The American White Pelican in Minnesota after the Deepwater Horizon Oil Spill: Assessing Distribution, Abundance and Population Change

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Introduction

On April 20, 2010, an explosion occurred on the Deepwater Horizon oil drilling rig off the Louisiana coast in the Gulf of Mexico. This national disaster resulted in a massive spill of approximately 4.9 million barrels of oil into Gulf waters, making this the largest offshore spill in U.S. history and in the Gulf of Mexico. Oil spread from the initial site of the explosion, and extensive areas of coastline were oiled, mostly in Louisiana, but also in Mississippi, Alabama and Florida (http://response.restoration.noaa.gov/deepwaterhorizon). The Gulf Coast region provides essential habitat for many wildlife species, and is significant worldwide for its diversity. It is an especially important region for aquatic bird species, including seabirds, marshbirds, wading birds, shorebirds and waterfowl. These birds utilize the region throughout the year, and thus are extremely vulnerable to the effects of the spill. Many waterbird species were immediately impacted through contamination with oil (e.g., Brown Pelican (*Pelecanus occidentalis*). Additionally, strong concern exists over potential impacts to breeding waterbirds from the north that migrate to this region for the winter.

Minnesota is home to many breeding waterbird species that utilize the Gulf Coast region extensively during various times during their annual cycle. Once the scale of the oil spill became apparent, the Minnesota Department of Natural Resources (DNR) began receiving numerous calls from the public and media representatives asking about the potential impact of the oil spill on birds that nest in Minnesota and winter in the Gulf. In July, 2010, the Legislative Citizen Commission on Minnesota Resources (LCCMR) set aside $250,000 and requested that the MN DNR: 1) identify birds most likely to be affected by the oil spill; and 2) develop research to assess potential impacts on Minnesota birds.

The American White Pelican (*Pelecanus erythrorhynchos*) (AWPE) was identified as one of two Minnesota species that could be particularly vulnerable to the oil spill, and is a high priority for monitoring in Minnesota for several reasons: 1) Most Minnesota-origin pelicans winter in the

Gulf of Mexico (Evans and Knopf 2004). Young pelicans spend one year in the Gulf before returning to MN, thus pelican chicks hatched in 2009 were present in the Gulf during the oil spill. 2) Pelicans utilize aquatic food that could have been contaminated by oil residue in the Gulf. 3) The AWPE is a state-listed Special Concern species, and identified as a Species in Greatest Need of Conservation in Minnesota's State Wildlife Action Plan (MN DNR 2006); 4) Minnesota has a substantial AWPE breeding population, comprising a significant proportion of the continental population, and provides habitat for one of the largest colonies in the world at Marsh Lake in western MN; 5) the AWPE is listed as a moderate conservation concern in Bird Conservation Regions (BCRs) that overlap Minnesota (BCRs 11, 12 and 23), and is designated as a Stewardship priority in BCR 12 (Beyersbergen et al. 2004; Wires et al. 2010).

The MN DNR conferred with other conservationists and proposed a collaborative package of assessment actions that would provide the best opportunity to document oil spill damages to the priority birds identified. One component of this assessment was to conduct two consecutive statewide surveys of Minnesota's AWPE breeding population in 2011 and 2012. The goal of these surveys was to determine if Minnesota's pelican population experienced significant declines in these years that could be attributable to the oil spill. Because of the state's large breeding population and the species' conservation status, regular state-wide monitoring for pelicans was initiated by the MN DNR in 2004. Since that time, two state-wide surveys have been completed to assess the distribution and abundance of AWPE in Minnesota, the first in 2004-05, and the second in 2010. Fortuitously, this monitoring effort compiled thorough baseline information on AWPEs in Minnesota pre-oil spill. Because the oil spill occurred at a time when birds that return north to breed would have already left the Gulf Coast, and many would be present at their breeding grounds, we assume we had current information on status of pelicans prior to the spill. In fact, during the second statewide survey, the first flight to verify presence of

pelicans at southern and central MN breeding colonies was undertaken on the same day the oil rig explosion occurred. During this flight, several of the nesting sites used by pelicans were visited and pelicans were present and or initiating nesting activities.

The objectives of this project were to: 1) document distribution and abundance of the American White Pelican in Minnesota in 2011 and 2012; 2) summarize survey results for 15 known nesting sites (active as of 2010) and any additional nesting sites discovered in 2011 and 2012; 3) ensure that the survey protocol used in 2011 and 2012 was the same as that used in 2004 and 2010 so that results could be compared with survey results from those years; and 4) determine if significant declines occurred since the oil spill event using data from 2011 and 2012.

Methods

Potential nesting locations and site visits. In 2011 and 2012, potential sites for surveys were selected through : 1) review of all sites visited and their status in the 2004/05 and 2010 statewide surveys (this included sites where pelicans had not been observed breeding but were present in spring and summer and had potential to nest in the future); 2) an e-mail solicitation to MN DNR field staff by the DNR liaison requesting information on new colonies that were not identified in the 2010 census, and on colonies inactive in 2010 but known to have become active since that time; and 3) incidental observations of potentially active sites during a preliminary reconnaissance flight and other flights to determine status and activity at particular sites. All potential sites were visited on the ground or by aircraft between mid-May and early-June to verify activity status and census pelicans. This time period was chosen as the optimum time for field survey based on phenology data obtained during previous survey efforts. Field survey crews accessed colonies from land, by watercraft or from the air, depending on accessibility of the site.

Watercraft used included a canoe. Aircraft used included a Cessna 185, a Cessna 185 with floats, and a high-wing Scout.

Nest estimates. Nest estimates were obtained at all sites where pelicans nested. The count datum was the active nest, and was considered to represent one pair of birds. Active nests were defined as nests containing eggs and/or chicks, apparently occupied nests (obvious nests that may lack eggs or chicks but have signs of active use (e.g. fresh nesting material, well formed). In aerial photos, active nests were defined by birds apparently sitting on or tending nests.

Because pelicans are very sensitive to human disturbance at their nesting colonies, our primary survey method was to obtain aerial photographs of colonies and estimate numbers of nests present in the photos. In counts based on aerial photographs, images of nesting birds were obtained while flying over the colony site in a small fixed-wing aircraft at approximately 70-90 mph (T. Pfingsten, pers. comm.) using a hand-held digital camera (Nikon d200 SLR) equipped with an image stabilized lens. Photos were taken from approximately 150-200 m above the colony site and efforts were made to obtain photos from vertical views, but oblique views were sometimes acquired. Typically, two passes were made over the colony and birds did not usually flush from nests. On islands where the configuration of nesting birds required multiple photographs be taken to capture all nesting pairs, we typically photographed the birds starting at one end of the island progressing to the other so that a panoramic view could be re-created. We utilized data on phenology from previous census efforts in Minnesota to obtain photographs when most adults were on nests incubating eggs or brooding young chicks.

Images were downloaded from memory cards to a computer, and then enlarged and closely examined. Because colonies were occupied by birds other than those on a nest, we manually counted to avoid over-estimating the number of nests present. We used Arc Map/GIS software to hand count and mark individual birds that were on nests. Birds tending nests were recognizable in both vertical

and oblique views, and were typically sitting and appeared rounder in shape than birds not tending nests, which were typically standing (Figure 1). Review of photographs indicated that in all colonies, a mix of birds was present: some actively tending nests, some simply standing in the colony, and some whose status (nesting vs non-nesting) we could not determine. Therefore, at all sites, we counted and marked two additional categories of birds: a) birds standing or loafing that were obviously not on a nest, and b) birds with nesting status that could not be confidently determined. We then used the proportion of nesting to non-nesting birds to estimate the number of birds with uncertain status that were likely nesting; these likely nesting birds were then added to the total nest estimate for a particular location.

At locations where visibility from the air was poor, we conducted direct ground counts. During these counts, nests were marked with biodegradable spray paint to avoid double counting, and technicians walked through colonies and tallied the number of active nests on hand-held counters. All counts were conducted by project personnel and field assistants with the exception of Little Pelican Island at Leech Lake. This site is regularly monitored by Steve Mortensen (Leech Lake Band of Ojibwe) and he provided the estimates used in this study.

Detectability of nests. Alhough no studies were conducted to estimate detectability rates for pelicans counted in ground counts and aerial photographs, field work with other species suggests detectability for this species is likely high using both census methods. Cuthbert and Wires (2007) utilized a double-observer approach to estimate detection probability (Nichols et al. 2000) for five ground-nesting species during ground counts conducted in the Great Lakes. This work demonstrated that marking nests greatly increases estimate accuracy at sites with > 25 nests; when nests were marked, detection probability was on average high (95% for single observers). Of the five species considered in the study, observers had the highest detection of ground-nesting Double-crested Cormorants; on average, 98% of their nests were detected in a sample by one observer. In work assessing detectability rates for cormorants counted in aerial photographs in Minnesota and the Great

Lakes, detection probabilities for aerial surveys averaged 0.98 (SE 0.03) (Wires et al, in prep). The large body size, white color, ground nesting and distinct nesting pattern of pelicans are characteristics that increase the reliability of aerial photography for estimating number of nesting birds, and we assume we have detectability rates in aerial photographs that are at least comparable to those for cormorants.

Results and Discussion

A total of 53 sites were visited in 2011 and 2012, with a total of 17 sites active in one or both years (Table 1; Photos provided in electronic format, Appendix 1). In 2011, 16 sites distributed on seven lakes were occupied by an estimated 22,506 pairs of nesting pelicans (Table 2). Similarly, in 2012, 15 sites distributed on the same seven lakes were occupied by an estimated 22,023 nesting pairs of pelicans. During these two survey years, Marsh Lake and Lake of the Woods each supported active colonies on five separate islands. For comparative purposes, Table 2 shows results from this survey along with those from the two previous survey efforts (2004-05 and 2010). The majority of sites used during the four surveys were public state-owned (62%) or tribal lands (29%). The Marsh Lake complex of colonies continues to comprise most of the state's population (71-74%), as it did in the two earlier surveys. The very small colonies (< 25 pairs) that had been previously documented on Big Twin Lake, Lake Hanska and Lake Hassel were not active in 2011 or 2012. Additionally, the colony at Red Lake that was active in 2004 but had no successful reproduction was not active in later years, although large numbers of loafing birds were present. Other than these changes, overall distribution within the state remained essentially the same (Figure 2).

Comparison of nest estimates in 2011 and 2012 to those in 2010 indicates the state population of AWPE has increased by 38-41% (Table 2, Figure 3). Large increases (ranging from 37 to 159%) were documented on Marsh Lake, Lake Johanna, Leech Lake, Minnesota Lake and Pigeon

Lake. The only lake showing a major decline was Swartout Lake. In 2011, the island area on Swartout Lake where pelicans had formerly nested appeared substantially diminished due to flooding, and only 11 nesting pairs were estimated, representing a 99% decline from 2010. In 2012, more area was available and numbers increased but were still substantially reduced from the high observed in 2010 (Table 2).

The percent statewide increase reported for 2011-2012 could be lower than what is stated here because in 2010, two different surveys were undertaken at Marsh Lake and two different estimates were provided for this location. The two surveys used slightly different methodologies and five days passed between when the surveys were conducted. The 2010 estimate for Marsh Lake included in this report represents the more conservative estimate. However, even if the less conservative 2010 Marsh Lake estimate was used (resulting in a state total of 18,921 nests vs. 15,999), the 2011-12 data still indicate an increase of 16-19% since 2010 (Figure 3).

Understanding population trends

We have been collecting comprehensive data on pelicans in Minnesota since 2004, and now have four complete statewide counts of nesting pairs. Additionally, in 2005, we again counted pelicans at Marsh Lake, which at that time made up about 85% of the state's population. Nevertheless, more data are needed to rigorously describe population variation and detect population trends. The only other fairly comprehensive data available for this species in MN are those from the national Breeding Bird Survey (BBS), which has been monitoring trends of breeding birds in Minnesota annually since 1967. Data collected by the BBS provides an index to population trends and first began recording pelicans on survey routes in 1978. This survey effort also indicates significant increases in the state's American White Pelican population over time. Although the BBS and our surveys have counted somewhat different groups of birds, with the BBS broadly reporting all birds seen on survey routes vs. our surveys which count only actively occupied nests, the nesting population should correlate with the number of birds observed during the BBS. Therefore, to

compare our data with those collected by the BBS we converted the BBS data to mean pelicans observed per route surveyed. We then ran a Bayesian state-space model on the BBS data, which basically removes much of the random "noise" and assumes that the population size in year t + 1 has some relationship to the population size in year t. We then plotted the corrected BBS data vs. the nest count data obtained between 2004 and 2012 to graph the predicted nesting population with 95% credible intervals (Figure 4). For 2005, we assumed population change only in the monitored colonies at Marsh Lake and assumed nesting populations on all other lakes remained similar. This analysis estimated an annual rate of population growth, r, of 0.21, which is extremely high, and corroborates our survey observations of a rapidly increasing population. More broadly, the nest count data provides an effective way to calibrate the BBS data.

Future directions

During the 2011 survey, we observed and documented the deliberate destruction of the entire nesting effort at the mainland site at Minnesota Lake by one individual, allegedly because birds were destroying corn fields. This documentation was submitted to the MN DNR. Because the pelican population appears to be growing rapidly, there is continued and greater potential for pelicans to conflict with fisheries and agricultural interests. Therefore, we recommend statewide population monitoring be continued biannually for this species. Additional data points will help determine population trends, distributional changes, the most important sites for pelicans, and help document conflicts with human interests, if needed.

Although individual pelicans were oiled during the Deep Water Horizon oil spill event and some birds died (http://www.fws.gov/home/dhoilspill/pdfs/Bird%20Data%20Species%20Spreadsheet%2005122011.pdf) our data indicate that as of 2012, no impacts were apparent at the Minnesota breeding population level. However, information on reproductive success post-oil spill is not available, and some initial research examining pelican eggs collected in Minnesota post-oil spill found that most eggs collected

contained some level of spill-related contaminants. Therefore, there may be population level effects occurring that have not yet been detected. As a result, we suggest information on numbers of fledgling birds be obtained at several colonies as a step towards assessing whether productivity at colonies has been compromised due to the contamination of adult birds on the wintering grounds via the oil spill.

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Table 1. Sites visited and nesting status of American White Pelican (AWPE) in 2011 and 2012 (NV = Not Visited).

Site Name	County	Lat (DMS)	Long (DMS)	2011 nests or status	2011 date visited	method	2012 nests or status	2012 date visited	method
Amber Lake	Martin	43° 37' 18"	94° 27' 58"	NV	NV	NV	~ 30 loafing, foraging	5/9/2012	aerial
Artichoke Lake	Big Stone	45° 21' 19"	96° 8' 25"	0	5/26/2011	aerial	NV	NV	NV
Big Twin Lake	Martin	43° 43' 44"	94° 45' 2"	0	6/1/2011	aerial	NV	NV	NV
Bigstone Lake (NWR)	Lac Qui Parle	45° 14' 15"	96° 18' 45"	0	5/26/2011	aerial	NV	NV	NV
Bolland Slough	Lac Qui Parle	44° 53' 45"	96° 21' 30"	0	5/26/2011	aerial	NV	NV	NV
Chautauqua Lake	Ottertail	46° 14' 18"	96° 1' 13"	Present / loafing	5/26/2011	aerial	NV	NV	NV
East Chain Lake	Martin	43° 31' 29"	94° 22' 3"	NV	NV	NV	> 30 loafing	5/9/2012	aerial
Egret Island	Grant	46° 3' 4"	95° 48' 14"	Present / loafing	5/26/2011	aerial	NV	NV	NV
Elysian Lake	Waseca	45° 13' 48"	94° 4' 48"	Present / loafing	6/1/2011	aerial	< 5 loafing	4/24/2012	aerial
Geneva Lake	Freeborn	43° 48' 30"	93° 14' 21"	Present / loafing	6/1/2011	aerial	> 60 loafing	5/9/2012	aerial
Hanska Lake	Brown	44° 8' 25"	94° 36' 45"	Present / loafing	6/1/2011	aerial	3 birds loafing	5/9/2012	aerial
Lady Slipper Lake	Lyon	44° 34' 18"	95° 37' 53"	0	5/26/2011	aerial	NV	NV	NV
Lake Hassel	Swift	45° 23' 33"	95° 33' 60"	0	5/26/2011	aerial	NV	NV	NV
Lake Johanna	Pope	45° 27' 48"	95° 13' 23"	1203	5/26/2011	aerial	1904	5/21/2012	aerial
Lake Vermilion - Potato Island	St. Louis	47° 51' 25"	92° 18' 27"	Present / flew by	6/1/2011	ground	NV	NV	NV
Lake Waconia	Carver	44° 53' 60"	93° 1' 33"	Present / loafing	4/29/2011	ground	0	5/9	aerial
Little Kandiyohi Lake	Kandiyohi	46° 14' 18"	96° 1' 13"	NV	NV	NV	~ 45 loafing	4/24/2012	aerial
Little Pelican Is, Leech Lake	Cass	47° 6' 22"	94° 22' 19"	239	6/9/2011	ground	314	5/21/2014	aerial
LOTW-Bridges Is	Lake of the Woods	49° 7' 30"	94° 46' 37"	NV	NV	NV	0	6/5/2012	aerial
LOTW-Crowduck Is	Lake of the Woods	49° 15' 14"	94° 53' 8"	160	6/9/2011	aerial	193	6/5/2012	aerial
LOTW-Four Block Is & associated rocks	Lake of the Woods	49° 16' 29"	94° 58' 07"	NV	NV	NV	2 loafing	6/5/2012	aerial
LOTW-Gull Rock	Lake of the Woods	48° 59' 5"	95° 3' 33"	0	6/9/2011	aerial	0	6/5/2012	aerial
LOTW-Knight Is	Lake of the Woods	49° 05' 50"	94° 45' 19"	NV	NV	NV	few loafing	6/5/2012	aerial
LOTW-Little Massacre	Lake of the Woods	49° 11' 11"	94° 48' 38"	533	6/9/2011	aerial	248	6/5/2012	aerial
LOTW-O'Dell Is	Lake of the Woods	49° 15' 39"	94° 51' 48"	450	6/9/2011	aerial	442	6/5/2012	aerial

Site Name	County	Lat (DMS)	Long (DMS)	2011 nests or status	2011 date visited	method	2012 nests or status	2012 date visited	method
LOTW-Red Lake Rock	Lake of the Woods	49° 15' 49"	94° 52' 7"	43	6/9/2011	aerial	60	6/5/2012	aerial
LOTW-Techout Is	Lake of the Woods	49° 15' 58"	94° 52' 17"	126	6/9/2011	aerial	93	6/5/2012	aerial
LOTW-Twin Rock	Lake of the Woods	48° 58' 26"	95° 01' 44"	loafing	6/9/2011	aerial	1 loafing	6/5/2012	aerial
Maple Lake	Wright	45°13'59"	93°57'53"	NV	NV	NV	~ 100 loafing / foraging	4/24/2012	aerial
Maplewood	Ottertail	46° 31' 9"	95° 58' 38"	0	5/26/2011	aerial	NV	NV	NV
Marsh Lake-Banding Is	Big Stone	45° 11' 36"	96° 7' 40"	1074	5/26/2011	aerial	3579	5/15/2012	aerial
Marsh Lake-Big Is	Lac Qui Parle	45° 11' 18"	96° 7' 52"	279	5/26/2011	aerial	6465	5/15/2012	aerial
Marsh Lake-Currie Is	Big Stone	45° 11' 21"	96° 7' 12"	6245	5/26/2011	aerial	5163	5/15/2012	aerial
Marsh Lake-Peninsula	Big Stone	45° 11' 40"	96° 7' 52"	8983	5/26/2011	aerial	0	5/15/2012	aerial
Marsh Lake-Rock Is	Big Stone	45° 11' 53"	96° 9' 9"	0	5/26/2011	aerial	0	5/15/2012	aerial
Marsh Lake-Small Is	Big Stone	45° 11' 20"	96° 8' 7"	0	5/26/2011	aerial	337	5/15/2012	aerial
Mink Lake	Wright	45° 16' 10"	94° 2' 34"	NV	NV	NV	0	4/24/2012	aerial
Minnesota Lake	Faribault	43° 50' 5"	93° 52' 35"	429	6/1/2011	aerial	1868	5/21/2012	aerial
Minnesota Lake - Ag Field	Faribault	43° 49' 37.5"	93° 52' 29.1"	1458	5/18/2011	ground	0	5/21/2012	aerial
North Heron Lake	Jackson	43° 45' 45"	95° 15' 45"	0	6/1/2011	aerial	~ 40 loafing	5/9/2012	aerial
Pelican Lake	Wright	46° 3' 4"	95° 48' 14"	loafing	6/1/2011	aerial	few loafing and flying	4/24/2012	aerial
Pierce Lake	Martin	43° 37' 20"	94° 33' 17"	NV	NV	NV	> 100 loafing	5/9/2012	aerial
Pigeon Lake (Bare is)	Meeker	45° 23' 33"	95° 33' 60"	6	6/1/2011	aerial	115	5/21/2012	aerial
Pigeon Lake (veg is)	Meeker	45° 23' 33"	95° 33' 60"	1267	5/23/2011	ground	1066	5/16/2012	ground
Preston Lake	Renville	43° 50' 5"	93° 52' 35"	Present / loafing	6/1/2011	aerial	0	4/24/2012	aerial
Red Lake - Ponemah Pt	Beltrami	48° 05' 18"	94° 59' 39"	Present / loafing	6/9/2011	aerial	> 400 loafing	6/5/2012	aerial
Shields Lake	Rice	46° 9' 7"	93° 38' 40"	0	6/1/2011	aerial	0	4/24/2012	aerial
Swartout Lake, Swart Watts Lake	Wright	46° 3' 4"	95° 48' 14"	11	6/1/2011	aerial	176	5/21/2012	aerial
Swenson Lake	Big Stone	45° 23' 59"	96° 25' 8"	Present / loafing	5/26/2011	aerial	NV	NV	NV
Thielke Lake	Big Stone	45° 23' 20"	96° 23' 30"	0	5/26/2011	aerial	NV	NV	NV
Upper Sakatah Lake	Rice	46° 10' 45"	93° 31' 52"	Present / loafing	6/1/2011	aerial	< 20 on water	4/24/2012	aerial

Site Name	County	Lat (DMS)	Long (DMS)		2011 nests or status	2011 date visited	method		2012 nests or status	2012 date visited	method
Wells Lake	Rice	48° 59' 5"	95° 3' 33"		0	6/1/2011	aerial		> 50 loafing on water	5/9/2012	aerial
West Toqua	Big Stone	45° 33' 7"	96° 27' 40"		0	5/26/2011	aerial		NV	NV	NV

Table 2. Active breeding colony locations and nest estimates 2004-2012.

Breeding colony locations		Number Nests			
Site	**Site ownership / status**	**2004/05**	**2010**	**2011**	**2012**
Big Twin Lake	MN DNR AMA (Aquatic Management Area)	16	0	0	0
Hanska Lake	MN DNR Wildlife / County	0	3	0	0
Lake Hassel	Swift County	19	0	0	0
Lake Johanna	MN DNR SNA (Scientific Natural Area)	97	735	1203	1904
Leech Lake, Little Pelican Is,	BIA -Leech Lake Band of Ojibwe	11	174	239	314
Red Lake	BIA-Red Lake Band of Chippewa	340	0	0	0
Swartout Lake	Private-Larry Hoffman	49	913	11	176
Lake of the Woods					
Lake of the Woods - Crowduck Is.	BIA-Red Lake Band Ojibwe	242	408	160	193
Lake of the Woods - Little Massacre Is.	BIA-Red Lake Band Ojibwe	277	185	533	248
Lake of the Woods - O'Dell Is.	BIA-Red Lake Band Ojibwe	25	0	450	442
Lake of the Woods - Red Lake Rock	BIA-Red Lake Band Ojibwe	0	292	43	60
Lake of the Woods - Techout Is.	MN DNR Angle Islands WMA	25	143	126	93
Lake of the Woods - Total		*569*	*1028*	*1312*	*1036*
Marsh Lake					
Marsh Lake - Banding Is	MN DNR WMA	4160	684	1074	3579
Marsh Lake - Big Is	MN DNR WMA	5292	1082	279	6465
Marsh Lake - Curry Is	MN DNR WMA	0	4813	6245	5163
Marsh Lake - Peninsula	MN DNR WMA	2706	4650	8983	0
Marsh Lake - Small Is	MN DNR WMA	1020	4	0	337
Marsh Lake - Total		*13178*	*11233*	*16581*	*15544*
Minnesota Lake					
Minnesota Lake - Island	MN DNR	974	622	429	1868
Minnesota Lake – Mainland (Ag field)	Private-Latusek family	0	748	1458	0
Minnesota Lake - Total		*974*	*1370*	*1887*	*1868*
Pigeon Lake					
Pigeon Lake Bare Is.	MN DNR Wildlife	357	24	6	115
Pigeon Lake Veg Is.	MN DNR Wildlife	0	519	1267	1066
Pigeon Lake-Total		*357*	*543*	*1273*	*1181*
State Total		**15610**	**15999**	**22506**	**22023**

Figure 1. Photo from Lake Johanna, MN, showing AWPE on nests and standing in colony, 5/26/2011.

Figure 2. Distribution of American White Pelican (AWPE) colonies in Minnesota, 2004-2012.

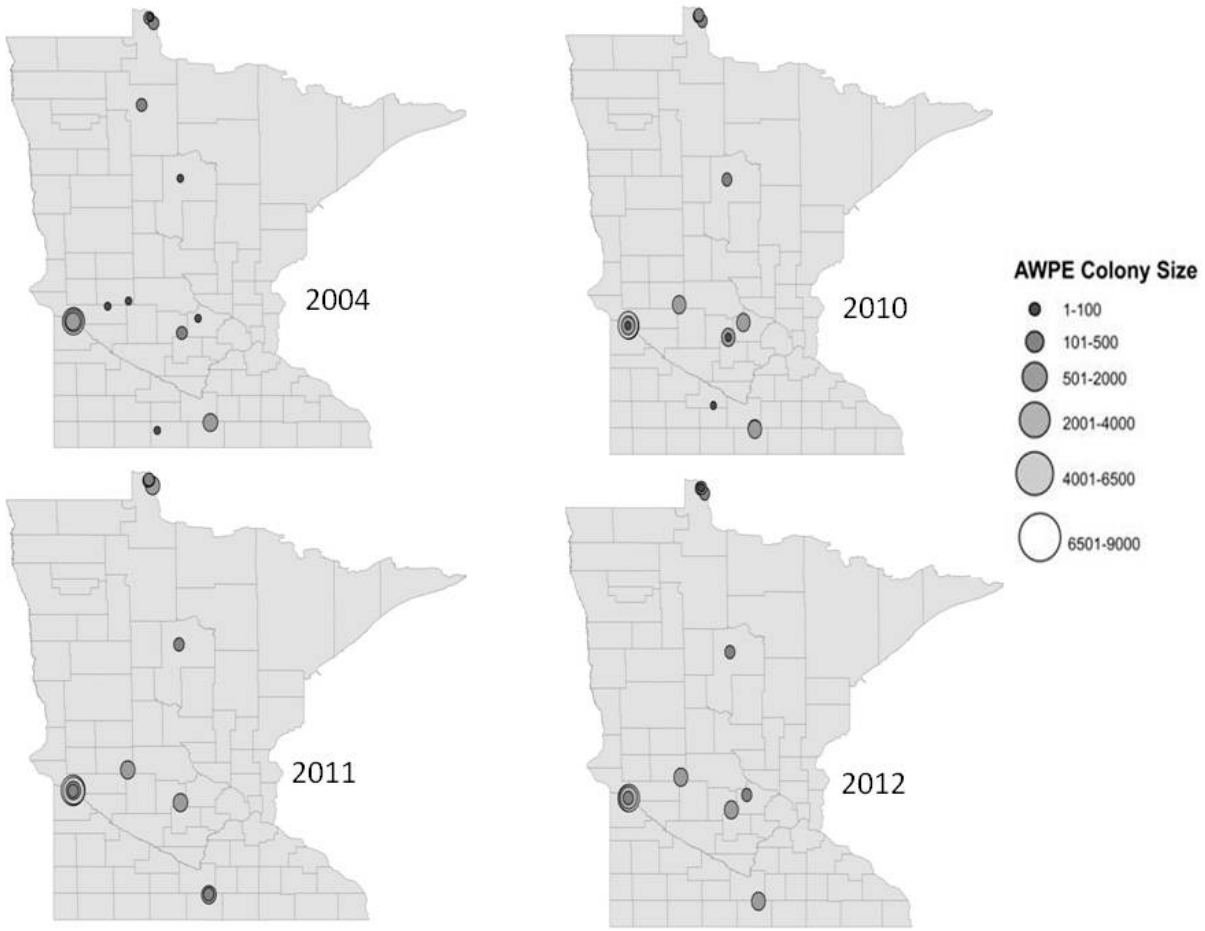

Figure 3. Estimated numbers of breeding AWPE in Minnesota during statewide censuses conducted 2004-2012.

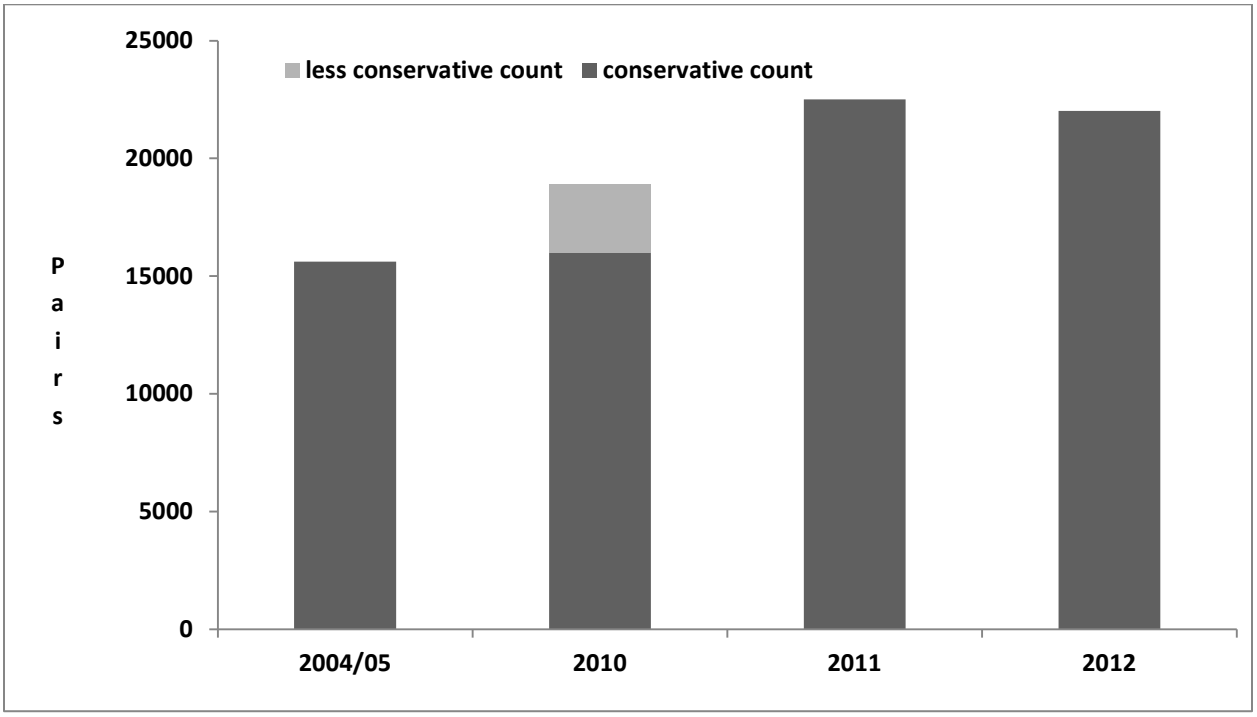

Figure 4. American White Pelican abundance in Minnesota, 1967-2012 based on BBS data and pelican nest counts (Lighter gray = BBS; Black = nest counts). Count for 2005 extrapolated from partial count focused on Marsh Lake.