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PREDATORS AND SCAVENGERS OF EASTERN MIGRATORY WHOOPING CRANE EGGS

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PREDATORS AND SCAVENGERS OF EASTERN MIGRATORY WHOOPING CRANE EGGS

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Abstract: The Eastern Migratory Population of whooping cranes (*Grus americana*) is not yet self-sustaining, primarily due to low recruitment. We deployed 81 cameras on whooping crane nests in Wisconsin during 2019-2024 to determine the fate of each nest. We identified 7 instances of depredation of crane eggs and 10 of abandoned eggs that were later scavenged. Coyotes (*Canis latrans*, *n* = 3 nests) and raccoons (*Procyon lotor*, *n* = 2) were the primary predators of crane eggs. We documented common ravens (*Corvus corax*, *n* = 2 nests), American crows (*Corvus brachyrhynchos*, *n* = 2), a bald eagle (*Haliaeetus leucocephalus*, *n* = 1), a common snapping turtle (*Chelydra serpentina*, *n* = 1), a sandhill crane (*Grus canadensis*, *n* = 1), a raccoon (*n* = 1), an American mink (*Neovison vison*, *n* = 1), and an unidentified mammal (*n* = 1) scavenging whooping crane eggs. Identifying the fate of whooping crane nests and potential predators or scavengers of whooping crane eggs can inform future management of this endangered species and their breeding habitat.

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Key words: depredation, *Grus americana*, nesting, predator, recruitment, reintroduction, reproduction, scavenger, whooping crane, Wisconsin.

The reintroduced Eastern Migratory Population (EMP) of whooping cranes (*Grus americana*) began when captive-reared cranes were released into the eastern flyway in 2001. As of 2024, the population is not yet self-sustaining and relies on continued releases of captive-reared individuals for population growth (Thompson et al. 2022, ICF 2024). Low recruitment rates are a primary driver of slow population growth (McLean 2019, Thompson et al. 2022). We documented cases of nest predation and identified specific species of predators responsible to inform future management of the population and whooping crane nesting habitat in Wisconsin. We also report on cases of scavengers eating abandoned eggs to identify species that could consume crane eggs but may be less of a threat to crane egg depredation if the adults are present at and defending the nest.

Biologists banded captive-reared whooping cranes in the EMP prior to release (rearing techniques described by Hartup 2019), or prior to separation from their parents for wild-hatched cranes, with a unique combination of leg bands and 1-2 transmitters (Very High Frequency [VHF], Advanced Telemetry Systems, Isanti, Minnesota, USA; Platform Transmitting Terminal [PTT], Microwave Telemetry Inc., Columbia, Maryland, USA; or Global System for Mobile Communication [GSM], Ornitela, Vilnius, Lithuania, Microwave Telemetry Inc., Columbia, Maryland, USA; Urbanek 2018). We monitored known breeding areas using aerial and ground surveys, remote transmitter data, and reports from landowners or the public. Once a nest was located, we deployed a camera near the nest, using the same technique as McKinney (2014), Jaworski (2016), Thompson and Gordon (2020), and Gordon et al. (2022). During 2020-2024, we collected habitat data at the nest during camera retrieval after the nesting period to reduce disturbance. We recorded the distance to closed vegetation in each of the cardinal directions using a rangefinder (Nikon PROSTAFF 7 or Bushnell Elite 1500) and the water depths at each meter, from 1-5 m from the nest in each of the cardinal directions (as in Strobel and Giorgi 2017). Using ArcGIS Pro 3.2.2 (ESRI, Redlands, California, USA), we used the 'Near' tool to measure the distance to the nearest road as identified by the Wisconsin County and Local Roads layer supplied by the Wisconsin Department of Natural Resources (WDNR). We also used a 'spatial join' in ArcGIS Pro to determine the size of the wetland from the Wisconsin Wetlands Inventory (WDNR). We used ANOVAs in R (R Core Team 2023) to compare habitat characteristics of predated and non-predated nests (distance to roads, wetland size, average water depth around the nest, and the minimum distance to closed vegetation).

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The nests in this study were located throughout the breeding range of the EMP (Fig. 1) and included the core breeding and release areas at Necedah and Horicon National Wildlife Refuges (NWR; n = 43 at Necedah NWR, n = 4 at Horicon NWR), White River Marsh State Wildlife Area (SWA; n = 11), other properties owned by WDNR (McMillan and Meadow Valley SWAs, n = 4), and private properties in Sauk (n = 5), Juneau (n = 4), St. Croix (n = 4), Green Lake (n = 3), Portage (n = 2), and Adams (n = 1) Counties in Wisconsin (Table 1). Necedah NWR is in the Central Sand Plains of Wisconsin, which is characterized by sandy soils, and includes emergent sedge meadow and managed wetlands, oak-pine (*Quercus* and *Pinus* spp.) barrens, sand prairies, and mixed forests (Strobel and Giorgi 2017). White River Marsh SWA and Horicon NWR are both in eastern Wisconsin, which is predominantly agricultural, but is interspersed with wetlands, grasslands, and forests (Van Schmidt et al. 2014). The other WDNR properties are large wetlands, similar to and not far from Necedah NWR, and the private properties where cranes nested were primarily smaller wetlands surrounded by agriculture.

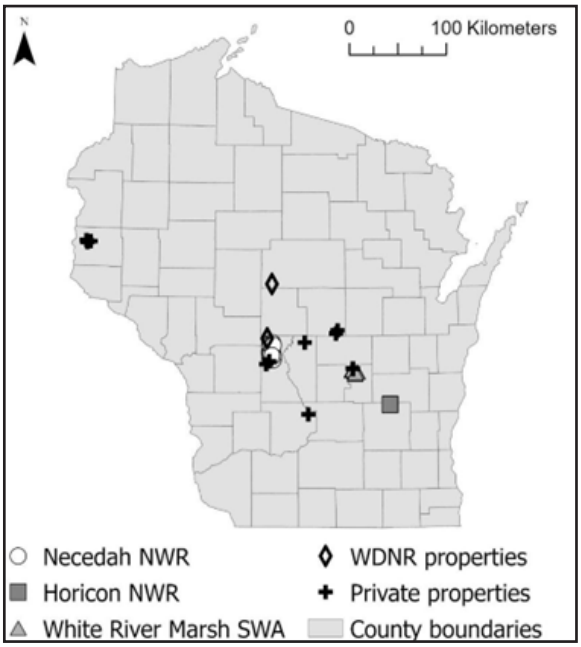

Figure 1. Map of nesting areas in Wisconsin of whooping cranes in the Eastern Migratory Population that were monitored with cameras during 2019-2024. Nests were at Necedah National Wildlife Refuge (NWR, n = 43), Horicon NWR (n = 4), White River Marsh State Wildlife Area (SWA, n = 11), other properties owned by the Wisconsin Department of Natural Resources (WDNR, n = 4), or by private landowners (n = 19).

Table 1. Whooping crane nests monitored with cameras on the breeding grounds in the Eastern Migratory Population (EMP) during 2019-2024, with a focus on those that were depredated or abandoned and scavenged. The primary breeding and release locations were Necedah National Wildlife Refuge (NNWR) and Horicon National Wildlife Refuge (HNWR) in Juneau and Dodge counties, respectively, and White River Marsh State Wildlife Area (WRM) in Green Lake County, Wisconsin. The rest of the crane nests were on property owned by the Wisconsin Department of Natural Resources (WDNR) in Juneau or Marathon counties, or on private properties in Sauk (n = 5), Juneau (n = 4), St. Croix (n = 4), Green Lake (n = 3), Portage (n = 2), and Adams (n = 1) Counties, Wisconsin. (below)

Location	Years	No. monitored	No. with known fates	No. depredated	No. abandoned and scavenged	No. hatched 1 egg and 2nd egg scavenged	Predators (n)	Scavengers (n)
NNWR	2019-2024	43	40	3	3	0	coyote (1), raccoon (1), unknown (1)	common raven (2), sandhill crane (1)
WRM	2019-2024	11	11	2	2	0	coyote (1), raccoon (1)	raccoon (1), American crow (1)
HNWR	2020-2023	4	4	0	0	0	none	none
WDNR properties	2019-2021	4	4	1	0	1	coyote (1)	bald eagle (1[a])
Private properties	2019-2024	19	19	1	2	2	unknown (1)	American mink (1), common snapping turtle (1), American crow (1[a]), unidentified mammal (1[a])
Total	2019-2024	81	78	7	7	3	coyote (3), raccoon (2), unknown (2)	common raven (2), American crow (1), sandhill crane (1), raccoon (1), American mink (1), common snapping turtle (1)

[a] Species observed at nest where 1 egg hatched and the second egg was abandoned and then scavenged.

During 2019-2024, we monitored 81 EMP whooping crane nests using cameras. Some cameras failed prior to nest completion (4%, n = 3) and we were not able to determine the cause of nest failure. Overall, we documented 7 cases of nest depredation (9% of nests with known fates), and we could confirm the specific predator at 5 nests (Table 2). At WDNR properties in Juneau and Marathon Counties, 25% failed due to predation (1 of 4 nests with known fates), 18.2% were predated at White River Marsh SWA (2 of 11 nests), 7.5% at Necedah NWR (3 of 40 nests), 5.3% on private properties (1 of 19 nests), and 0% at Horicon NWR (0 of 4 nests). Most predation events (85.7%, 6 of 7 events) occurred during nighttime and only 1 was documented during daylight.

We documented 2 species of predators at whooping crane nests across all sites in all years. The predator detected most often was coyote (*Canis latrans*) which was responsible for 60% of all nest depredations with known predators (3 of 5 nests with known predators). We detected coyotes eating whooping crane eggs at Necedah NWR, White River Marsh SWA, and on WDNR property in Juneau County (Fig. 2). We also documented nest predations by raccoon (*Procyon lotor*, 2 of 5 nests with known predators). Raccoons were nest predators at Necedah NWR (Fig. 3) and White River Marsh SWA.

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Table 2. Information about whooping crane nests monitored by cameras, that were depredated during 2019-2024. Nesting sites included White River Marsh State Wildlife Area (WRM), a private property in St. Croix County, a Wisconsin Department of Natural Resources property at Meadow Valley Wildlife Area (WDNR), and Necedah National Wildlife Refuge (NNWR), all in Wisconsin. Bird ID numbers, ages, and rearing methods are listed for both male (M) and female (F) adult cranes. We collected habitat data at the nest after the eggs were predated and recorded the distance to closed vegetation in each of the cardinal directions (minimum distance reported here), the distance to the nearest road, the size of the wetland, and the water depths at each meter from 1-5 m from the nest in each of the cardinal directions (average reported here). Rearing methods included costume-rearing (CR), parent-rearing (PR), and wild-hatched (W), as described by Hartup (2019).

Bird IDs (m/f)	Site	Predator	Date and time of predation	Min. dist. to closed vegetation (m)	Dist. to road (m)	Wetland size (ha)	Avg. water depth (cm)	Age (years) (M/F)	Rearing method (M/F)
4-12 / 3-14	WRM	coyote	2 May 20 1:20	39.5	107.9	36.8	46.5	8/6	CR/CR
1-11 / 59-13	St. Croix	unknown	1 May 21 4:58	2	51.0	0.43	38.9	10/8	CR/CR
19-10 / 7-11	WDNR	coyote	4 May 21 4:14	140.9	491.8	56.3	37.4	11/10	CR/CR
9-05 / 13-03	NNWR	unknown	19 May 21 7:40	2.5	114.3	12.0	37.1	16/18	CR/CR
30-16 / W3-17	WRM	raccoon	22 April 22 0:29	9.8	923.0	391.0	25.1	7/6	PR/W
7-07 / W3-10	NNWR	coyote	30 May 23 21:55	105	322.1	6.9	NA[a]	16/13	CR/W
13-02 / 24-08	NNWR	raccoon	11 May 24 22:11	35	79.5	0.4	39.2	22/16	CR/CR

[a] Water depth not available due to drought drying the marsh around the nesting site when habitat data were collected.

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Overall, depredated nests were on relatively small wetlands (0.4-56.3 ha) except for 1 at White River Marsh SWA (391.0 ha). Five of 7 nests were 2-39.5 m from the closed vegetation;1 nest was 105 m distant and 1 was 140.9 m. The average water depths around the nests were between 25.1 and 46.5 cm. The nest on private property in St. Croix County was in a small wetland on a quarry used to make concrete. All other depredated nests were in state or federally owned protected areas. There were no differences in habitat between predated and non-predated nests (distance to roads: $F = 1.73$, df = 1, $P = 0.19$; wetland size: $F = 0.01$, df = 1, $P = 0.94$; water depth: $F = 0.22$, df = 1, $P = 0.64$; distance to closed vegetation: $F = 0.56$, df = 1, $P = 0.46$); however, sample sizes of predated nests were small ($n = 7$).

For nests that were abandoned, we documented 5 species scavenging the remaining eggs. We documented scavenging of crane eggs at abandoned nests by common ravens (*Corvus corax*, $n = 2$), common snapping turtle (*Chelydra serpentina*, $n = 1$), sandhill crane (*Grus canadensis*, $n = 1$), American crow (*Corvus brachyrhynchos*, $n = 1$), raccoon ($n = 1$), and American mink (*Neovison vison*, $n = 1$). We also documented 3 nests that had 1 egg hatch, and the pair abandoned the second egg which was later scavenged by a bald eagle (*Haliaeetus leucocephalus*, $n = 1$), an American crow ($n = 1$), or an unknown mammal ($n = 1$).

Predation of crane eggs was relatively uncommon (9%), which is comparable to previous nesting years. During 2014-2016, nest predation rates were even lower at Necedah NWR and Meadow Valley SWA (3.5%); in contrast, sandhill crane nests monitored during the same period exhibited higher nest predation rates and scavenging was not recorded (18.2%, McKinney 2014, Jaworski 2016). No whooping crane nest predation events were recorded at Horicon NWR during this study; however, we only monitored 4 nests. Similarly, during 2018-2020, only 1 nest predation event was observed out of 46 monitored sandhill cranes nests at Horicon NWR (Berzins 2020).

Figure 2. A coyote eating whooping crane eggs at Meadow Valley Wildlife Area, a property owned by the Wisconsin Department of Natural Resources in Juneau County, Wisconsin, during 2021.

Figure 3. A raccoon eating a whooping crane egg at Necedah National Wildlife Refuge during 2024, while a whooping crane tries to defend the nest.

Raccoons and coyotes are omnivorous habitat generalists, known for predating and scavenging nests (Littlefield 2003, Maxson et al. 2008, Butler 2009). The majority of predated nests were attributed to coyotes, possibly due to their larger body size compared to whooping cranes. Furthermore, coyote and raccoon exhibit higher occupancy and relative abundance compared to other predator species found in whooping crane breeding areas (Necedah NWR, White River Marsh SWA, and Horicon NWR; Gordon 2024), making them more likely to prey on nests (Littlefield 1995, Littlefield 2003, Fino 2023). Conversely, Urbanek

(2015) documented raccoons as the most frequently recorded potential chick scavengers at Necedah NWR, followed by gray wolves (*Canis lupus*), striped skunks (*Mephitis mephitis*), American minks, short-tailed weasels (*Mustela erminea*), and American badgers (*Taxidea taxus*). We documented a diverse range of species scavenging eggs, with the majority being avian species. The difference in species observed scavenging eggs compared to those preying directly on nests may be attributed to whooping cranes successfully defending their nests against smaller or less aggressive predators.

Although nest success for the EMP has been relatively high with low instances of nest depredation, recruitment rates remain low. Notably, during 2016-2018 predation was responsible for 32% and 16.2% of whooping crane and sandhill crane chick mortalities, respectively (Stewart 2020), contributing to low fledging rates. Nest predators may differ from those that target chicks or adults, yet there can be significant overlap among these predator groups. Therefore, identifying nest predator species is crucial for better understanding predator communities near breeding birds and chicks. This understanding may inform future habitat or predator management strategies or predator aversion training, ultimately increasing survival and recruitment in the EMP. Future research should focus on comparing nest habitat characteristics at predated versus successful nests to gain insights into predator habitat use and efficacy of predator aversion training for captive-reared cranes prior to release. This information can guide habitat management practices aimed at decreasing the risk of nest and chick predation.

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