Heron (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Brown	3	4	6	48	230	204
Spink	1	4	4	1	109	117
McCook	2	2	2	54	80	104
Pennington	5	8	8	133	126	99
Marshall	1	6	5	23	103	94
Hughes	2	2	2	61	60	75
Butte	1	2	3	124	167	74
Day	5	12	9	39	78	59
Aurora	1	2	2	31	75	59
Buffalo	2	1	1	21	42	55
Meade	3	6	3	33	88	32
Kingsbury	2	3	3	47	71	31
Davison	1	0	0	102	0	0

BLACK-CROWNED NIGHT-HERON

This species nests either in trees or reedbeds, usually with other colonial waterbirds. Twenty of the 25 historical colonies were no longer active during this survey, all but one because the habitat was no longer suitable for nesting. Of note, two of the four 2005 colonies failed, accounting for 56% of the known night-heron nests that year. In 2007, just one of 10 night-heron colonies failed, but accounted for 21% of night-heron nests known in the state.



BLACK-CROWNED NIGHT-HERON	2005	2006	2007
No. of known active colonies to date	4	7	10
Number active colonies that subsequently failed	2	0	1
Number of inactive colonies	1	0	1
Number counties with active colonies	3	5	8
Total no. of known breeding pairs	~222	~281	~226
Average colony size	55.5	40.1	25.1
Median colony size	12	15	7
Colony size range	1 - 125	1 - 104	2 - 103

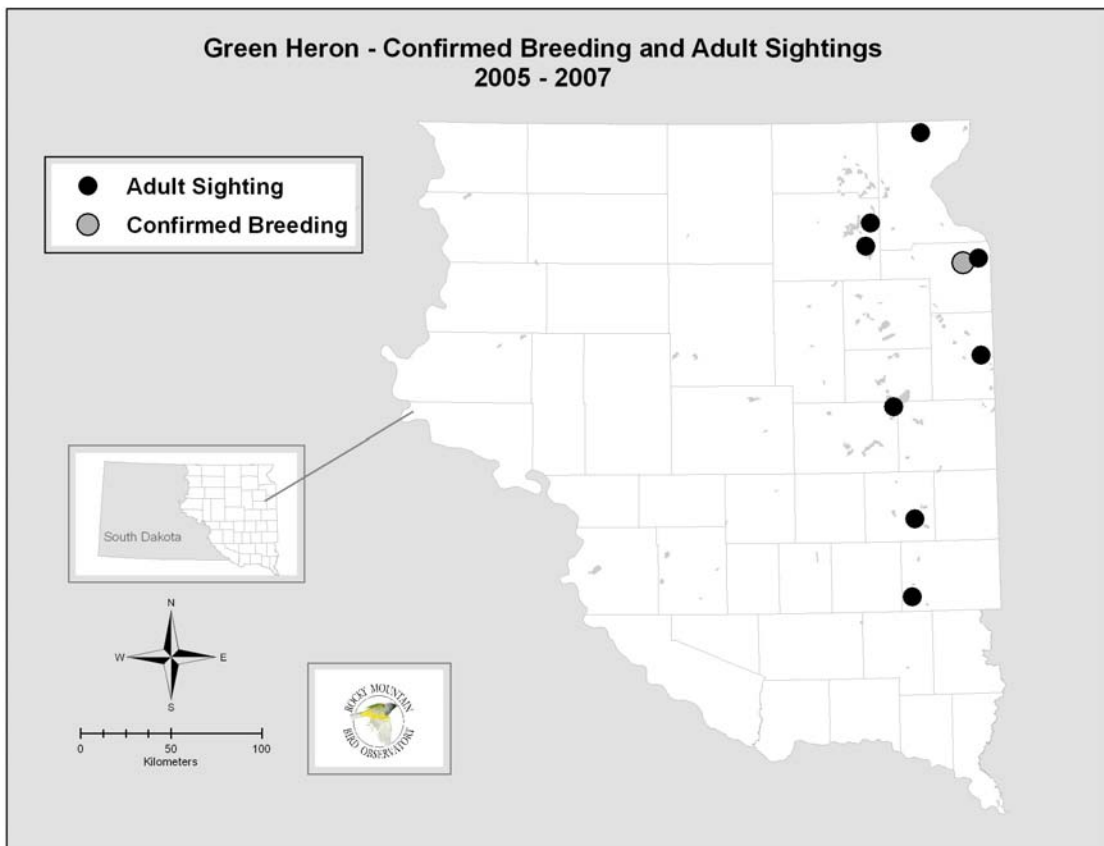
Black-crowned Night-heron (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Codington	2	2	1	218	119	4
Brown	0	2	3	0	101	161
Kingsbury	1	1	1	3	48	
Brule	0	0	1	0	0	50

GREEN HERON

Green Heron is an uncommon breeder throughout East River (Tallman *et al.* 2002); all records collected during this project were from the extreme eastern part of the state. Because Green Herons are secretive, solitary, and build their nests in dense woody vegetation, there are few confirmed historical breeding records. During this survey, no adults or nests were found at the five sites that historically had nests, even though the habitat was still suitable for breeding. One nest was found at a new site in 2006; in 2007 a second nest was built at the same location, touching the 2006 old nest.



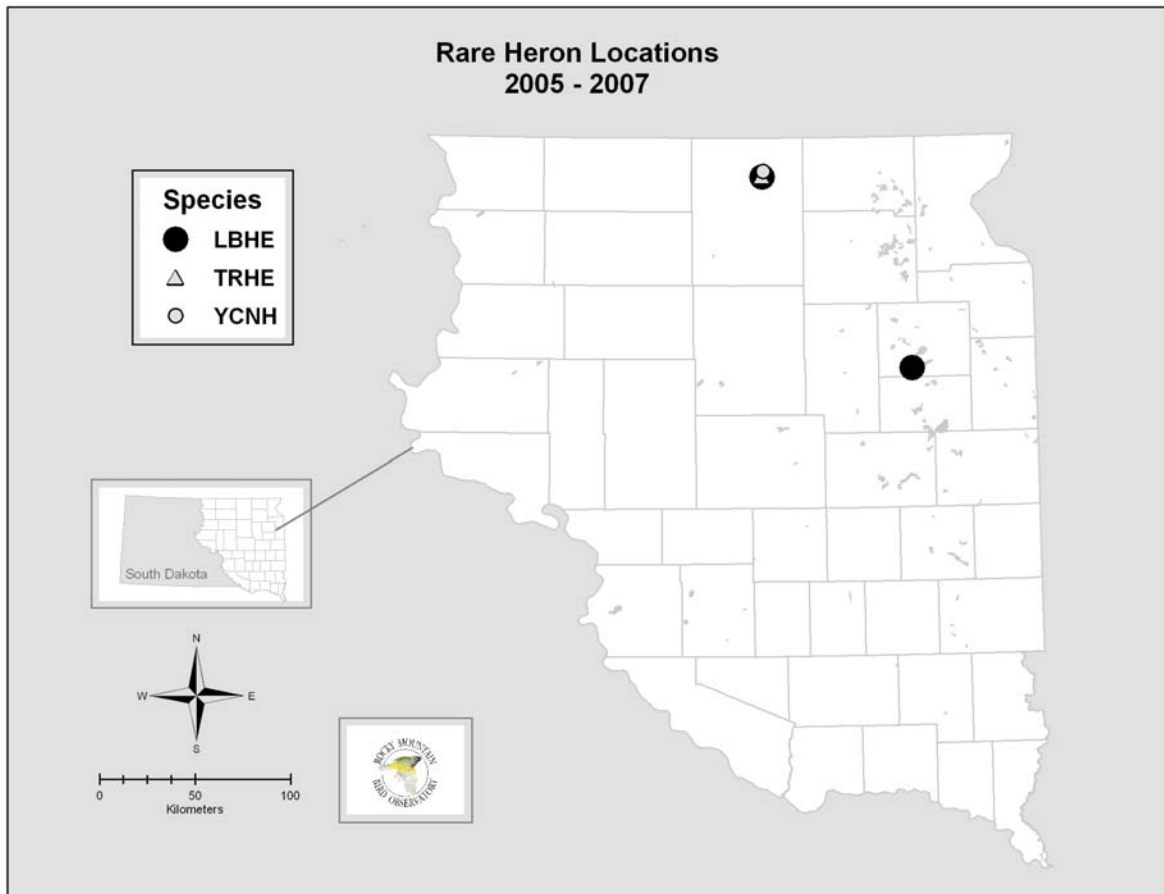
RARE HERON SPECIES

South Dakota is located northwest of the primary breeding ranges of three heron and night-heron species - Little Blue Heron (LBHE), Tricolored Heron (TRHE), and Yellow-crowned Night-heron (YCNH). All three occur infrequently in South Dakota.

Little Blue Herons first nested in the state in 1980. Historically, the species nests most frequently in Brown County with sporadic nesting elsewhere in East River. During this survey, a pair of Little Blue Herons was confirmed nesting at each of two locations in 2005 but both nests failed later in the season. No adults or nests were found in 2006 or 2007.

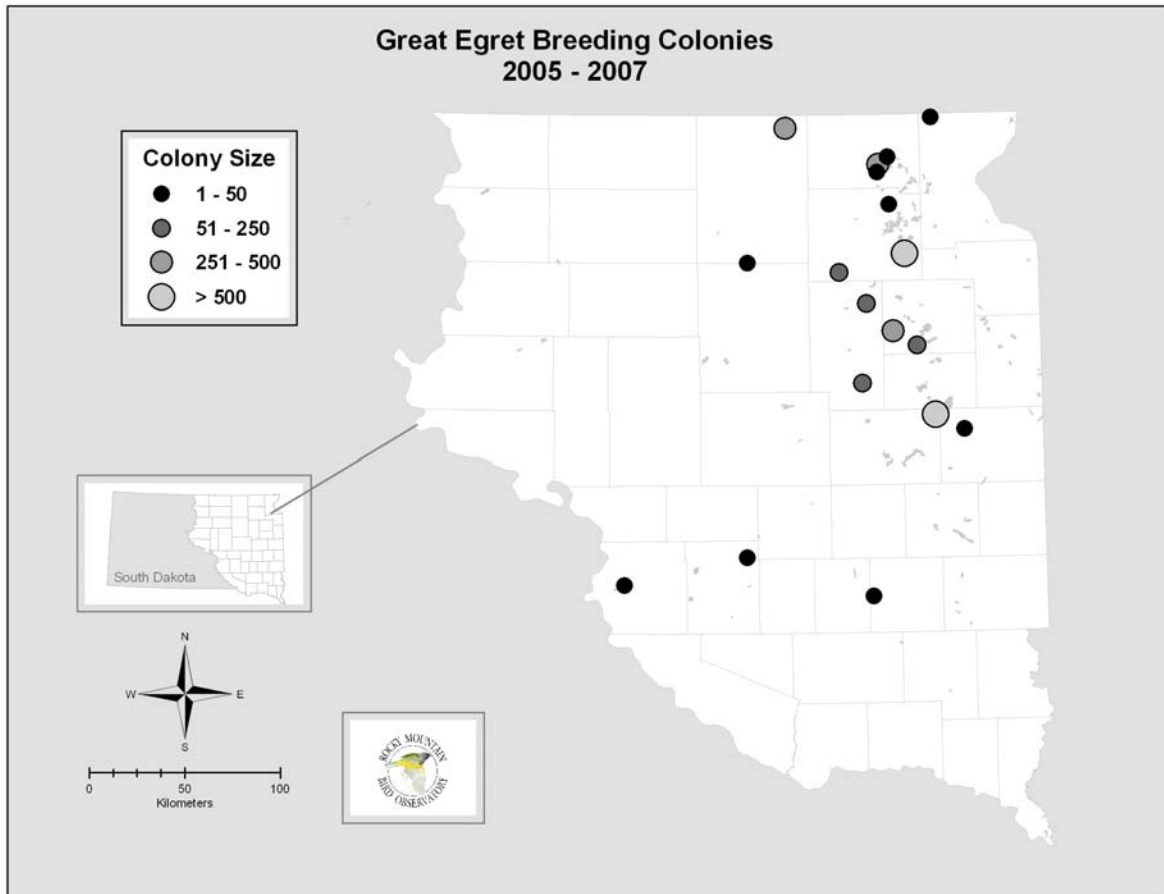
Tricolored Herons have been recorded nesting three times in the state, most recently in 2001 (Tallman *et al.* 2002). None of these sites had suitable nesting habitat during this survey. One adult was seen on one occasion in 2007 but no nest was found.

Yellow-crowned Night-herons have never been recorded nesting in South Dakota, although the species occasionally is sighted during the breeding season. During this survey, one bird was observed over a two-week period in June 2006 but no nest was found.

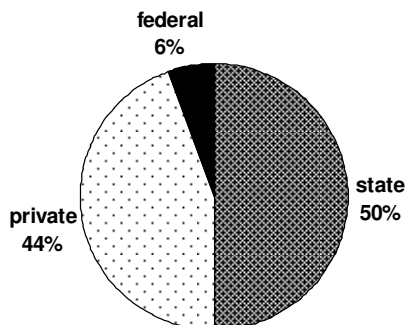


GREAT EGRET

Great Egrets first bred in South Dakota in 1978 and the species nests every year in East River tree colonies. Only three of 18 historical colonies were active during this survey. Because Great Egrets prefer to nest with Great Blue Herons and cormorants rather than the smaller egret species, the 2005 small egret colony failures had less of an impact on the state's Great Egret breeding population. Nevertheless, 2 colony failures in 2005 accounted for 7% of the known Great Egret nests, while the failed colony in 2007 accounted for 2% of the known nests in the state.



Site Ownership



GREAT EGRET	2005	2006	2007
No. of known active colonies to date	11	11	13
Number active colonies that subsequently failed	2	1	0
Number of inactive colonies	0	1	3
Number counties with active colonies	9	7	9
Total no. of known breeding pairs	1,658	2,241	1,945
Average colony size	151	204	150
Median colony size	72	51.5	60.5
Colony size range	2 - 512	1 - 715	4 - 559

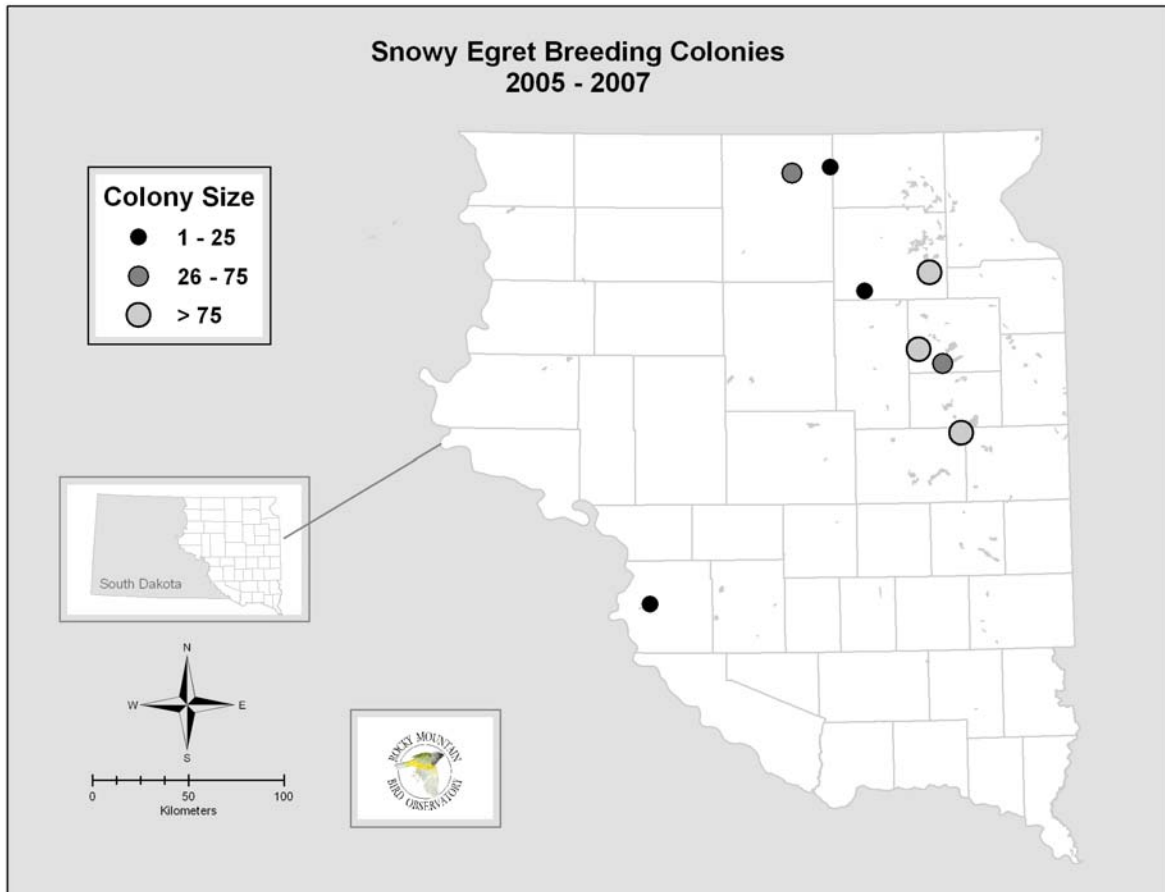
Great Egret (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

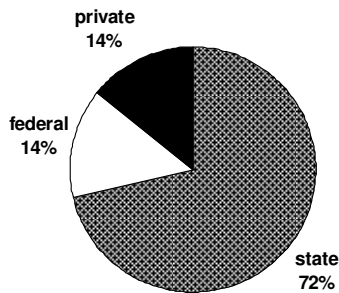
County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Kingsbury	1	1	1	512	715	559
Day	2	3	1	444	521	542
Codington	2	2	1	354	269	288
Marshall	1	1	3	175	370	199
Brown	1	1	2	72	357	232

SNOWY EGRET

Snowy Egrets first nested in South Dakota in the early 1980's. Most of the historical colony locations were flooded out during the late 1990's and only one of the active colonies during this survey was also active historically. In 2005, half of the known colonies with nesting Snowy Egrets failed, accounting for 9% of all nests in that year.



Colony Site Ownership



SNOWY EGRET	2005	2006	2007
No. of known active colonies to date	6	3	5
Number active colonies that subsequently failed	3	0	0
Number of inactive colonies	1	0	1
Number counties with active colonies	4	2	5
Total no. of known breeding pairs	510	158	395
Average colony size	85	53	79
Median colony size	9	58	31
Colony size range	4 - 304	32 - 68	15 - 266

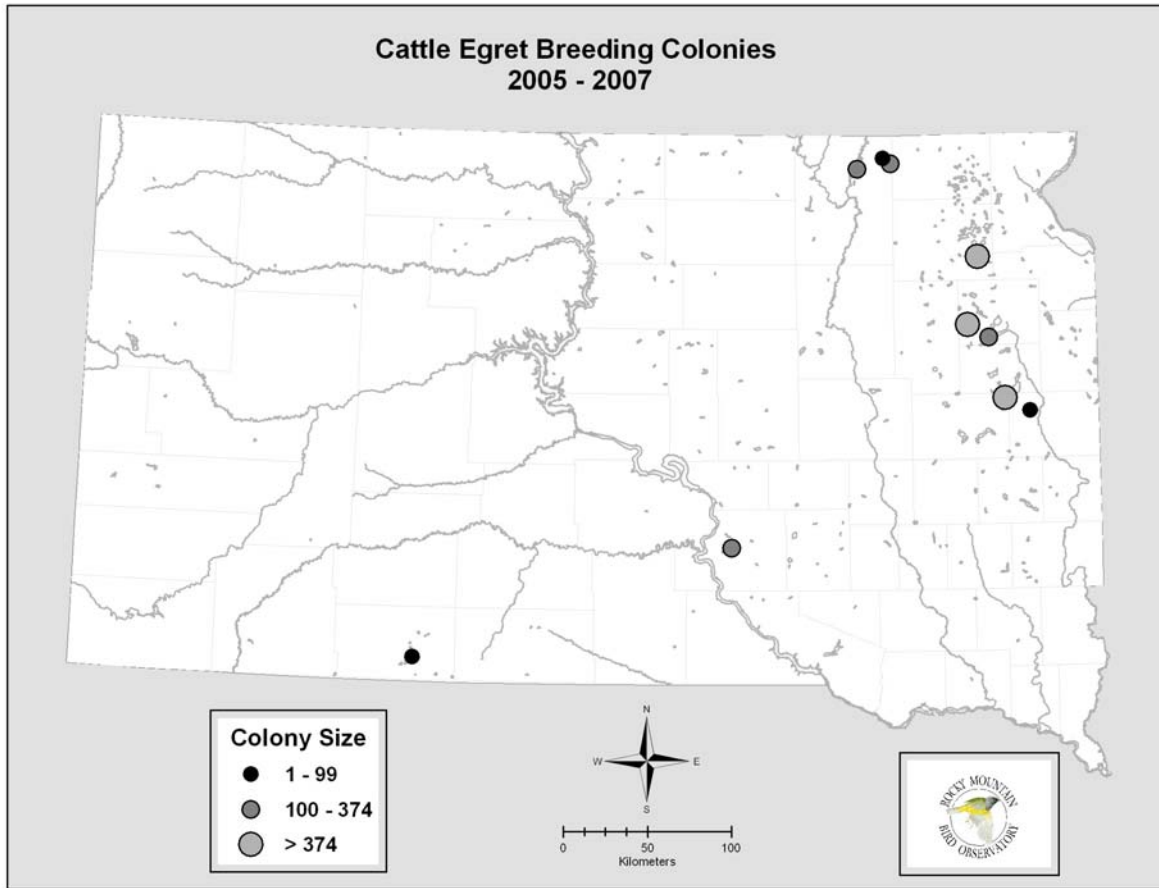
Snowy Egret (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

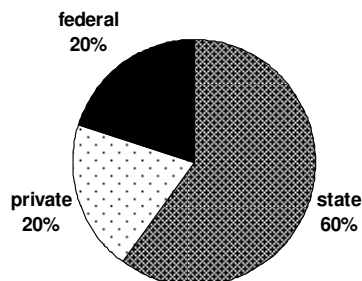
County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Codington	2	2	1	148	100	65
Kingsbury	1	1	1	304	58	31
Day	2	0	1	18	0	266

CATTLE EGRET

First recorded nesting in South Dakota in 1977, Cattle Egrets typically nest in a relatively small number of mixed-species colonies (Peterson 1995, Tallman *et al.* 2002), either in dense shrubby thickets or in reedbeds. Of nine historical colonies surveyed during this project, three were still active. In 2005, two of five known colonies failed, accounting for 38% of known Cattle Egret nests. In 2007, one colony failure resulted in the loss of 10% of known nests.



Colony Site Ownership



CATTLE EGRET	2005	2006	2007
No. of known active colonies to date	5	5	9
Number active colonies that subsequently failed	2	0	1
Number of inactive colonies	1	0	1
Number counties with active colonies	4	4	7
Total no. of known breeding pairs	~1,338	~783	~987
Average colony size	268	157	110
Median colony size	351	125	49
Colony size range	46 - 406	26 - 367	7 - 468

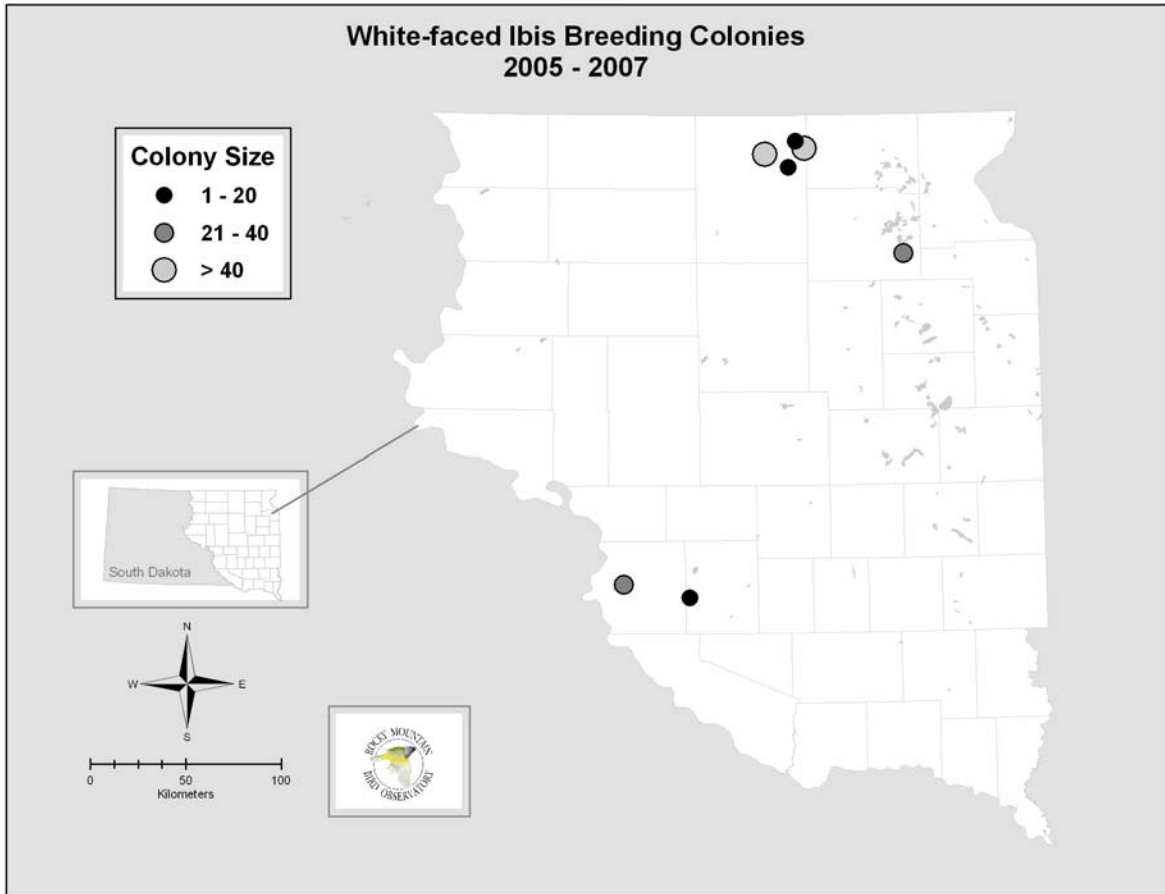
Cattle Egret (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

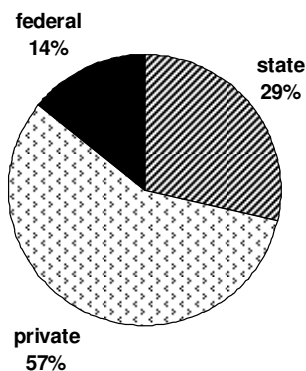
County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Codington	2	2	1	726	265	49
Kingsbury	1	1	1	406	367	38
Brown	1	1	3	160	125	170
Day	1	1	1	46	26	468
Brule	0	0	1	0	0	225

WHITE-FACED IBIS

White-faced Ibis, first recorded breeding in South Dakota in 1978, nest in reedbeds in large marshes throughout East River. Reedbeds at eight of nine historical colony sites no longer existed at the beginning of this survey; one of these sites received enough moisture to again host breeding ibis in 2007. Within-season colony failures resulted in the loss of 55% of known White-faced Ibis nests in 2005, 30% of known nests in 2006, and 29% of known nests in 2007.



Colony Site Ownership



WHITE-FACED IBIS	2005	2006	2007
No. of known active colonies to date	2	2	5
Number active colonies that subsequently failed	1	1	1
Number counties with active colonies	2	1	3
Total no. of known breeding pairs	~55	~53	~162
Average colony size	27.5	26.5	54
Median colony size	27.5	26.5	37.5
Colony size range	25 - 30	16 - 37	15 - 47

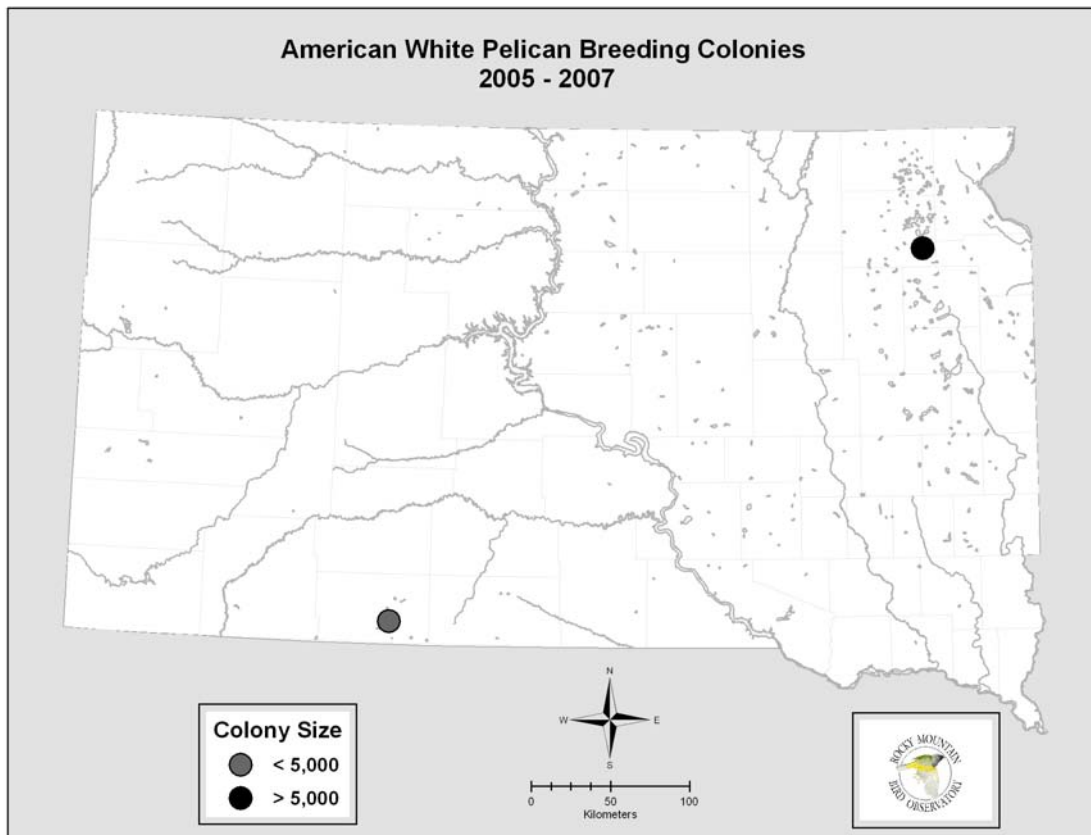
White-faced Ibis (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Brown	1	2	3	30	51	107
Brule	0	0	1	0	0	38
Day	1	0	0	25	0	0

AMERICAN WHITE PELICAN

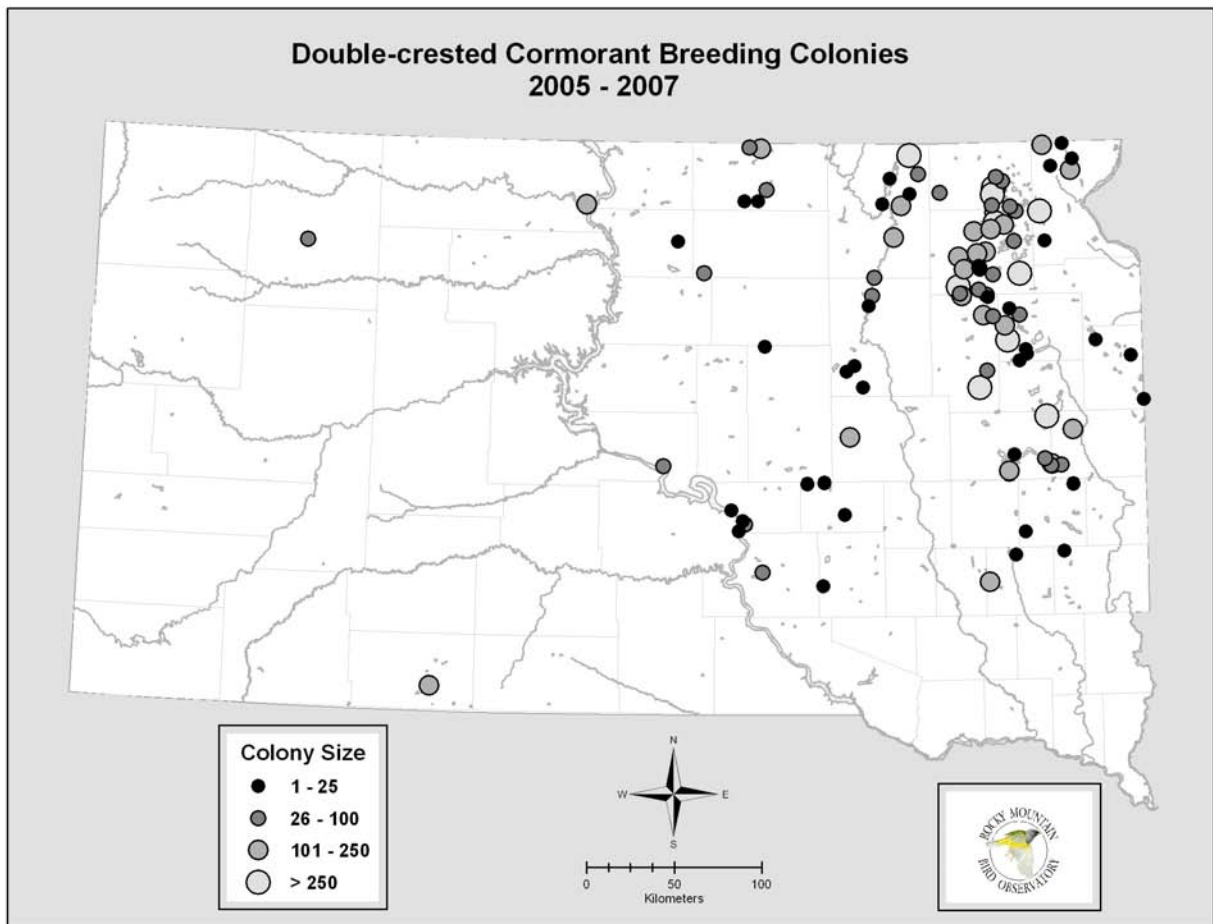
American White Pelican was the most abundant nesting waterbird species counted during this study but it occurs at only two locations. Lacreek NWR has been the most reliable breeding location since the 1949 reestablishment of pelican nesting in the state (Adolphson and Adolphson 1968, Lacreek NWR database). Although pelicans were confirmed nesting at Bitter Lake in the mid-1980s (Skadsen 1987), the colony did not become well-established until the late 1990s when high waters created suitable islands (Tallman *et al.* 2002). This colony currently is one of the largest in the U.S. (M. Assenmacher *pers. comm.*). Pelicans have nested sporadically on various lakes in northeastern South Dakota (Adolphson and Adolphson 1968, Skadsen 1987, Sloan 1982), but islands at these sites are currently under water. A doubling of the breeding population during this survey appears to be a real increase and possibly is a result of pelican colony failures in North Dakota (M. Assenmacher *pers. comm.*).



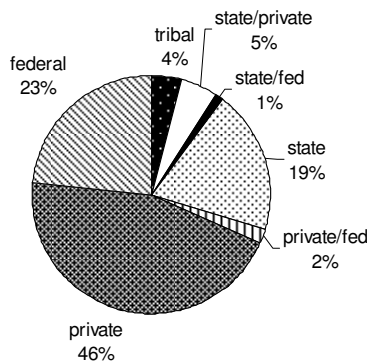
AMERICAN WHITE PELICAN	2005	2006	2007
No. of known active colonies	2	2	2
Number counties with active colonies	2	2	2
Total no. of known breeding pairs	~8,760	~17,137	~15,213
Average & median colony size	4,380	8,689	7,607
Colony size range	800 - 7,960	2,375 - 14,762	500 - 14,713

DOUBLE-CRESTED CORMORANT

Cormorants have nested in South Dakota continuously for at least 130 years and the state hosted the largest and highest number of colonies in the United States in the 1920s (summarized in Lundquist 1949, Adolphson and Adolphson 1968, Wires *et al.* 2001). Four of nine 1949 colonies and 21 of 36 Breeding Bird Atlas (1988-1992) (Peterson 1994) colonies were still active during the current survey. South Dakota cormorant colonies are relatively small compared to those in the Great Lakes and Canada, which can number in the tens of thousands (Wires *et al.* 2001).



Colony Site Ownership



D-C CORMORANT	2005	2006	2007
No. of known active colonies to date	49	73	83
Number active colonies that subsequently failed	2	2	1
Number of inactive colonies	10	5	7
Number counties with active colonies	19	24	24
Total no. of known breeding pairs	~5,060	~9,094	~8,547
Average colony size	103.3	125	103
Median colony size	61	56	38.5
Colony size range	2 - 500	1 - 941	1 - 1762

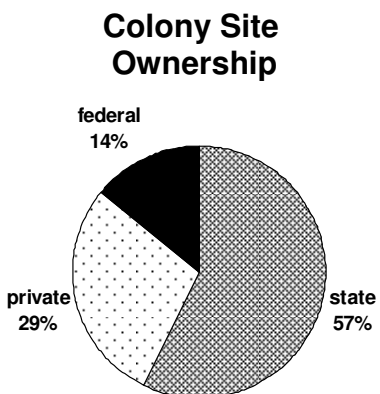
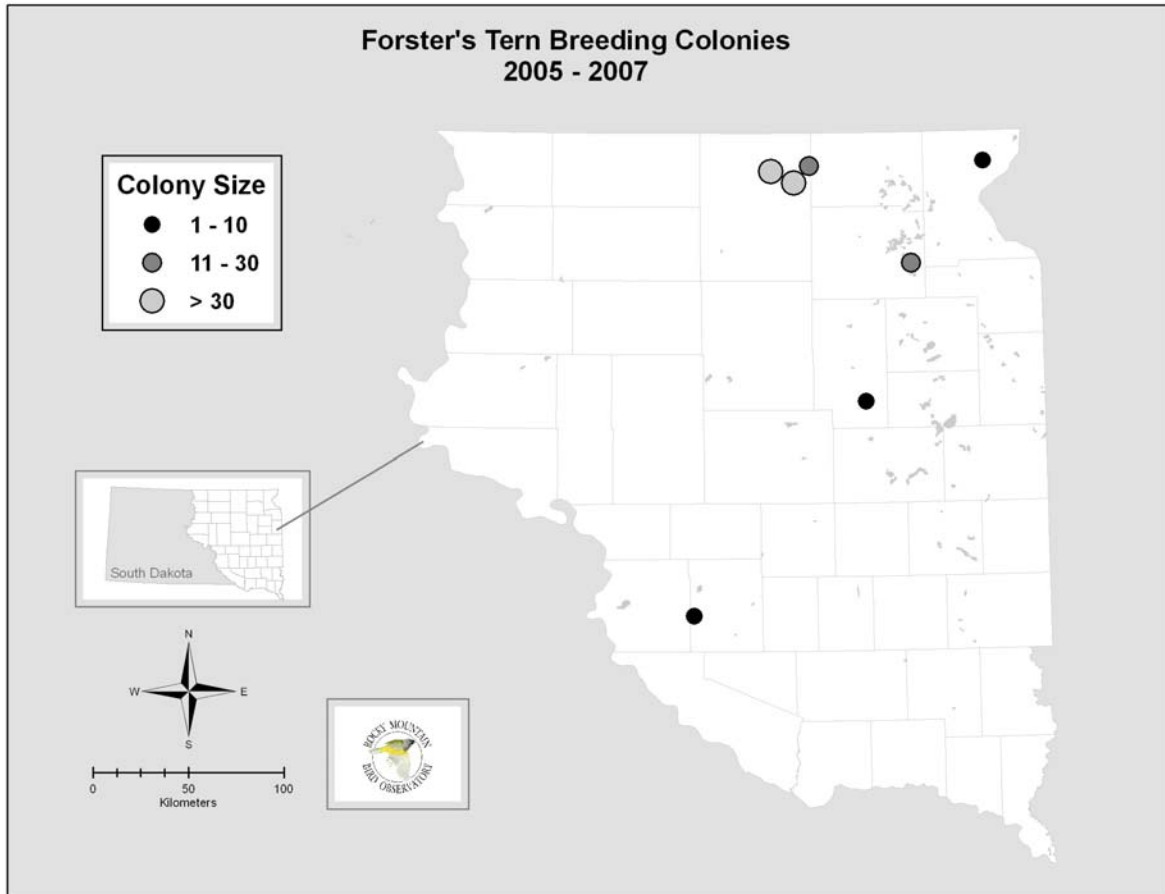
Double-crested Cormorant (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Day	12	15	16	2,178	3,068	3,512
Marshall	4	8	7	463	1,084	948
Brown	3	7	7	207	1,036	698
Clark	3	6	7	316	934	690
Roberts	1	3	6	129	209	514
Codington	5	5	5	495	525	476
Brookings	3	3	3	328	420	413
Kingsbury	3	4	5	282	896	407

FORSTER'S TERN

Forster's Tern is not of conservation concern at either the state or regional level (Beyersbergen *et al.* 2004), but few breeding colonies have been found (Harris 1970, 1982, Peterson 1995, Tallman *et al.* 2002, this study). This likely is because of the difficulty of finding nests in dense marsh vegetation and generally small colony size (McNicholl *et al.* 2001). Three of five historical colonies were still active during this survey, all at large permanent marshes.



FORSTER'S TERN	2005	2006	2007
No. of known active colonies to date	3	4	6
Number active colonies that subsequently failed	0	1	1?
Number counties with active colonies	3	3	4
Total no. of known breeding pairs	~45	~101	~105
Average colony size	15	25	17.5
Median colony size	6	13.5	12
Colony size range	3 - 36	1 - 73	2 - 43

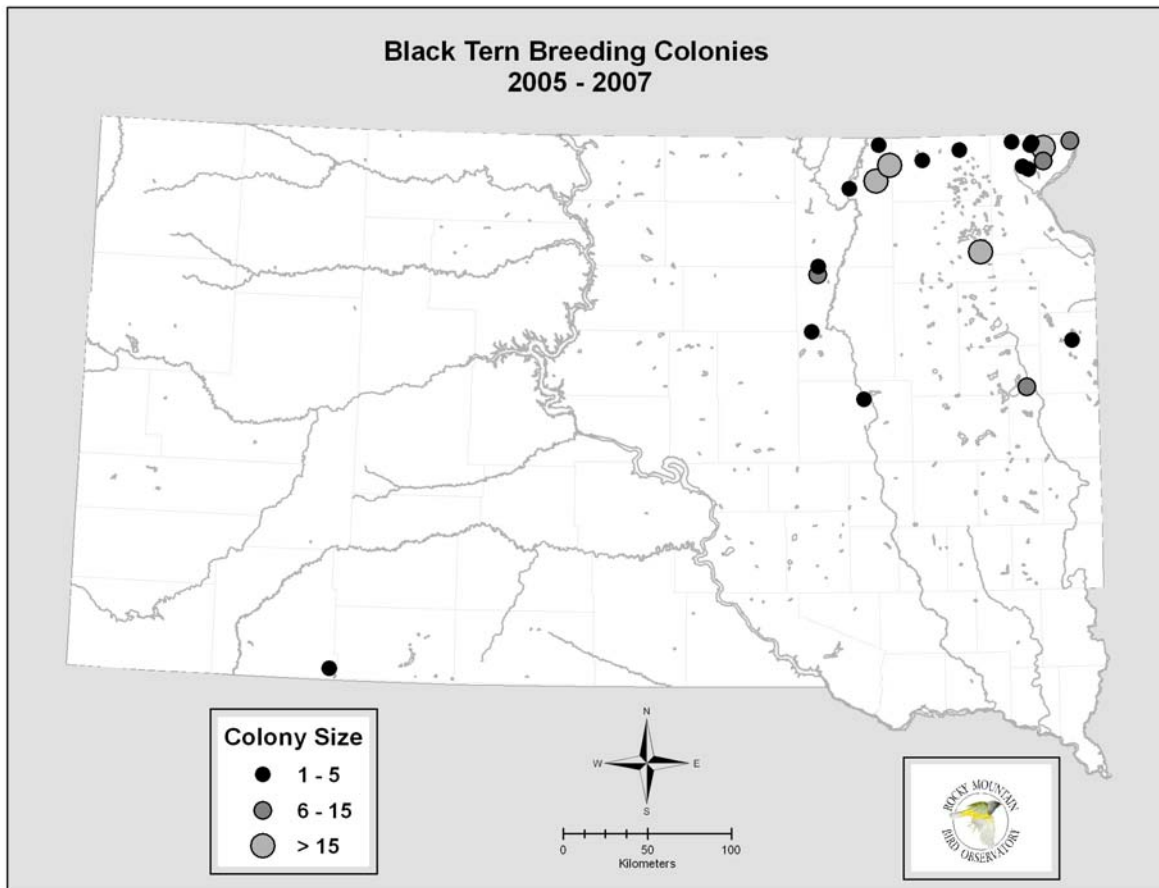
Forster's Tern (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

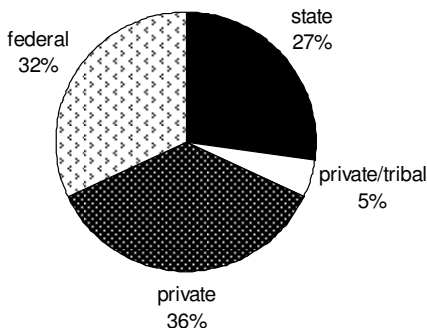
County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Brown	2	2	3	36	8	85
Day	1	1	1	0	20	8

BLACK TERN

Black Tern, a species of Conservation Concern throughout its range, nests in large marshes with regenerating or degenerating vegetation (Naugle *et al.* 2000). Because they forage up to 4 km from their nests, Black Tern nesting marshes are located within a landscape of high wetland density, especially semipermanent wetlands (Naugle *et al.* 1999). During this survey, only the northeast part of the state, and the Sandhills region to a lesser extent, satisfied these criteria. Just two of 31 historical colony sites were active during this survey.



Colony Site Ownership



BLACK TERN	2005	2006	2007
No. of known active colonies to date	8	6	14
Number active colonies that subsequently failed	0	0	0
Number counties with active colonies	6	4	6
Total no. of known breeding pairs	~122	~73	~54
Average colony size	15.5	12	4
Median colony size	14	7.5	2.5
Colony size range	1 - 31	1 - 28	1 - 20

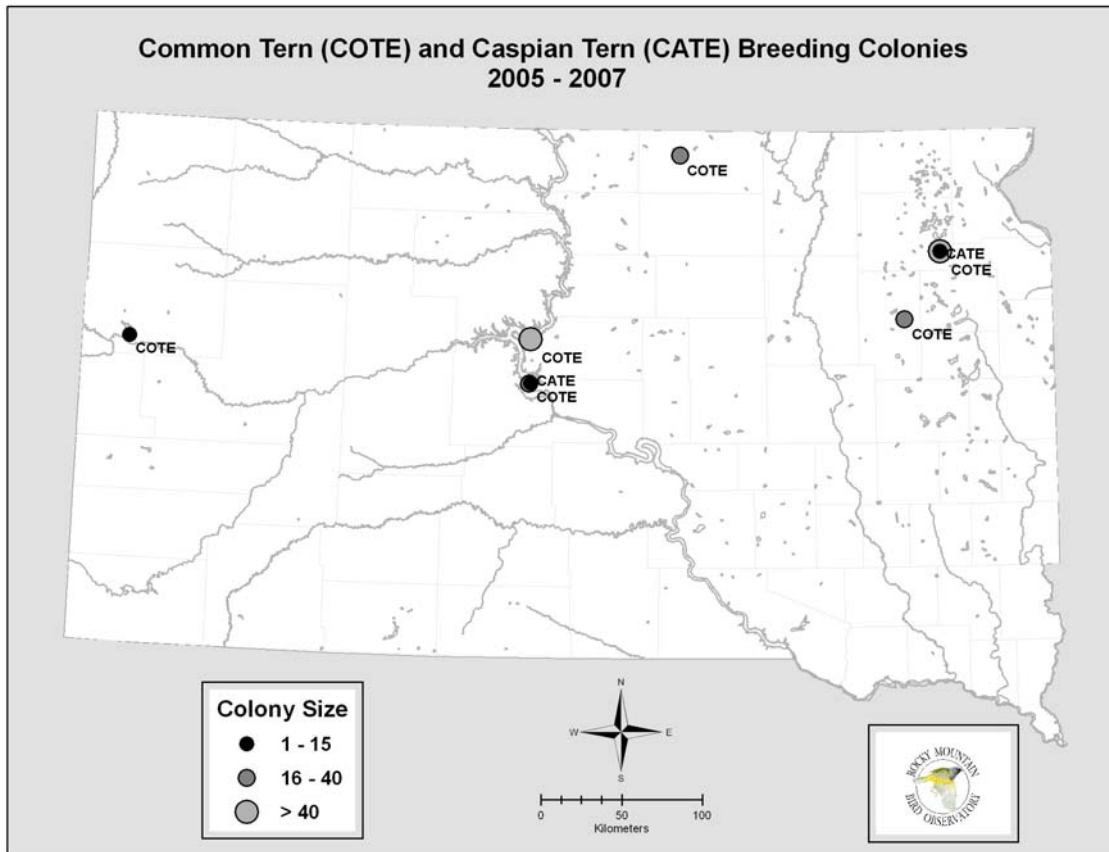
Black Tern (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Roberts	3	3	7	45	40	38
Day	1	0	0	31	0	0
Hamlin	1	1	0	15	4	0
Brown	2	1	2	1	28	2

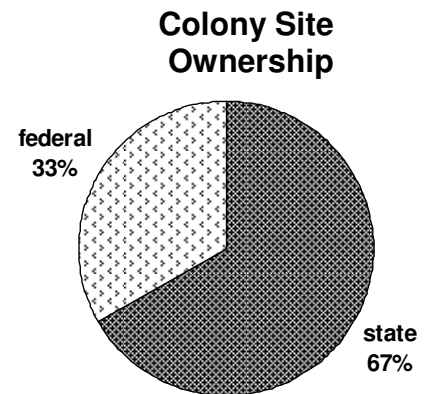
COMMON TERN and CASPIAN TERN

These two ground-nesting species breed on small sandy islands with little vegetation. Only one of seven historical Common Tern colonies were still active during this survey; breeding islands no longer existed at the other six sites. Caspian Terns, whose normal breeding range is in Canada, first bred in the state in 1997 (Harris and Betts 1998). That colony still is active and this survey discovered another breeding colony.



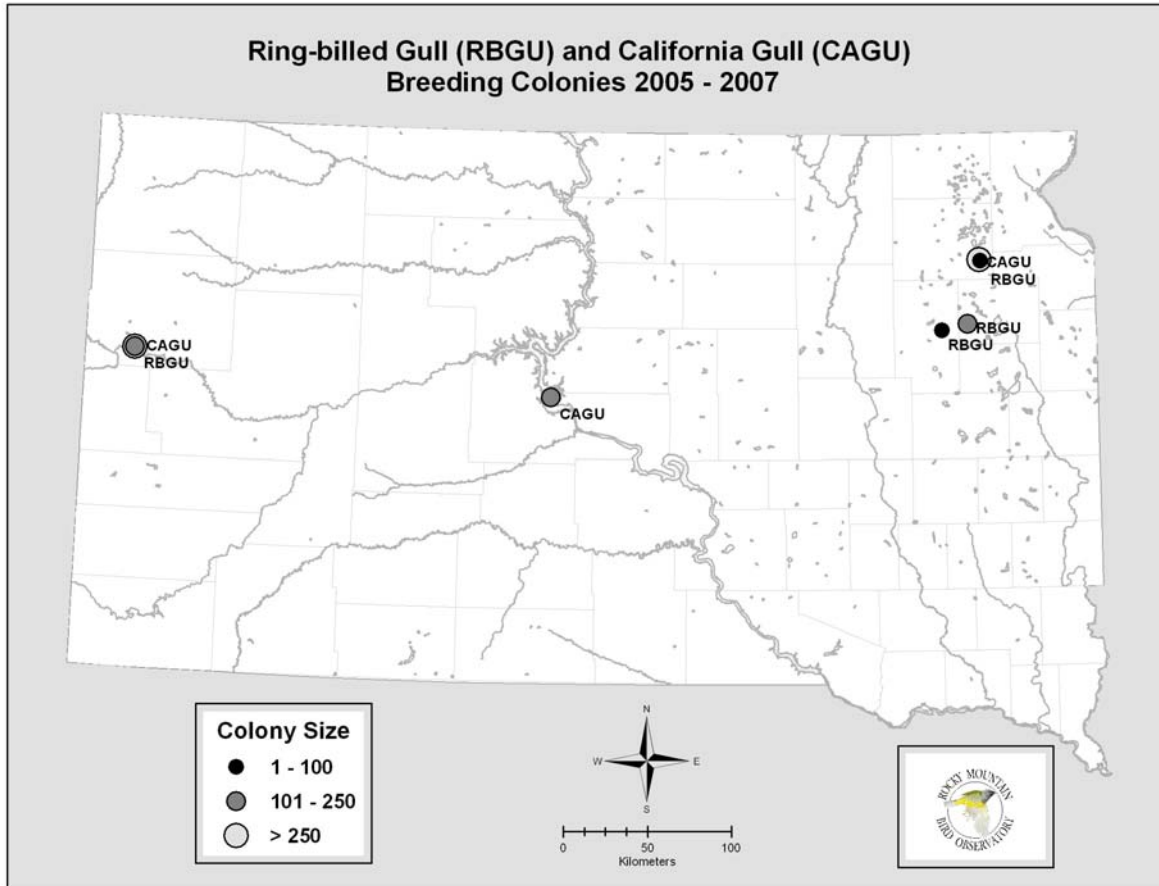
COMMON TERN	2005	2006	2007
No. of known active colonies to date	2	4	4
Number counties with active colonies	2	4	4
Total no. of known breeding pairs	~41	~77	~91
Average colony size	20.5	19	23
Median colony size	20.5	13.5	18
Colony size range	15 - 26	10- 40	5 - 50

CASPIAN TERN	2005	2006	2007
No. of known active colonies to date	0	2	2
Number counties with active colonies	---	2	2
Total no. of known breeding pairs	0	~16	~22
Average and median colony size	---	8	11
Colony size range	---	3 - 13	5 - 17



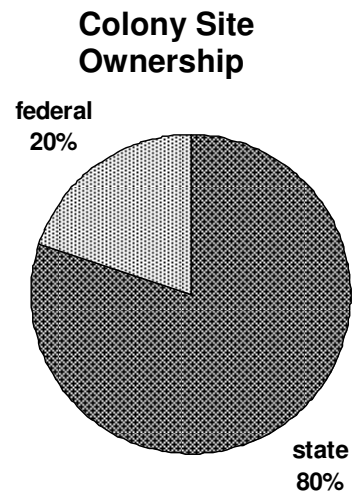
RING-BILLED GULL and CALIFORNIA GULL

In South Dakota, these two species are extremely local breeders and shift breeding sites as suitable sparsely-vegetated islands become inundated or exposed (Harris 1970, 1982, Skadsen 1987, Harris and Betts 1998). For each species, only one of four historical sites were active during this survey because the islands of the other sites no longer existed.



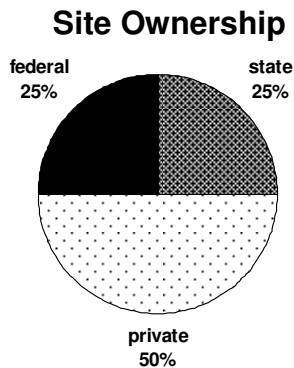
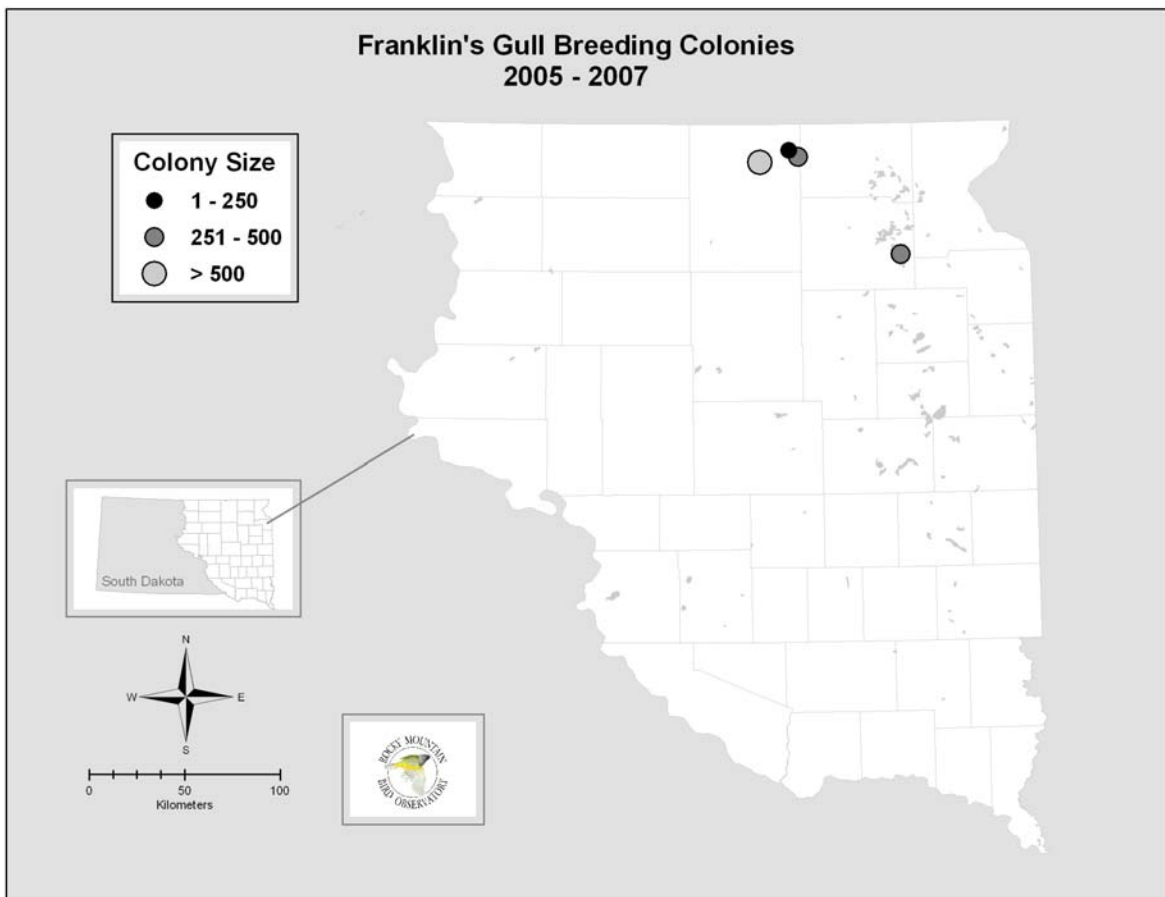
RING-BILLED GULL	2005	2006	2007
No. of known active colonies to date	3	1	3
Number counties with active colonies	3	1	3
Total no. of known breeding pairs	~2,070	~2,850	~4,757
Average colony size	856	---	1,586
Median colony size	200	---	180
Colony size range	120 - 2,250	---	27 - 4,550

CALIFORNIA GULL	2005	2006	2007
No. of known active colonies to date	2	2	3
Number counties with active colonies	2	2	3
Total no. of known breeding pairs	~70	~481	~310
Average colony size	35	241	103
Median colony size	35	241	120
Colony size range	20 - 50	160 - 321	30 - 160



FRANKLIN'S GULL

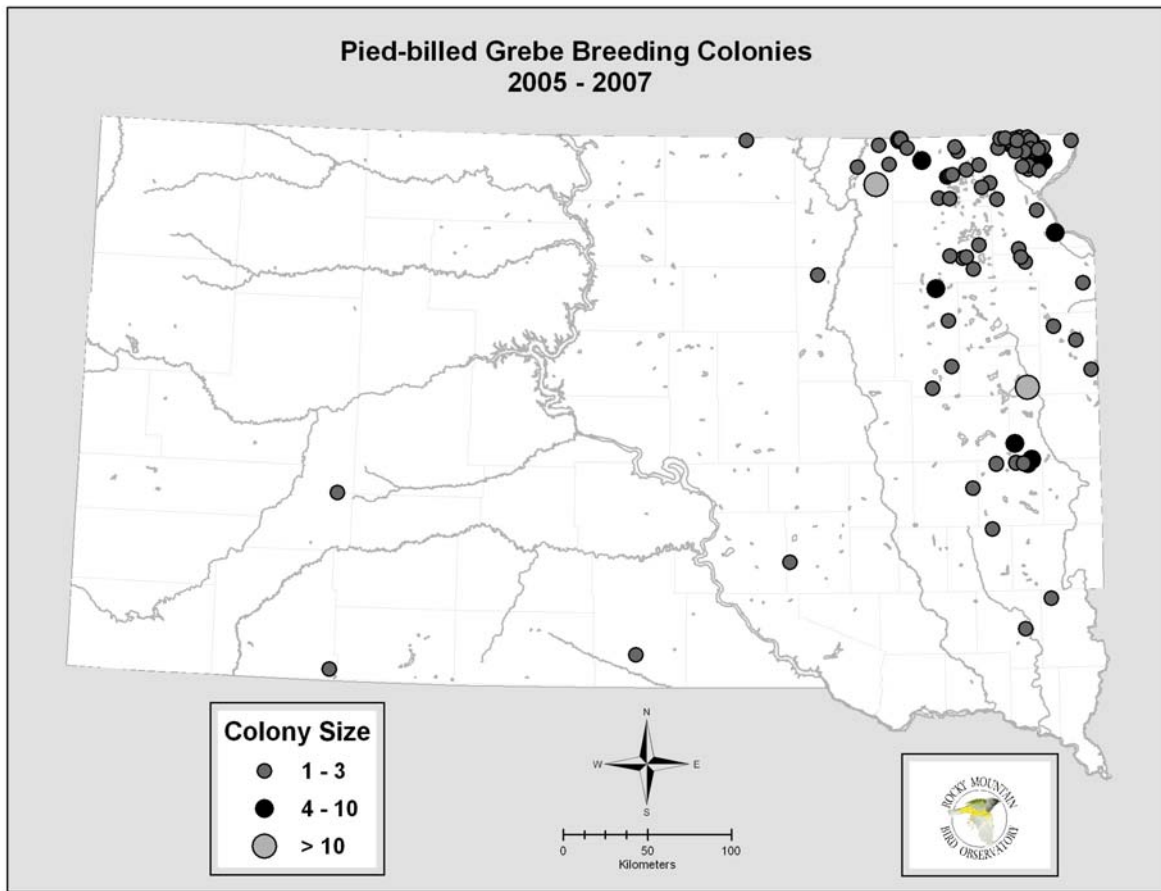
Of the three marsh-nesting *Laridae* species, Franklin's Gull is the most conspicuous but most localized breeder (Burger and Gochfeld 1994, Tallman *et al.* 2002). Colony size can be very large (over 125,000 nests at one SD colony in 1995, Schultze 1996) but varies dramatically, depending on water levels. In the first two years of this survey, none of the three historical colonies were active because there was little marsh vegetation. In 2007, conditions improved at one historical site which then hosted nesting birds. Mid-summer rains flooded one colony in 2007, accounting for 56% of the known state breeding population, but some nests may already have successfully fledged young.



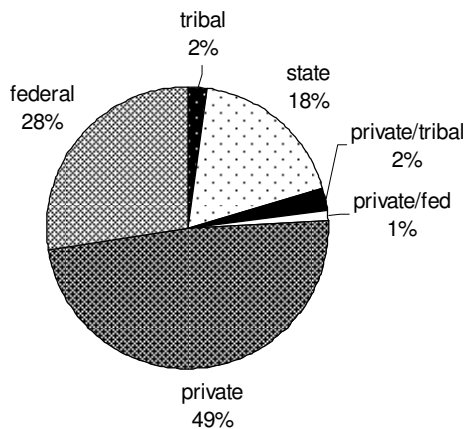
FRANKLIN'S GULL	2005	2006	2007
No. of known active colonies to date	1	2	4
Number active colonies that subsequently failed	0	0	1?
Number counties with active colonies	1	2	2
Total no. of known breeding pairs	~250	~395	~1,350
Average colony size	---	195	337.5
Median colony size	---	195	287.5
Colony size range	---	90 - 450	75 - 700

PIED-BILLED GREBE

Pied-billed Grebe is a common breeding bird in marshes throughout the state, although less so West River (Tallman *et al.* 2002). This species is not colonial but relatively high numbers of pairs may breed in the state's largest marshes. Only seven of 34 historical Pied-billed Grebe breeding sites were active during this survey.



Colony Site Ownership



PIED-BILLED GREBE	2005	2006	2007
No. of known active colonies to date	10	41	53
Number counties with active colonies	8	12	17
Total no. of known breeding pairs	23	86	117
Average colony size	2	2	2.2
Median colony size	1	1	1
Colony size range	1 - 8	1 - 13	1 - 15

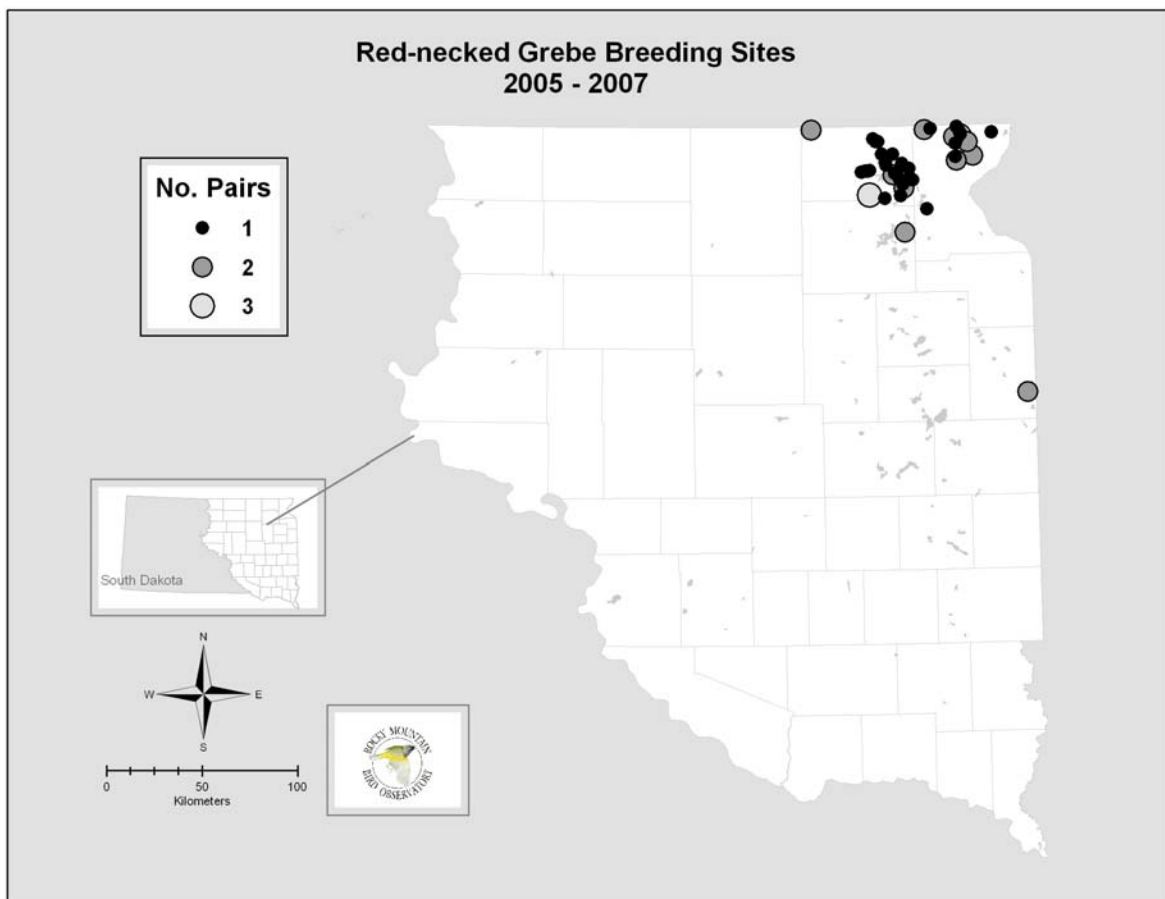
Pied-billed Grebe (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

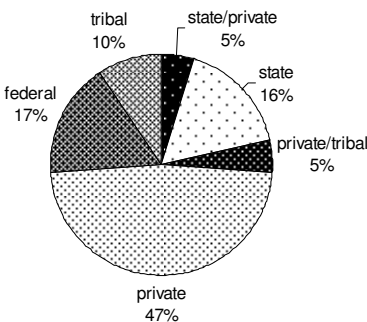
County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Roberts	3	22	16	10	32	26
Marshall	0	6	12	0	12	18
Hamlin	1	1	1	4	13	15
Brown	0	2	3	0	11	18

RED-NECKED GREBE

The southeastern edge of the breeding range of Red-necked Grebe just reaches into northeast South Dakota (Stout and Nuechterlein 1999). Historically, nesting has been documented as far south as Brookings Co. and as far west as McPherson Co. (Tallman *et al.* 2002). However in this study, all but two of 42 confirmed breeding sites were located in the extreme northeastern counties of Marshall and Roberts. Normally, this species is non-colonial but these birds will nest in colonies under certain conditions (Stout and Nuechterlein 1999). During this study, up to six Red-necked Grebe pairs were observed per wetland, but the maximum number of confirmed successful breeding pairs at a site was three.



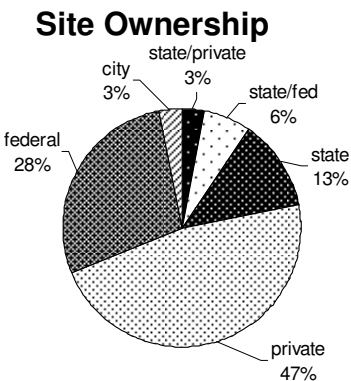
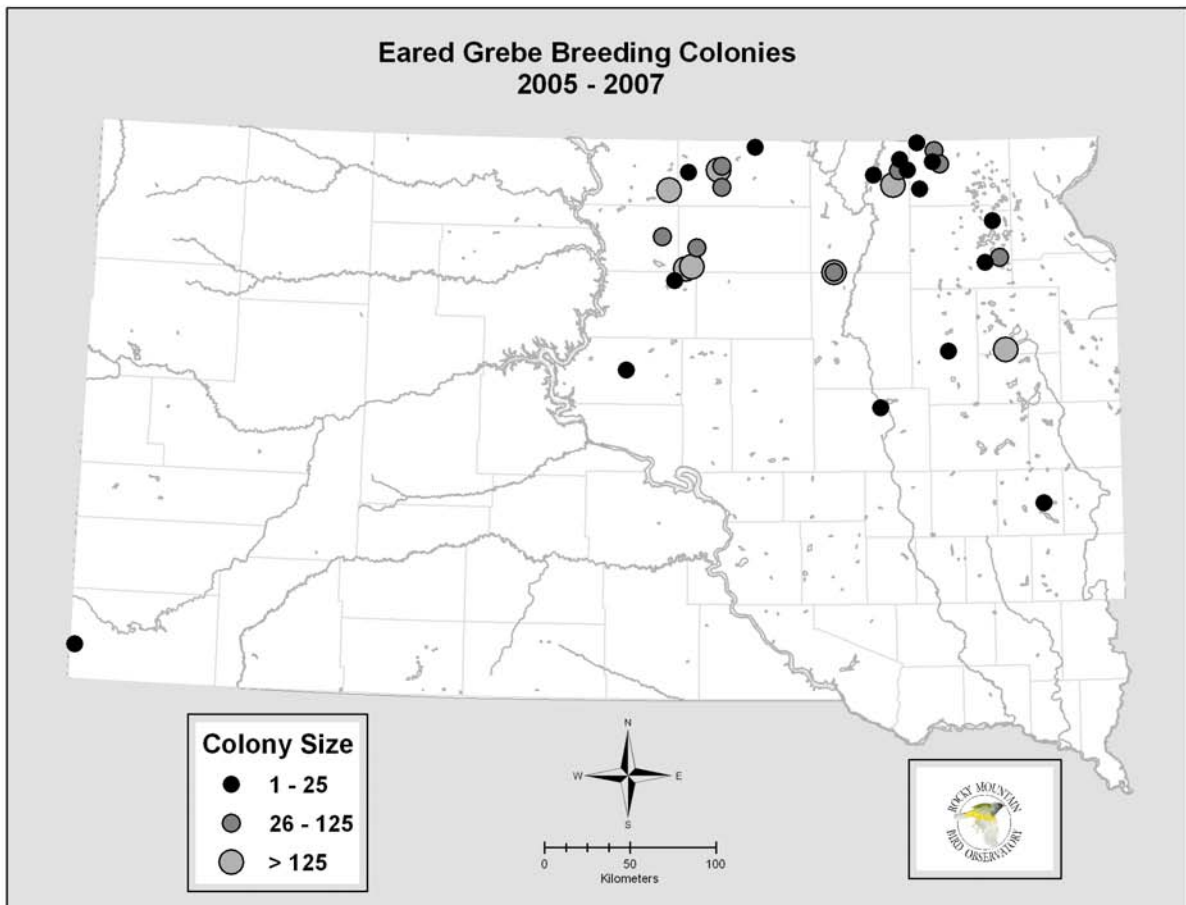
Colony Site Ownership



RED-NECKED GREBE	2005	2006	2007
No. of known active colonies to date	9	21	31
Number counties with active colonies	3	4	3
Total no. of known breeding pairs	11	26	42
Average colony size	1.2	1.2	1.4
Median colony size	1	1	1
Colony size range	1 - 2	1 - 2	1 - 3

EARED GREBE

Most historical records of Eared Grebe breeding colonies are from East River, primarily in the Prairie Coteau, Prairie Pothole, and Lakes regions but also as far south as Lake Andes. During periods of high water levels, this species also breeds throughout West River on impoundments. During this survey, drought throughout West River and the southwest section of East River limited the breeding distribution. Breeding site fidelity generally is low in most grebe species, presumably because their overwater nests are so near the waterline and frequently flood (Beyersbergen *et al.* 2004). Eared Grebes followed this pattern during this survey; just four of 29 Eared Grebe breeding sites listed in the historical database hosted colonies.



EARED GREBE	2005	2006	2007
No. of known active colonies to date	7	16	22
Number active colonies that subsequently failed	1	0	0
Number counties with active colonies	6	8	11
Total no. of known breeding pairs	283	1,581	476
Average colony size	40	99	22
Median colony size	26	44	5
Colony size range	1 - 137	4 - 199	1 - 174

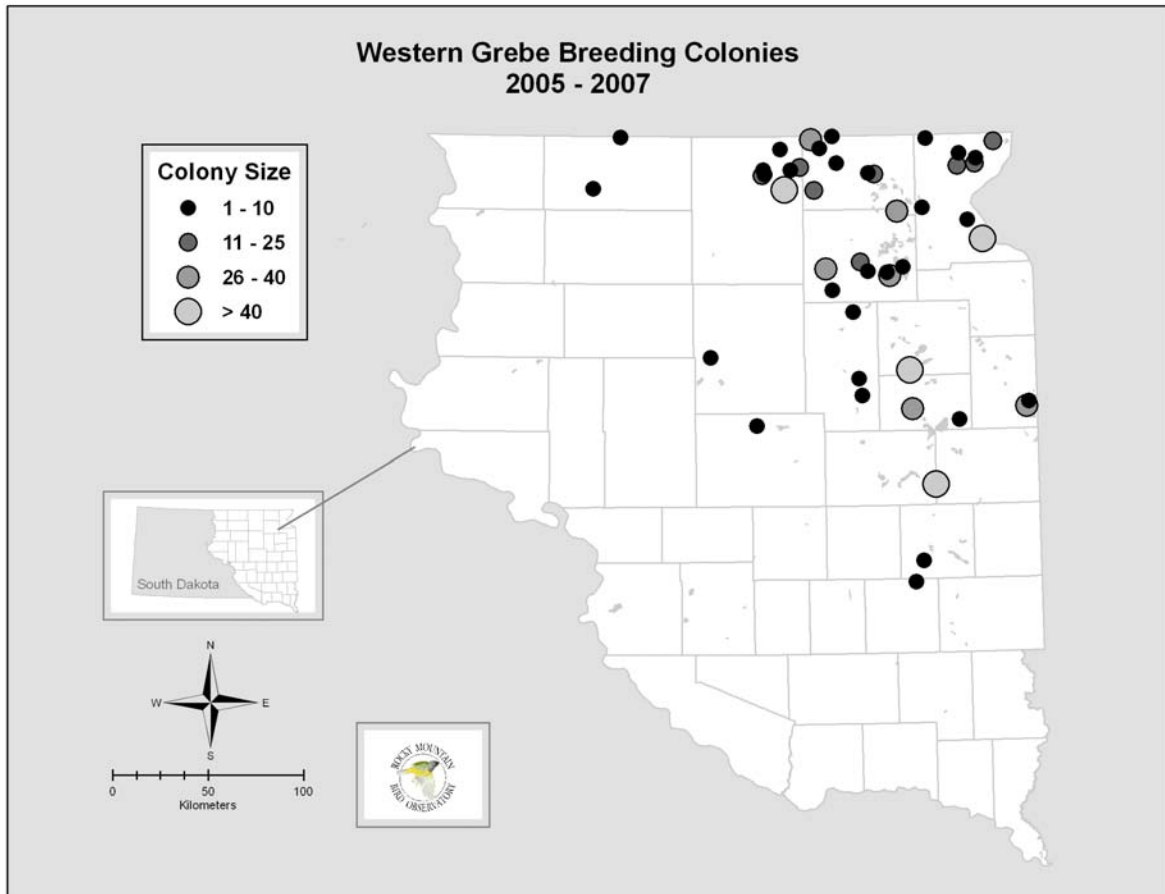
Eared Grebe (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

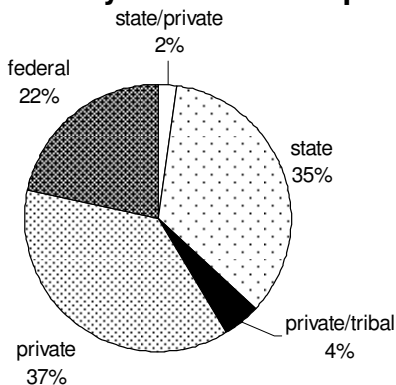
County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Edmunds	2	2	1	106	588	13
McPherson	1	4	4	2	336	90
Brown	0	3	5	0	229	207
Marshall	0	2	4	0	136	80
Codington	1	1	0	137	15	0
Campbell	0	1	1	0	164	1
Day	1	2	2	31	66	10
Spink	0	0	1	0	0	63

WESTERN GREBE

Western Grebes breed throughout the state, especially the northeast, in shallow lakes and ponds with marsh vegetation. Abnormally dry conditions in much of the state possibly limited the breeding distribution during this survey and no colonies were found West River. Two of 15 Western Grebe breeding sites listed in the historical database hosted colonies. Two colony failures during the survey accounted for 1.5% of all known nests in 2005 and 0.8% of all nests in 2006 and probably had little impact on the overall breeding population. A trend occurred through the survey period, from a small number of larger colonies in 2005 to a large number of small colonies in 2007.



Colony Site Ownership



WESTERN GREBE	2005	2006	2007
No. of known active colonies to date	7	19	41
Number active colonies that subsequently failed	1	1	0
Number counties with active colonies	4	9	11
Total no. of known breeding pairs	132	284	382
Average colony size	19	15	9
Median colony size	11	7	3.5
Colony size range	1 - 51	1 - 77	1 - 41

Western Grebe (cont.)

Table B. Counties with highest number of colonies and breeding pairs.

County	Total number known colonies			Total number known breeding pairs		
	2005	2006	2007	2005	2006	2007
Roberts	3	4	9	84	12	53
Marshall	1	2	7	3	35	89
Day	1	2	7	1	12	92
Brown	1	4	6	0	91	66
Deuel	0	2	2	0	37	34
Hamlin	0	1	2	0	8	34
Kingsbury	0	1	0	0	45	0
Codington	1	0	0	44	0	0

RARE GREBE SPECIES

Horned Grebe and Clark's Grebe are the two grebe species whose breeding status in South Dakota are least known (Tallman *et al.* 2002).

During this survey, no adult Horned Grebes were seen during the breeding months, although they commonly were seen during spring migration throughout East River. Edmunds and McPherson Counties in north-central South Dakota are at the extreme southeast end of the Horned Grebe's North American breeding range (Stedman 2000). During this survey, most potholes in these north-central counties were dry or held too little water to support marsh vegetation used for nesting. These conditions may have contributed to the lack of birds. Also, the Horned Grebe's breeding range has been receding slowly to the northwest (Stedman 2000, Beyersbergen *et al.* 2004); there has been only one breeding record in South Dakota in the past 20 years.

In South Dakota, Clark's Grebe is a rare breeder, found as single pairs or a few pairs in Western Grebe colonies (Tallman *et al.* 2002). During this survey, one to two Clark's Grebes were seen every year at Sand Lake but breeding was never confirmed. This site has been the most reliable breeding location for the past several years, and has also had documented mixed species Clark's Grebe-Western Grebe breeding pairs (Tallman and Hanson 1997). No Clark's Grebes were seen at any of the remaining four historical breeding sites; two sites had suitable habitat and Western Grebe colonies, while high water at the other two sites made them unsuitable grebe breeding habitat.

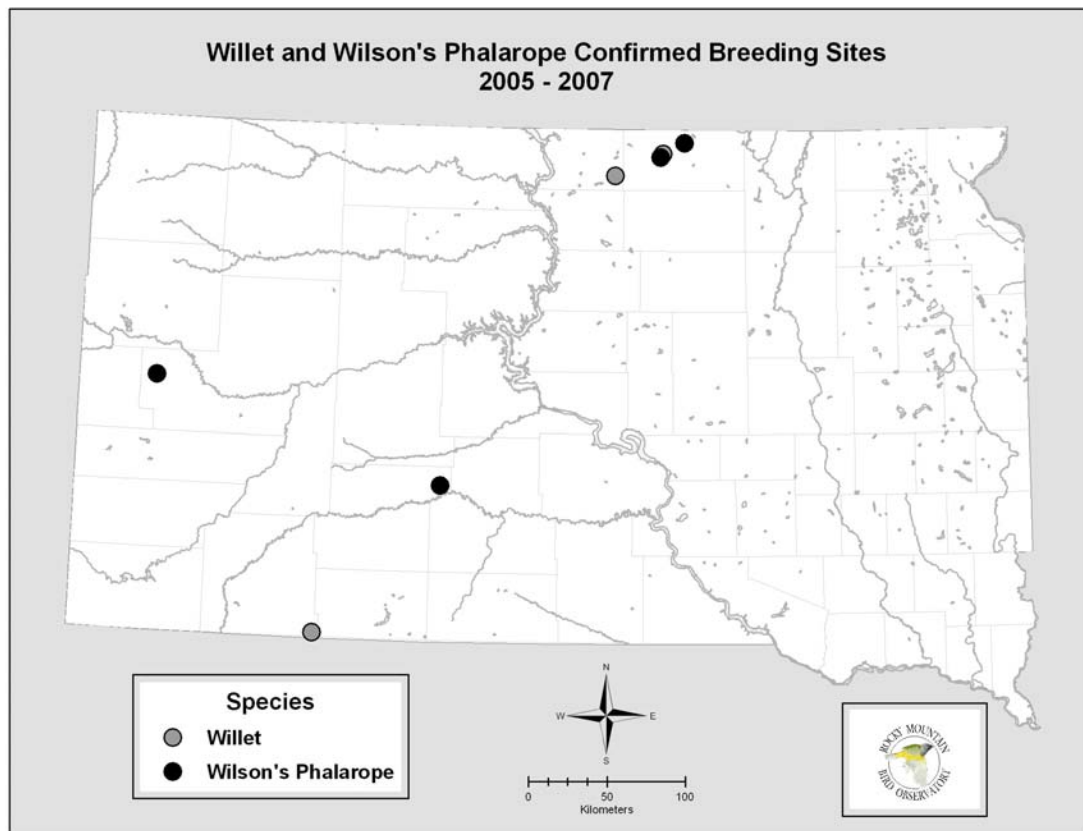
SHOREBIRDS

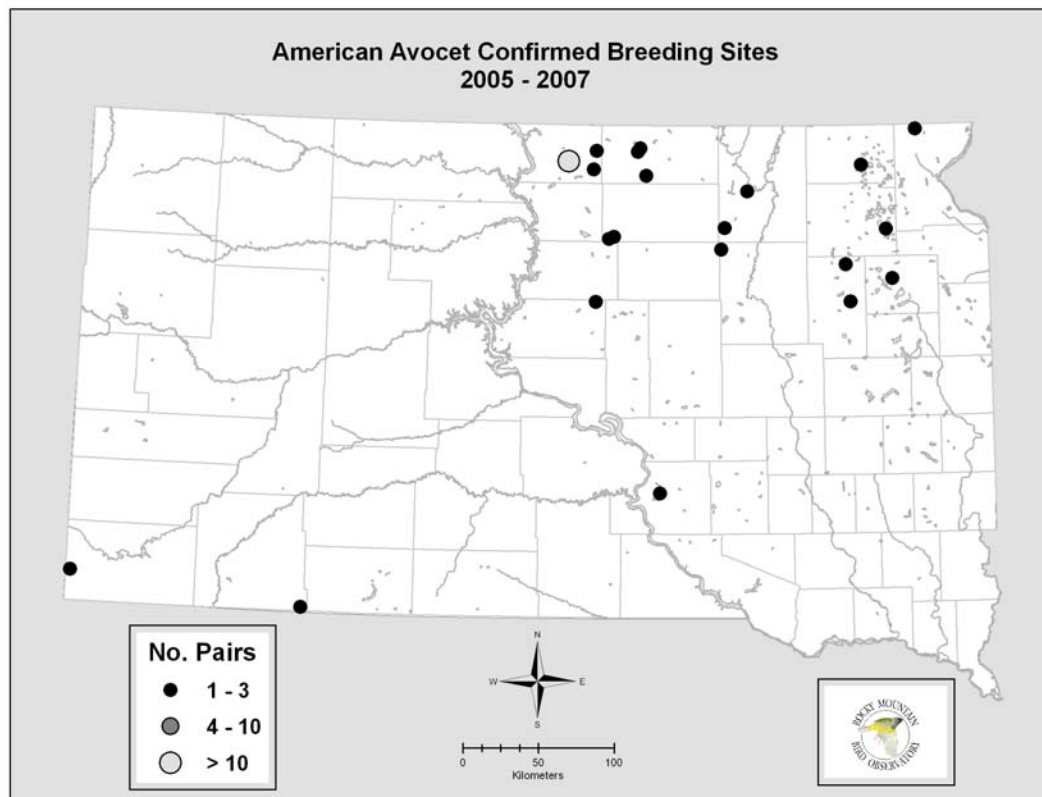
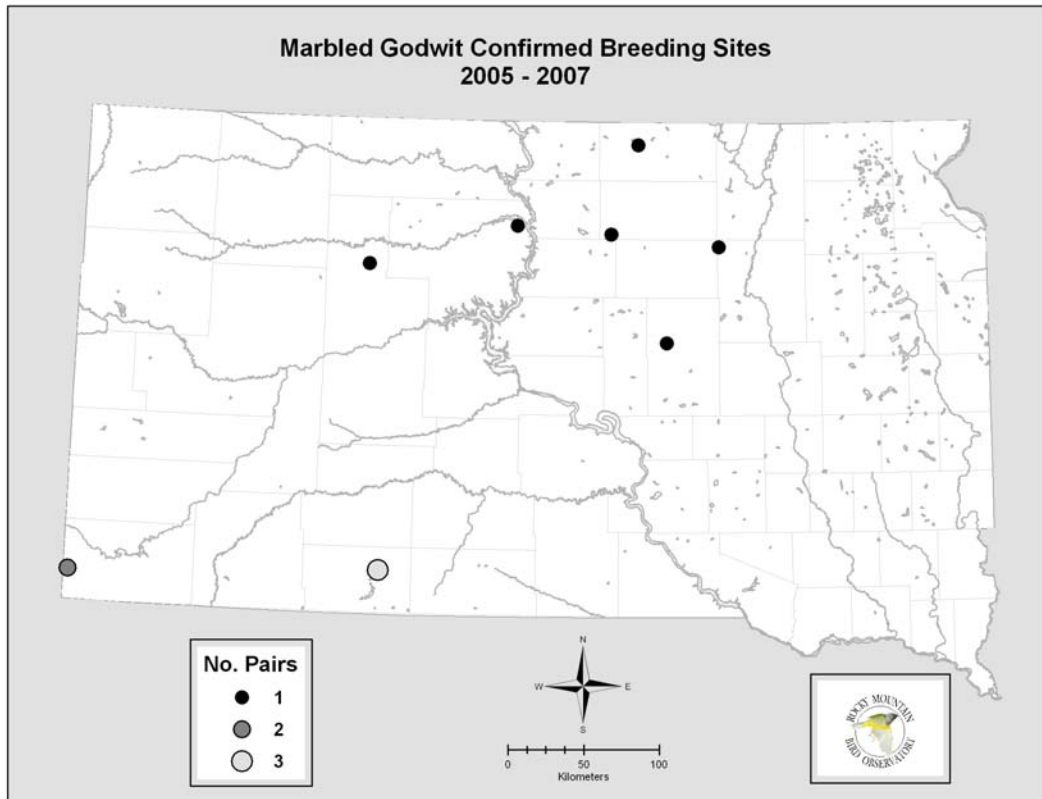
Five of the targeted shorebird species were confirmed as breeding during this project. Four of these are common (American Avocet, Wilson's Phalarope) to uncommon (Marbled Godwit, Willet) breeders throughout the state, but are of conservation concern because of continuing loss of their wetland habitat. There are less than five breeding records for Black-necked Stilts in the state (Tallman *et al.* 2002) and none of these sites had stilts during these surveys. A pair of stilts with a brood was located at a new site in McPherson County. Piping Plover, a federally-listed threatened species, is monitored annually along the Missouri River and this project only searched at off-river sites. Several individuals and pairs were located at wetlands near the Missouri River and in the Sandhills region, but breeding was not confirmed. Spotted Sandpiper is common throughout the state while Wilson's Snipe is more local and uncommon (Tallman *et al.* 2002). During this project, pairs of both species were encountered in all years throughout the state, but because these were Tier 3 (lowest priority) species, efforts were not made to locate nests.

2005	Number of locations detected	Total number of adults	Number pairs confirmed breeding
American Avocet	13	73	10
Marbled Godwit	10	82	1
Willet	11	18	0
Wilson's Snipe	10	12	0
Wilson's Phalarope	9	17	0
Spotted Sandpiper	4	4	0
Black-necked Stilt	0	0	0
Piping Plover	0	0	0

2006	Number of locations detected	Total number of adults	Number pairs confirmed breeding
American Avocet	26	199	19
Marbled Godwit	31	154	8
Willet	21	72	2
Wilson's Phalarope	18	166	2
Spotted Sandpiper	12	31	0
Wilson's Snipe	10	20	0
Piping Plover	3	4	0
Black-necked Stilt	0	0	0

2007	Number of locations detected	Total number of adults	Number pairs confirmed breeding
American Avocet	18	231	19
Wilson's Phalarope	23	2,124	2
Willet	9	22	1
Black-necked Stilt	1	2	1
Marbled Godwit	20	51	0
Spotted Sandpiper	17	27	0
Wilson's Snipe	5	18	0
Piping Plover	2	4	0





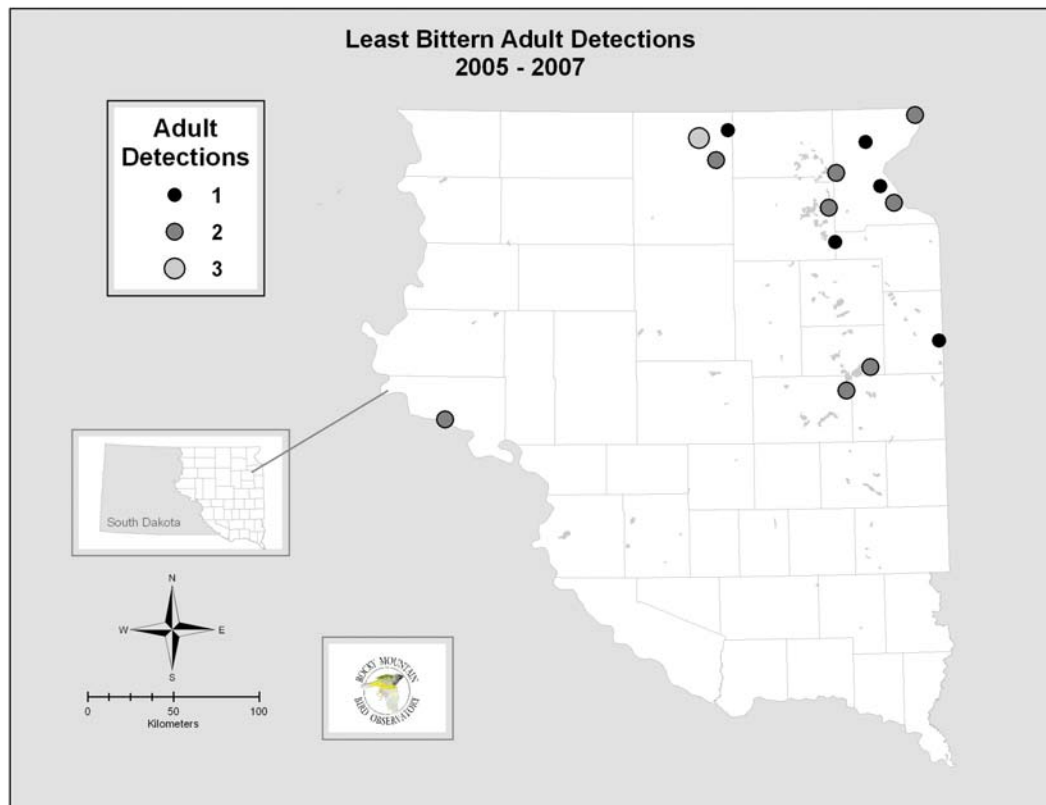
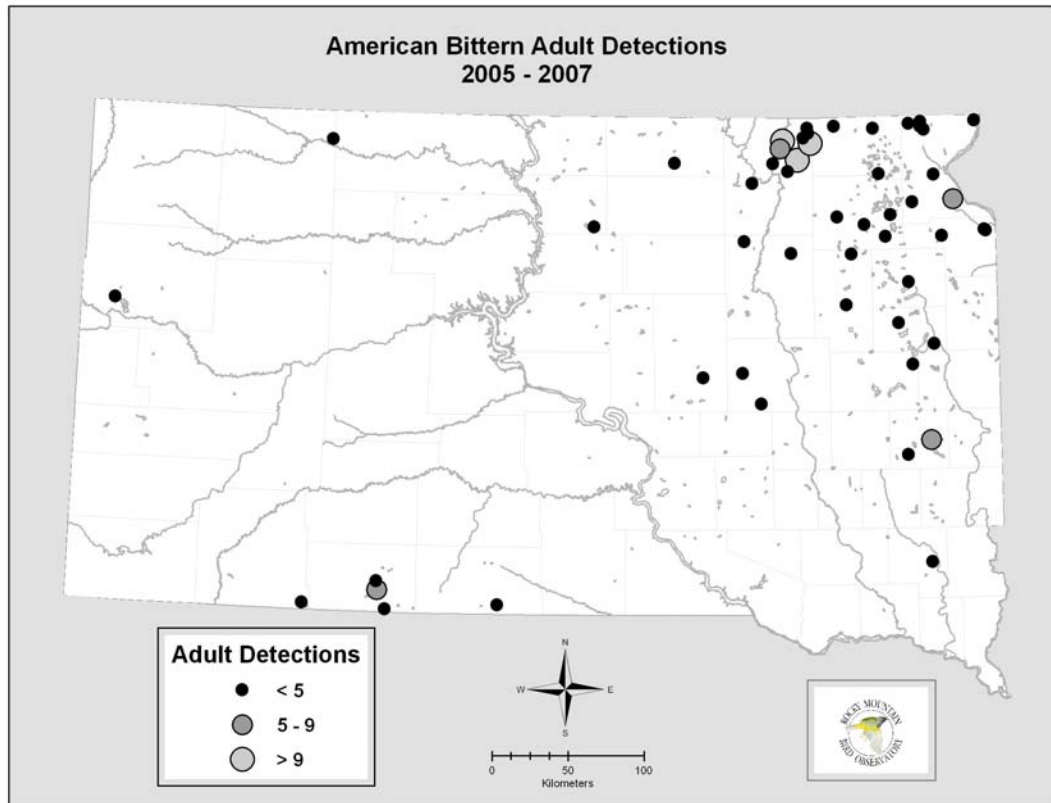
SECRETIVE MARSHBIRDS

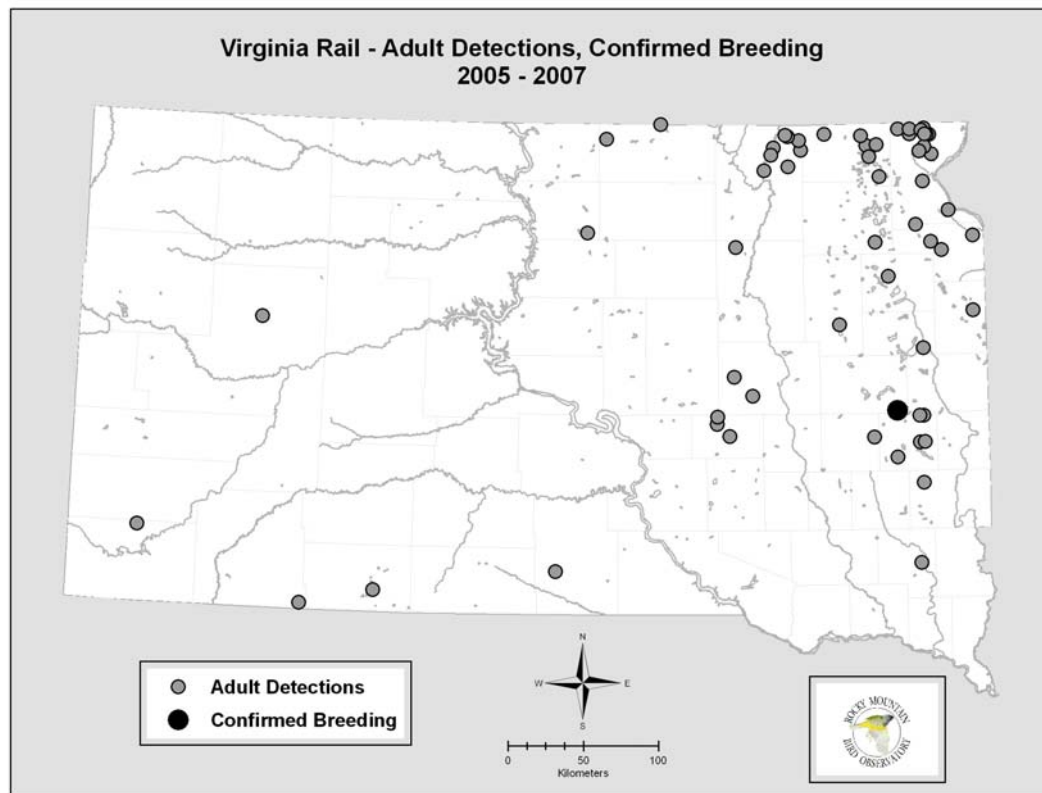
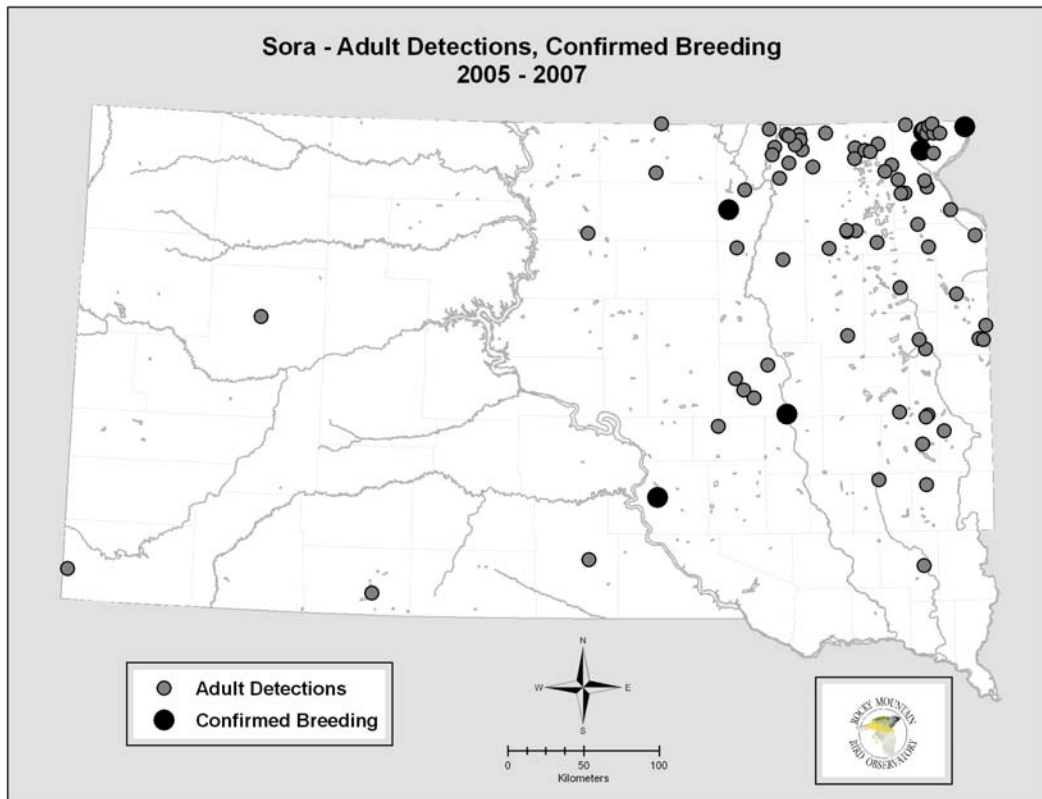
Sora, Virginia Rail, and American Bittern are common breeding birds in marshes throughout the state, while Least Bittern is uncommon throughout East River (Tallman *et al.* 2002). Because of their secretive nature and dense nesting habitat, this project was unable to confirm breeding for most of the detected individuals of the common species. Secretive marshbird protocols assume that these individuals are breeding because they move around so little during the breeding season (Conway 2004). Yellow Rails breed in North Dakota but have never been confirmed as breeding in South Dakota. Although this project found suitable habitat, no Yellow Rails were detected.

2005	Number of locations detected	Total number of adults	Number pairs confirmed breeding
Sora	17	22	1
Virginia Rail	15	20	1
American Bittern	11	14	0
Least Bittern	3	5	0
Yellow Rail	0	0	0

2006	Number of locations detected	Total number of adults	Number pairs confirmed breeding
Sora	32	67	1
Virginia Rail	29	70	0
American Bittern	13	48	0
Least Bittern	6	9	0
Yellow Rail	0	0	0

2007	Number of locations detected	Total number of adults	Number pairs confirmed breeding
Sora	46	156	4
Virginia Rail	29	60	0
American Bittern	35	97	0
Least Bittern	10	17	0
Yellow Rail	0	0	0





MISCELLANEOUS SPECIES

Waterfowl: Two of the four targeted waterfowl species were confirmed as breeding during these surveys. Common Mergansers have bred along Rapid Creek in Pennington County since 1984 (Tallman *et al.* 2002) and this project found broods in the same area every year. Trumpeter Swans were introduced into South Dakota in the early 1960's in Bennett County and the current breeding population appears to be in western South Dakota, eastern Wyoming, and the Nebraska Sandhills (Tallman *et al.* 2002). This project found one nest in Tripp County and one brood in Meade County.

Raptors: Nests of two wetland-dependent raptor species were encountered during these surveys. Osprey is a rare breeding bird in the Black Hills; this project noted two different nests during the survey period and another pair whose nest was not located. Bald Eagles first nested in South Dakota in recent times in 1992 (Tallman *et al.* 2002) and annual statewide surveys indicate that almost 50 pairs currently breed in the state (C. Aron, *pers. comm.*). This project found one new active nest and confirmed breeding at other known sites.

	2005		2006		2007	
	No. locations	No. breeding pairs	No. locations	No. breeding pairs	No. locations	No. breeding pairs
Common Merganser	1	1	2	2	2	2
Trumpeter Swan	1	1	0	0	1	1
Bald Eagle	8	8	9	8	5	6
Osprey	1	1	1	1	2	1

APPENDIX E. Evaluation of alternatives for design of long-term monitoring. Alternatives are briefly described with general advantages and disadvantages, starting with the baseline alternative of no field work.

- 1) Baseline monitoring: only volunteer colony monitoring program, refuge staff monitoring, incidental reporting (from the public, wildlife and fisheries staff in the field, refuge biologists, other field personnel)
 - a. advantages: cheap, few people needed
 - b. disadvantages: volunteer colonies don't represent random sample so can't extrapolate to whole state, important waterbird regions (especially Coteau) not covered properly, can't make any statements that answer most objectives
- 2) Ground visits only: ground visit to every major colony every 1-3 years + baseline monitoring
 - a. advantages: relatively easy,
 - b. disadvantages: can't interpret impact on species if a colony disappears, may miss major new colonies or major shifts
- 3) Aerial surveys only: 20% of state each year or most of state every 5 years + baseline monitoring
 - a. advantages: cover large areas quickly, especially inaccessible sites
 - b. disadvantages: counts extremely inaccurate from air, detectability low for some species, can not collect habitat or other data
- 4) Both aerial surveys and ground visits: aerial surveys every 5 years (or 20% of state each year) + ground visits every 2 – 3 years + baseline monitoring.
 - a. advantages: best way to address objectives, best odds of getting a handle on state-wide populations,
 - b. disadvantages: more expensive than just visiting known colonies
- 5) Every 5 years: all-out, full-time effort every 5 years + baseline monitoring
 - a. advantages: don't have to devote time & resources the other 4 years.
 - b. disadvantages: relatively expensive, if major colony doesn't 'happen' that year-falls off the radar, more difficult to evaluate management actions (is change because of precipitation event, natural population fluctuation, management?)

APPENDIX F: Colony Monitoring by Citizen-Scientists - 2007 Pilot Project

Although most state natural resource agencies accept incidental colony sightings from the public, a recent trend has been to recruit and train a cadre of volunteer citizen-scientists to 'adopt' colonies for long-term monitoring. For example, Colorado's Colony Watch program has utilized more than 160 volunteers to monitor 16 colonial waterbird species since the program's inception in 1998 (Levad *et al.* 2005). In 2007, we initiated a pilot volunteer colony count project in South Dakota. The pilot project's overall goal was to test the feasibility of establishing a permanent volunteer colony monitoring program in South Dakota. Specific objectives were to

1. Ascertain if there is a pool of potential citizen-scientists willing to participate,
2. Determine the number, types, and locations of colonies that could be covered by citizen-scientists,
3. Develop materials and methods appropriate for citizen-scientists,
4. Identify difficulties that participants have in monitoring colonies, and
5. Assess willingness of participants to monitor colonies on a long-term basis.

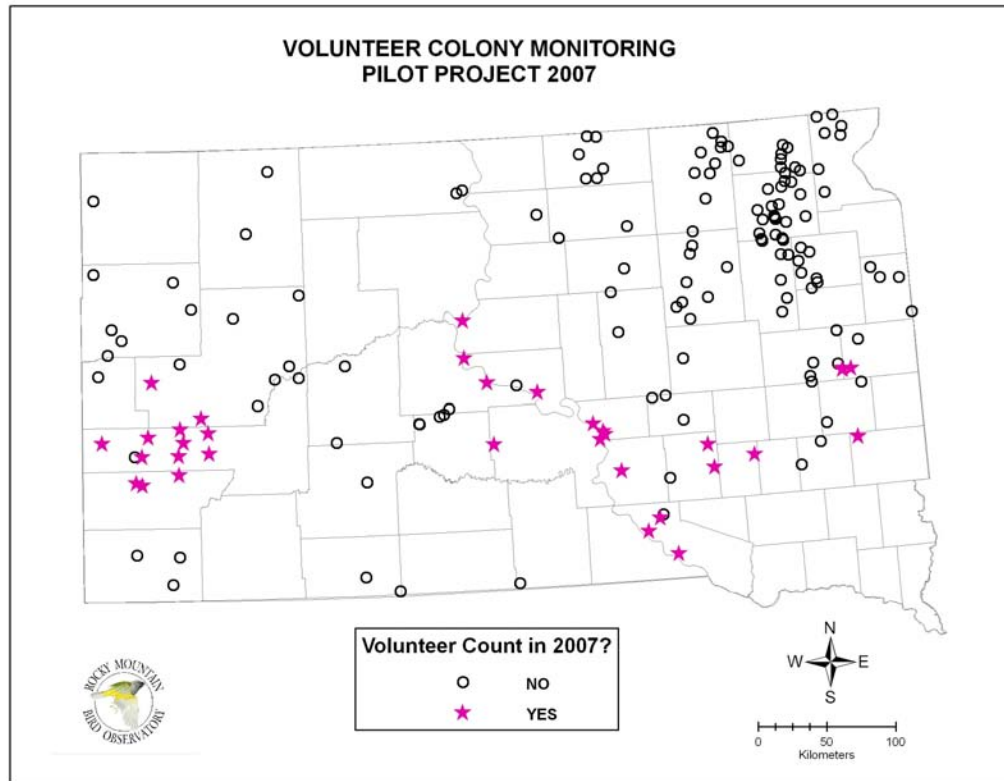
VOLUNTEER RECRUITMENT and RESULTS

In February 2006, a recruitment message explaining the program was sent to the SD Birds email listserv, as well as to all known local bird clubs and Audubon chapters. People who responded expressing an interest were sent a longer explanation of the program including a summary of the methods, what was involved in terms of time, expenses, equipment, and needed skills, and a list of known tree-nest colonies in their area.

By mid-March, 14 people had volunteered to count nests at a total of 34 colonies throughout the state. Each person was sent detailed written instructions of the methods, data forms, and detailed directions to and descriptions of their colonies. There were no training sessions, although volunteers could and did contact the project coordinator with questions. Methods and data forms were the same as those used by the South Dakota Colonial Waterbird project, except that volunteers were not asked to distinguish between active and inactive nests. As all of the volunteer-monitored colonies were relatively small tree-nesting colonies, volunteers were instructed not to enter colonies, but rather count from afar to avoid disturbing nesting birds.

In the end, 13 of the 14 interested people actually conducted counts at 31 colonies. Of the 13 participants, three were partnered with other volunteers so that a total of 10 groups conducted counts. Number of colonies monitored per group ranged from one to ten. The distribution of colonies monitored by volunteers was clumped around the home towns of participants (Figure F1).

Figure F1. Location of volunteer-monitored tree-nest colonies in 2007 (stars) and tree-nest colonies not monitored by a volunteer (open circles).



Seventeen of the colonies were located East River or on the Missouri River and 14 were West River. All monitored colonies were tree-nest colonies; 17 were single-species Great Blue Heron (GBHE) colonies, three were single-species Double-crested Cormorant (DCCO) colonies, and six were mixed DCCO-GBHE colonies. An additional five non-active GBHE colonies were visited. The 31 colonies 'adopted' by volunteers represented 18.5% of all known tree-nest colonies in the state.

To assess the ability of volunteers to count nests at colonies, paid technicians from the South Dakota Colonial Waterbird Project counted nests at all but one of the 26 active volunteer-monitored colonies (Table F1). Volunteer counts at three colonies were the same as the paid biologists' counts. Of the rest, volunteers counted fewer nests at 17 colonies than did paid staff, and volunteers at five colonies counted more nests. There are a variety of reasons for the discrepancies. Because many of the GBHE colonies were located in live cottonwood stands, volunteers were advised to count these colonies before leaf-out. However, at several colonies, volunteers appeared to have visited the colony too early, before any birds arrived (volunteer counts of 0 in Table F1, except at colony '22'). Count discrepancies at colonies '14' and '19' also may be because volunteers visited before most of the breeders arrived. In the future, volunteers should be made aware of this issue. Two colonies (paid staff counts of 0 in Table F1) appeared to have failed or fledged by the time paid

Table F1. Comparison of nest counts by volunteers versus paid technicians. Proportion of Paid is the proportion of the paid technician counted nests that was counted by the volunteer. DCCO = Double-crested Cormorant, GBHE = Great Blue Heron.

Colony	Volunteer Count Date	Paid Date	Volunteer Count	Paid Count	Proportion of Paid	Species
'20'	3/31/07	6/25/07	0	3	0	GBHE
'11'	4/1/07	5/30/07	0	17	0	GBHE
'12'	4/1/07	4/24/07	0	10	0	GBHE
'10'	4/15/07	5/30/07	0 0	28 5	0 0	DCCO GBHE
'22'	4/15/07	4/27/07	0 0	8 55	0 0	DCCO GBHE
'4'	4/20/07	7/5/07	0	1	0	GBHE
'9'	5/13/07	5/29/07	1	8	0.175	GBHE
'3'	6/8/07	5/23/07	54 4	178 7	0.30 0.57	DCCO GBHE
'2'	6/8/07	5/24/07	8 1	24 6	0.33 0.17	DCCO GBHE
'14'	4/3/07	5/5/07	7	20	0.35	GBHE
'25'	4/27/07	5/30/07	45 26	91 26	0.49 1.00	DCCO GBHE
'26'	4/27/07	5/4/07	7	14	0.50	DCCO
'6'	6/20/07	5/23/07	53	92.5	0.57	DCCO
'8'	4/15/07	5/29/07	12	17	0.71	GBHE
'17'	3/31/07	6/25/07	12	16	0.75	GBHE
'19'	3/31/07	4/11/07	14	20	0.70	GBHE
'5'	4/20/07	4/28/07	49	58	0.84	GBHE
'1'	5/25/07	5/22/07	8	8	1.00	DCCO
'13'	4/3/07	4/2/07	5	5	1.00	GBHE
'23'	4/15/07	6/23/07	1	1	1.00	GBHE
'15'	4/3/07	5/6/07	39	33	1.18	GBHE
'18'	3/31/07	6/25/07	4	2	2.00	GBHE
'7'	4/29/07	4/27/07	48	19	2.52	GBHE
'21'	6/9/07	6/25/07	3	0	3.00	GBHE
'16'	4/3/07	5/4/07	5	0	5.00	GBHE

staff arrived. At colony '7', the paid staff's count was considered too low and the volunteer's count more likely to be the actual. At colony '22', the volunteer was not at the right spot. At colonies '2' and '3' nest counts were fairly close in time and the discrepancy could be because of undercounting by the volunteer, although large-scale nest abandonment can not be discounted. At the remaining colonies, too much time elapsed between counts to be able to discern whether the difference was because of natural nest additions and abandonment or because of erroneous counts. If such an assessment is to be attempted in the future, efforts should be made to schedule counts as close together as possible.

Only one volunteer group appeared to be unsure of the correct unit to count - sometimes reporting number of birds and sometimes reporting number of nests. Everyone else collected the correct data. Five of the 10 volunteer groups made copies of their forms and filled them in. The other five provided their data in narrative form in emails.

Participants also were asked to revisit their colonies later in the summer, ideally during the late chick stage, to determine if the colony was still active. Three of the 10 groups reported revisiting colonies, one reported that they did not have time to revisit, and the other six did not report and presumably did not make second visits.

At the end of the summer, participants were sent an evaluation asking whether they enjoyed their experience, what were the problems they encountered, and whether they were willing to count nests at their colonies in future years. Five participants responded. All reported that they enjoyed visiting the colonies and were willing to return in future years. The most frequently reported problem was difficulty finding some colonies. This was solved once the colony was found. One participant reported having a problem getting a consistent count at a large dense colony. In the future, hands-on training should be given to this participant and others responsible for counting nests at larger colonies.

CONCLUSIONS and RECOMMENDATIONS

This pilot project demonstrated that it would be feasible to establish a citizen-scientist colony monitoring program in South Dakota, but not on the scale as is possible in Colorado and some other states. In South Dakota, there are not enough participants and they are not distributed widely enough for volunteers to monitor all colonies in the state. In particular, many of the state's potential volunteers are in Sioux Falls but there are no known waterbird breeding colonies nearby, whereas most of the colonies are in the northeast part of the state where there are few people. With more assertive recruitment, up to five more participants possibly could be added to the program and possibly up to 20-25% of the state's tree-nest colonies could be monitored by citizen-scientists.

Based on results of this pilot project and experiences of other state programs, the following are recommendations for the development of a citizen-scientist colony monitoring program in South Dakota.

1. *Coordinator.* To have a citizen-scientist monitoring program, a person needs to be identified who can develop and manage the program. Possible responsibilities of the coordinator would be to develop the program, recruit and retain volunteers, organize each year's data collection, be available to answer questions and train, collect data sheets, evaluate volunteers and program, and produce reports. Outside of training and report production, these duties should take up approximately 2-5 days of coordinator time per year.

2. *Recruitment of more volunteers.* Volunteer recruitment for the pilot project was relatively passive - no potential volunteers were contacted individually. Additional potential volunteers should be identified and approached individually. Possible sources of additional volunteers are schools, colleges and universities, nature or bird clubs, and volunteer databases of other programs.
3. *Retention of volunteers.* Steps should be developed to keep volunteers interested and engaged in the program:
 - a. show participants how their efforts are important to conservation of colonial waterbirds in South Dakota
 - b. provide opportunities for hands-on training
 - c. be available to answer questions
 - d. encourage and respond to feedback from participants
 - e. encourage and give feedback to participants
4. *Appropriate colonies.* Counting nests at some types of waterbird colonies in South Dakota would be challenging for citizen-scientists. The greatest concern of nest counts is disturbing nesting birds. Therefore, all volunteer colonies should be countable from some distance away. Other colony characteristics for volunteer monitoring are
 - a. three or fewer breeding species to avoid difficulties with nest identification.
 - b. tree-nest colonies. If ground-nest colonies or marsh-nest colonies, special training will have to be provided to learn count methods for those habitats and species.
 - c. smaller colonies, less than approximately 300-500 nests.
5. *Monitor every year.* Although the state-wide monitoring program does not mandate nests counts every year, the citizen-scientist program needs to do so. Experience shows that if colony visits are less frequent, volunteers forget or lose interest in the program.
6. *Update methods and manuals.* Volunteer instructions, forms, and methods that were developed for the pilot project should be updated to reflect knowledge gained from 2007 and to meet objectives of the state-wide monitoring program. The methods and manuals are kept with the Wildlife Diversity Program, SD Department of Game, Fish, and Parks.