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MISSISSIPPI SANDHILL CRANE CONSERVATION UPDATE 2014-2016

Scott G. Hereford
Angela J. Dedrickson

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MISSISSIPPI SANDHILL CRANE CONSERVATION UPDATE 2014-2016

SCOTT G. HEREFORD,[1] U.S. Fish and Wildlife Service, Mississippi Sandhill Crane National Wildlife Refuge, 7200 Crane Lane, Gautier, MS 39553, USA

ANGELA J. DEDRICKSON, U.S. Fish and Wildlife Service, Mississippi Sandhill Crane National Wildlife Refuge, 7200 Crane Lane, Gautier, MS 39553, USA

Abstract: To manage crane habitat during 2014-2016, 5,826 ha were treated with prescribed burns, 298 ha of woody vegetation were removed, 94 ha of invasive plants were chemically treated, and 8 ha of crops were planted. There were 247 predators removed. We acclimated and released 29 captive-reared juveniles. We began testing drones (unmanned aerial systems [UAS]), to locate nests. We detected an average of 34 nests per year with 6 fledglings each year. The December 2016 population was 129 cranes, up 9% from the previous 3 years.

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The Mississippi sandhill crane (*Grus canadensis pulla*), is an endangered non-migratory subspecies found in the wild only on and near the Mississippi Sandhill Crane National Wildlife Refuge (Refuge) in southeastern Mississippi (Fig. 1, USFWS 1991, Gee and Hereford 1995). The Refuge was established in 1975 to provide protection and recovery for the cranes, restore and maintain their wet pine savanna habitat, and provide compatible wildlife-oriented recreation (Hereford and Grazia 2008, Hereford and Billodeaux 2014, Hereford and Dedrickson 2016).

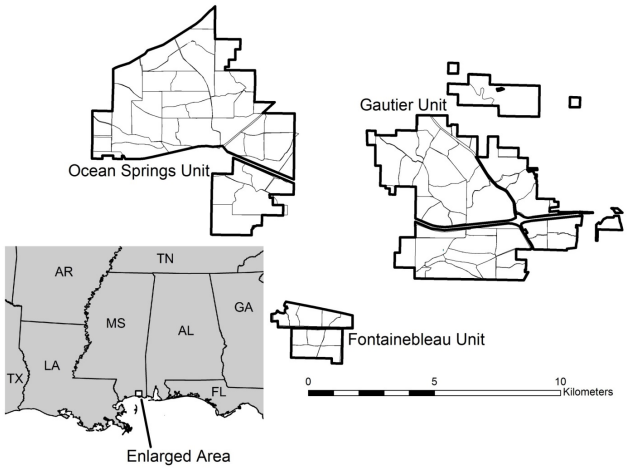

Figure 1. Location of Mississippi Sandhill Crane National Wildlife Refuge in southeast U.S. and the boundaries of its 3 main units and nearly 100 management compartments.

Habitat Management

From 2014 to 2016, conservation efforts for the recovery of this population included protection and law enforcement, restocking, predator management, farming, prescribed burning, mechanical vegetation removal, hydrological restoration, pest plant management, and education. The 7,810-ha Refuge is comprised of 3 major units, 49 major management compartments, and 103 sub-compartments, the latter used primarily as boundaries for prescribed burning. To maintain open savanna and mimic the natural fire return interval of 2-3 years, Refuge staff conducted 76 prescribed burns on 75 days, totaling 5,826 ha, with 76% of the area burned during the growing season. There were 19 burns totaling 1,467 ha in 2014, 29 burns totaling 2,322 ha in 2015, and 28 burns completed for 2,037 ha in 2016. Several compartments were burned more than once during the period.

To restore open savanna, more than 298 ha of woody vegetation were removed using mechanical methods. Using hand loppers or chain saws to fell pines, 1.6 ha were treated in 2014, 20.2 ha in 2015, and 60.3 ha in 2016. Mulching machines were used to treat 75.3 ha in 2014 and 70.4 ha in both 2015 and 2016. There were 18 pasture or crop units totaling 182 ha, which were mowed either 2 or 3 times annually. In 2014, to provide supplemental food, we planted 8 ha of chufa (*Cyperus esculentus*) in 2 different units, which the cranes utilized. Cogongrass (*Imperata cylindrica*) remained the most invasive plant and

[1] E-mail: scott_hereford@fws.gov

Refuge staff, contractors, and utility staff treated 94 ha of cogongrass—43 ha in 2014, 46 ha in 2015, and 5 ha in 2016.

Population Management

To protect cranes during nesting and release, a local predator trapper conducted trapping from January to June and October to December. There was a total effort of 13,221 trap-nights. He removed 41 coyotes (*Canis latrans*), 17 bobcats (*Lynx rufus*), 4 red foxes (*Vulpes vulpes*), and 185 raccoons (*Procyon lotor*).

As part of the ongoing supplementation program conducted to bolster the population, 547 captive-reared cranes in 79 cohorts have been released since 1981. During 2014-2016, we released 29 captive-reared juveniles as part of 6 cohorts (2 cohorts per year), including using a top-netted pen for the first time as part of the acclimation protocol. Twelve juvenile cranes were from the Freeport-McMoRan Audubon Species Survival Center (ASSC), New Orleans, Louisiana, and 17 were from the White Oak Conservation Center (WOCC), Yulee, Florida. We released 10 juvenile cranes in 2014, 12 in 2015, and 7 in 2016. Until this period, all but 8 cranes had been released using the acclimation technique with open-top pens (Ellis at al. 1992). In 2015, for the first time, we used a design based on that used for whooping crane chicks released in Wisconsin (G. H. Olsen, U.S. Geological Survey, personal communication) to help acclimate a release cohort in a top-netted pen. The pen was 30.5 m wide × 46 m long with the height varying between 2.1 and 3.0 m. A single 35 × 50-m piece of polyethylene mesh netting (6.3 × 6.3 cm) formed the sides and top of the pen. At release 1 month later, we opened 1 end of the pen and allowed the 6 cranes to leave. They walked a few meters outside the pen and took their first flight, at first in different directions but they were back together again as a group within hours. There may be some survival advantage to a cohort being able to fly well immediately upon release. In previous releases when open-topped pens were used, the juvenile cranes were prevented from flying during acclimation by wing-brailing, which may have temporarily affected their flight capability. Upon removal of the wing brail, their first flights were short and their wings unsteady. Many took their first flight as individuals rather than as a group and that may have been later that day up to a week later.

During the acclimation period in 2015, we tested the response of 4 costume-reared wing-restrained juveniles to predators in the 1.0-ha, open-top Ocean Springs pen. For a neutral or control, a human in a camouflage 'ghillie' suit accompanied a human in a crane costume while walking in a circle inside the pen. All 4 juveniles were alert and then performed run or run-flap behavior to maintain at least 50 m from the camouflaged human. Four days later in the same pen, a German shepherd dog was tethered about 30 m into the pen. All 4 juveniles were immediately alert, moved to the back of the pen 70 m away, paced perpendicular to the dog, and rubbed the fence. Variations of this technique may be useful to test appropriate wariness in each release cohort, but it was unsuccessful in eliciting predator attack behavior (Howard et al. 2018).

We fitted each released crane with a unique color combination of 3 plastic leg bands (Fraunhofer Institute, Berghausen, Germany), above the right hock joint and a VHF radio transmitter (Lotek, Newmarket, ON, Canada). We attached the radio transmitters for the 2014 release to a backpack harness. The radio transmitters for the 2015 and 2016 releases came attached to a leather leg mount; we placed them above the left hock. Additionally, we deployed a Global Positioning System/Global System for Mobile (GSM) Communication transmitter (North Star Science and Technology, Oakton, VA, USA) or cellular transmitter terminal (CTT) for the first time using a backpack harness on a 2016 release crane (1507) in the Ocean Springs Unit. CCTs operate using the GSM cellular network to provide accurate GPS location data. When out of cellular range, the CTT will still log GPS data and store the data until it is back in range.

Monitoring

To monitor crane response and assess progress towards recovery, we collected 3,043 observations of individuals in the population, including 948 radio locations, 1,976 visual-only, and 119 aural observations, as well as tens of thousands of camera trap images. Of these, 2,394 (79%) were located on the Refuge. Using the ArcMap 10.5 (ESRI, Redlands, CA, USA) convex hull function, the total range of all locations was 28,087 ha, excluding the 2 outliers described below. We determined that 43% of the locations were in scrub/shrub, 14% in grassland, 12% in palustrine scrub/shrub wetland, 9% in cultivated/

pasture/hay, 6% in evergreen forest, 5% in palustrine emergent wetland, 3% in low intensity developed, and 8% in other habitats. From December 2015 through December 2016, we obtained 2,155 locations from the GSM-CTT for crane 1507. She had a 3,812-ha range with 54% locations in cultivated, 19% in scrub/shrub, 10% in evergreen forest, 6% in palustrine forested wetland, 4% in palustrine emergent marsh, 4% in palustrine scrub/shrub, and 3% in other habitats.

In 2016, 2 cranes made record long post-release dispersals. Although both had working radio transmitters, they were far outside of our search area, and we only became aware of their locations by contact from state wildlife personnel through the landowners. Crane 1501 was found 50 km northwest on a dairy farm near Perkinston, Mississippi. We captured 1501 and returned him to the Refuge; he has remained nearby. Crane 1506 was located 114 km west in a residential subdivision near Abita Springs, Louisiana. He died from predation before we were able to capture and return him. The previous long-distance dispersal was 35 km in 2006, when a cohort flew east and returned in less than a week. Nearly all other dispersals were 6 km or less.

We captured only 4 cranes (1 subadult and 3 juveniles) for banding during the period of this report. We ran and grabbed 2 pre-fledged chicks and caught a fledged juvenile from a "coffin trap" or trough blind (Folk et al. 1999). The subadult capture, used to return 1501 to the Refuge, was the first successful use of "Phai nooses" (Fig. 2), a variation of Indian toe nooses (Hereford et al. 2001), adapting aspects of the Phai hoop trap (Northwoods Falconry, Olympia, WA, USA) used in capturing raptors (Bloom et al. 2015). By attaching 0.65-mm-thick, 30-pound (13.6-kg)- test wire nooses every 10 cm to a 1.27-cm diameter × 23 cm long garden soaker hose and then securing the hose in the ground with tent stakes, the Phai noose line can be set up for capture much quicker than traditional Indian toe nooses where the noose line is secured into the ground 1 noose at a time. We spliced multiple hose lines together with barb fittings. Like Indian toe nooses, we can place the Phai nooses in concentric circles around bait or in lines perpendicular to known crane walking lanes. We also began tests of a drop net, pneumatic net gun, and a battery-triggered snare.

Nesting

We conducted the annual nest census over 30 days in 2014, 21 days in 2015, and 75 days in 2016. We used camera traps at 29 areas, all on the Refuge, and conducted tens of road surveys, call surveys, and early morning blind surveys. We conducted 151 ground searches/visits, 11 surveys using all-terrain vehicles, 3 boat surveys, and 175 total area visits to 61 different areas. During the 3-year period, we accounted for 102 nests. We limited live nests visits to 28. There

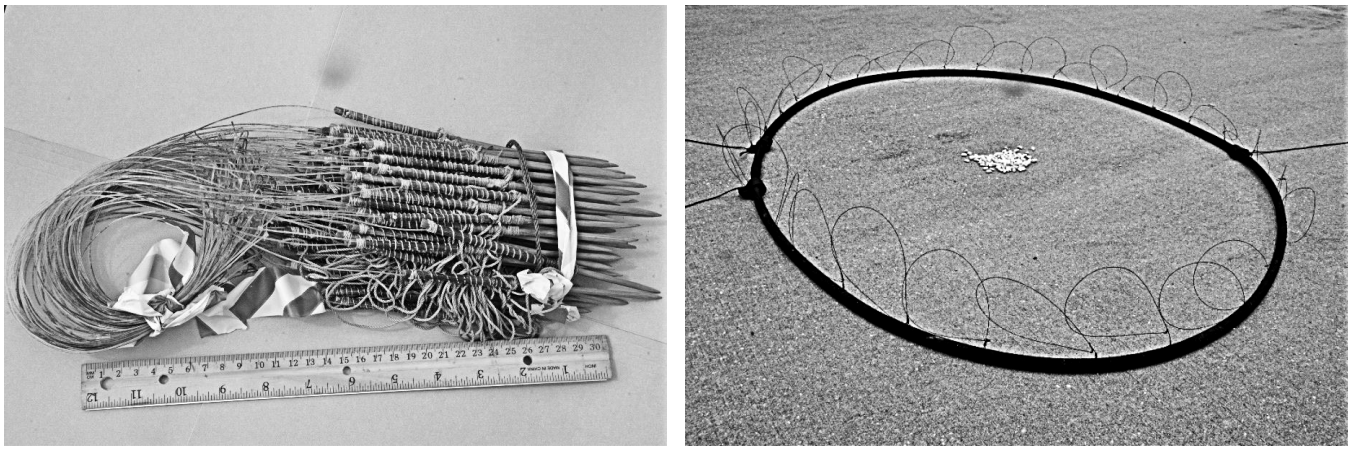

Figure 2. Toe nooses used to capture cranes. One line of 90 traditional Indian toe nooses (left) secured with flagging while not in use. Each noose of 30-pound (13.6-kg)-test fishing line is tied to a wooden stick and the sticks are attached in a series with string. To deploy, each stick is secured in the ground 1 at a time. "Phai" noose line (right) has 0.65-mm thick wire nooses attached to a garden hose and is faster and easier to set up. The hose is secured in place with a few tent stakes, either to attached lines or directly over the hose. Multiple concentric noose lines can be placed in circles around bait.

were 22 pairs and 36 nests in 2014, 24 pairs and 35 nests in 2015, and 23 pairs and 31 nests in 2016. Six chicks fledged in each of the 3 years, with 18 being the highest 3-year total ever documented. There were 7 new nesting pairs and 4 new territories established during the 2014-2016 period. Other nesting highlights included the fourth and fifth set of twin fledglings since monitoring began, the first nest in a power line right-of-way, the first nest in the Brown's Trail 1A territory since 1997, the first fledged chick from the Ben Williams territory, and the first fledging from the Little German territory, which was first used in 1997 and has been occupied in at least 16 of those 20 years. We removed 12 eggs, 1 each from 12 nests, (7 in 2014, 2 in 2015, and 3 in 2016); eggs went to ASSC for captive rearing for later releases.

We continued to search for additional means of locating crane nests and chicks in order to assess productivity and progress towards recovery, as well as plan prescribed burns during the growing season. In 2016, we first tested a proof-of-concept for using Unmanned Aerial Systems (UAS) to detect crane nests and chicks from the air. Innovative Imaging Research (I2R, Stennis Space Center, MS, USA) used a hexacopter micro-UAS with various imaging systems over 2 areas. On the 12-ha first test area, I2R flew 3 missions at 100-m altitude using single (RGB or red green blue) or dual (RGB/NGB or near infrared green blue) camera configurations, capturing still images every 4 or 5 seconds. Prior to the flight missions, Refuge staff had placed fake eggs on a nest platform and 3 crane decoys within the test area. I2R post-processed the image data to create GID-ready georeferenced map mosaics. For the 13-ha second area, I2R tested use of a ground-based FPV (real-time, first-person view camera) monitor with the hexacopter flying at 30-m altitude to locate a known nest. Unfortunately, we were unable to detect any of the nests or decoy cranes, but recommendations for future tests include flying at lower altitudes, using a high-definition 1080p video camera recording system,

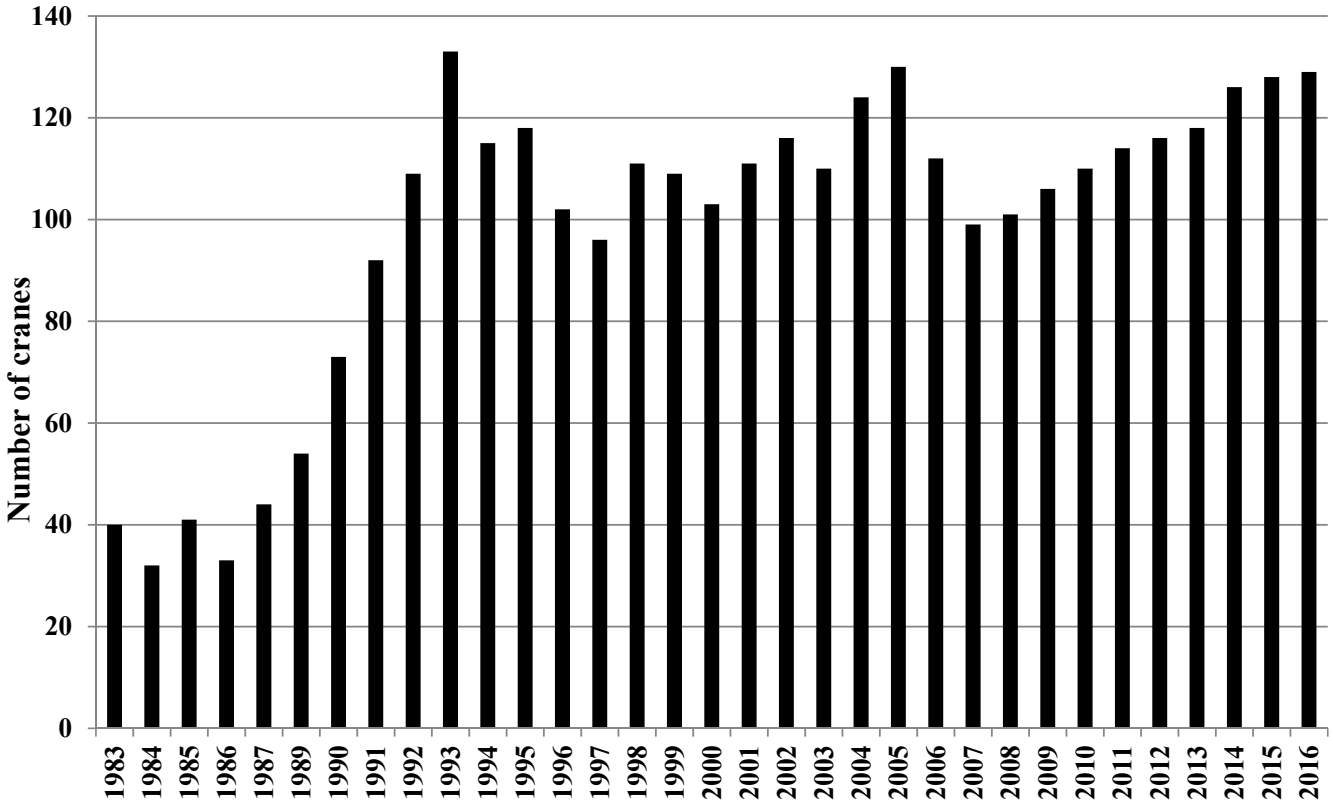

Figure 3. Year-end population of Mississippi sandhill cranes on and near the Mississippi Sandhill Crane National Wildlife Refuge, Jackson County, Mississippi, 1983-2016.

an infrared sensor, a circular polarized transmitter/receiver, and FPV goggles.

We thought that light sport aircraft (ultralight) aircraft, flying low and slow, could be utilized to locate crane nests. In May 2016, with Refuge permission, a local private pilot flying a modified Quicksilver 2-seater ultralight at 55 km/hour at 45-m altitude located an active crane nest in the Fontainebleau Unit. The incubating adult remained on the nest during the flyover. During 1 morning in 2016, we also tested the utility of humans on horseback when 2 Refuge personnel rode horses through a 24-ha area. They were able to search a much larger area per hour than walking observers, but the horses bogged down in the wet savannas and bogs and were ineffective in habitats where nests were frequently located. No cranes were encountered during the survey.

Population

We recovered the remains of 19 after-hatch-year cranes—7 in 2014, 6 in 2015, and 7 in 2016. Of 18 with known or suspected causes of death, 3 were due to predation, 2 to disease, 13 to trauma, and 1 to other causes. Nine of the 13 trauma deaths were due to vehicle collisions. Eight were discovered by the public, 9 during surveys, and 2 were found incidentally. Another 16 birds were missing and presumed dead—3 in 2014, 8 in 2015, and 5 in 2016.

The December 2016 population was 129 cranes, up 9% from 3 years earlier, 103 of which were banded (Fig. 3). There were 57 males, 60 females, and 12 of unknown sex. Sixty-six were in the Gautier Unit (east) area, 47 in the Ocean Springs (west) area, and 16 in the Fontainebleau (south) area. The population consisted of 66 cranes that had been reared at ASSC, 22 at WOCC, and 3 at the Patuxent Wildlife Research Center, Laurel, Maryland, and 38 cranes that were wild-hatched. There were 25 breeding pairs, an additional 8 behavioral pairs, and 63 unpaired cranes. At least 30 cranes were 3 years of age or younger. The oldest marked crane was 27 years old.

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