

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Transactions of the Nebraska Academy of Sciences
and Affiliated Societies

Nebraska Academy of Sciences

3-15-2017

Early emergence and seasonality of the Red-bellied Snake (*Storeria occipitomaculata*) along the Platte River in south-central Nebraska, USA

Simon P. Tye

University of Nebraska, Kearney, stye@icloud.com

Keith Geluso

University of Nebraska—Kearney

Mary J. Harner

University of Nebraska—Kearney

Follow this and additional works at: <http://digitalcommons.unl.edu/tnas>



Part of the [Biodiversity Commons](#), and the [Zoology Commons](#)

Tye, Simon P.; Geluso, Keith; and Harner, Mary J., "Early emergence and seasonality of the Red-bellied Snake (*Storeria occipitomaculata*) along the Platte River in south-central Nebraska, USA" (2017). *Transactions of the Nebraska Academy of Sciences and Affiliated Societies*. 507.

<http://digitalcommons.unl.edu/tnas/507>

This Article is brought to you for free and open access by the Nebraska Academy of Sciences at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Transactions of the Nebraska Academy of Sciences and Affiliated Societies by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Early emergence and seasonality of the Red-bellied Snake (*Storeria occipitomaculata*) along the Platte River in south-central Nebraska, USA

Simon P. Tye,¹ Keith Geluso,¹ and Mary J. Harner^{1,2}

¹ Department of Biology, University of Nebraska at Kearney, 68849, USA

² Department of Communication, University of Nebraska at Kearney, 68849, USA

Corresponding author: Simon P. Tye, Department of Biology, University of Nebraska at Kearney, 68849. stye@icloud.com

Abstract: The Red-bellied Snake (*Storeria occipitomaculata*) primarily inhabits moist woodlands of eastern North America, with two disjunct populations occurring in the Great Plains, one of which is in south-central Nebraska. This species is listed as at-risk in Nebraska, in part, due to being uncommon with limited information available about the ecology and natural history of this isolated population. We amassed 48 observations of Red-bellied Snakes in Nebraska from museum specimens and published accounts, including our observations and others reported to us published herein. The previous earliest documented date of spring emergence was 6 April from a specimen collected in 1999. On 12 March 2016, we observed an adult Red-bellied Snake along the Platte River in Buffalo County, Nebraska, which predates the previous earliest documented emergence date by almost a month. It is unclear whether our observation represents an unusual behavior related to an unseasonably warm winter or a normal occurrence that has remained undocumented for this secretive, uncommon snake. Our summary of observations in Nebraska demonstrates Red-bellied Snakes are active March through October, with peaks in observations in April/May and September. This disjunct population occurs within the Big Bend Reach of the Platte River in south-central Nebraska, which is a major spring stopover site for migratory Sandhill Cranes (*Antigone canadensis*). Emergence in March by these snakes greatly increases predation risks by opportunistically foraging cranes. Additional ecological information is warranted for this disjunct population, as use of the Platte River flood plains by Sandhill Cranes has increased during the last half century, and removal of riparian forests has been a common habitat management practice for Sandhill Cranes and endangered Whooping Cranes (*Grus americana*).

Keywords: emergence, floodplain, land management, Nebraska, Red-bellied Snake, seasonality, *Storeria occipitomaculata*

doi:10.13014/K2Z31WJ3

The Red-bellied Snake (*Storeria occipitomaculata*) primarily occurs in eastern North America, from Saskatchewan to Nova Scotia south to eastern Texas and central Florida, with disjunct populations in the Black Hills of South Dakota and adjacent Wyoming, as well as in south-central Nebraska (Ernst and Ernst 2003, Fogell 2010). This snake typically inhabits moist woodlands but also occurs in open fields, grassy habitats, and moist meadows within forests or near water (Ernst and Ernst 2003, Ballinger et al. 2010). In Nebraska, Red-bellied Snakes only have been observed within the Platte River flood plain in five counties: Buffalo, Dawson, Hall, Kearney, and Phelps (Fogell 2010, Geluso 2012). The Red-bellied Snake is listed as a Tier 2, at-risk species in Nebraska (Schneider et al. 2011), in part, because it is relatively uncommon throughout its range (Ernst and Ernst 2003, Ballinger et al. 2010) and limited information is available about the ecology and natural history of this disjunct population (Ballinger et al. 2010, Fogell 2010, Geluso and Harner 2013b). This species likely is active year-round in the southernmost parts of their range, such as in Florida and the Carolinas (Ernst and Ernst 2003), but they are

documented active only from March to October in Kansas, Missouri, and Virginia (Ernst and Ernst 2003); from May to October in the Black Hills of South Dakota (Kiesow 2006); and from April to October along the Platte River in Nebraska (Ballinger and Beachly 1999, Geluso 2012, Geluso and Harner 2013b). Herein, we report the earliest emergence date for Red-bellied Snakes in Nebraska; summarize data from museum specimens, published accounts, and unpublished observations to determine seasonal above-ground activity in the state; and discuss implications of early emergence of herpetofauna coinciding with an abundance of migratory birds, notably Sandhill Cranes (*Antigone canadensis*), along the Platte River in spring.

We observed an adult Red-bellied Snake on 12 March 2016 at about 1400 h Central Standard Time along the Platte River near Gibbon, Buffalo County, Nebraska (Fig. 1; 40.6680°N, 98.8897°W, WGS 84, 633 m elev.) crossing a dirt two-track road at the Iain Nicolson Audubon Center at Rowe Sanctuary. The observation site was located about 75 m south of an active channel of the Platte River. A narrow, deciduous riparian forest about 20-m wide was



Figure 1. Red-bellied Snake (*Storeria occipitomaculata*) observed in Buffalo County, Nebraska, on 12 March 2016, on a dirt road near adjacent to a riparian woodland and agricultural field. Photograph by M. Harner.

situated between the river and road, with an overstory dominated by mature Plains cottonwood (*Populus deltoides* var. *occidentalis*), green ash (*Fraxinus pennsylvanica*), and white mulberry (*Morus alba*), and an understory dominated by rough-leaf dogwood (*Cornus drummondii*). Other species of trees and shrubs in the forest included American elm (*Ulmus americana*), Siberian elm (*Ulmus pumila*), Russian-olive (*Elaeagnus angustifolia*), eastern red-cedar (*Juniperus virginiana*), smooth sumac (*Rhus glabra*), plum (*Prunus* spp.), and American bittersweet (*Celastrus scandens*). Botanical names follow Kaul et al. (2006). Eastern

red-cedars comprised < 10% of the forest. South of the road was an agricultural field rotated annually with corn and soybeans. In 2015, the portion of the field closest to the capture site was planted with soybeans, whereas the western part of the field was planted with corn. Weather conditions included a high temperature of 14°C and clear skies until about 1100 h, followed by overcast conditions. The previous day, the high temperature was 22°C with clear skies and S to SW winds. The overnight low temperature was -2°C and occurred at about 0700 h on 12 March (Kearney Municipal Airport, www.wunderground.com).

We amassed a total of 48 observations of Red-bellied Snakes, including 33 voucher specimens housed in museums ($n = 25$, University of Nebraska State Museum in Lincoln, UNSM; $n = 3$, University of Nebraska at Kearney, UNK; and $n = 5$, Sternberg Museum of Natural History in Hays, Kansas, FHSM), 5 observations from published accounts (Geluso and Harner 2013b), and 10 additional observations reported herein to summarize known seasonal activity of this species in Nebraska (Table 1). Those records indicate that observations occurred in March ($n = 1$), April ($n = 5$), May ($n = 4$), June ($n = 1$), July ($n = 3$); July-August ($n = 7$), August ($n = 7$), September ($n = 14$), and October ($n = 6$). Some specimens donated to the UNSM were labeled July-August, as specific data on month was not provided with specimens. Based on previously published accounts, the earliest seasonal date of occurrence was 6 April 1999 (UNSM ZM# 16282, Ballinger and Beachly 1999) and the latest was 24 October 2011 (FHSM #16161, Geluso 2012). Our observation on 12 March 2016 represents the earliest date of occurrence for Red-bellied Snakes in Nebraska by 28 days. This early observation

of aboveground activity might reflect a general warming trend across the United States (Bathke et al. 2014) or a paucity of emergence data for the species in Nebraska, with the species previously emerging in March, albeit undocumented. A museum record collected on 28 October 2011 (FHSM #16163, Table 1) extends the known activity period in autumn by 4 days.

Aboveground seasonal activity of Red-bellied Snakes in Nebraska, spanning March to October, matches the period when these snakes are active in adjacent, southerly states of Kansas and Missouri (Ernst and Ernst 2003), rather than the population in the Black Hills of South Dakota that is active from May to October (Kiesow 2006). The longer seasonal period of activity in the southern populations might be associated with warmer winter temperatures and longer frost-free periods in these areas. For example, northwestern Nebraska, immediately south of the Black Hills, has later spring freeze dates and earlier autumn freeze dates than south-central parts of the state (Lawson et al. 1977). Warmer temperatures and sunny days during winters can lead temperate ectotherms



Figure 2. Open cottonwood woodland with grassy understory where many observations of Red-bellied Snakes (*Storeria occipitomaculata*) were documented in Dawson County, Nebraska, during the last 30 years. Photograph by M. Peyton, October 2016.

Table 1. List of museum records and observations for Red-bellied Snakes (*Storeria occipitomaculata*) in central Nebraska. Museums that house specimens from Nebraska include the University of Nebraska State Museum (UNSM), University of Nebraska at Kearney (UNK), and Sternberg Museum in Hays, Kansas (FHSM).

	Date	County	Location	Habitat
1 UNK 161	20 Sep 1967	Buffalo ¹	1 mi S Odessa	
2 UNK 423	31 Aug 1987	Dawson ¹	3 km S, 2 km E Gothenburg ²	Along drainage ditch near homestead in agricultural area
3 UNK 424	31 Aug 1987	Dawson ¹	3 km S, 2 km E Gothenburg ²	Along drainage ditch near homestead in agricultural area
4 UNSM 9290	Sep 1987	Dawson	1.5 mi E, 3 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
5 UNSM 9883	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
6 UNSM 9884	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
7 UNSM 9885	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
8 UNSM 9886	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
9 UNSM 9887	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
10 UNSM 9888	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
11 UNSM 9889	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
12 UNSM 9890	Sep 1989	Dawson	2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
13 UNSM 9956	14 Sep 1989	Dawson	3 mi S, 2 mi E Gothenburg ²	Open cottonwood woodland with grassy understory
14 UNSM 9781	23-28 Aug 1988	Dawson	2 mi E, 2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
15 UNSM 9782	23-28 Aug 1988	Dawson	2 mi E, 2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
16 UNSM 9783	23-28 Aug 1988	Dawson	2 mi E, 2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
17 UNSM 9784	23-28 Aug 1988	Dawson	2 mi E, 2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
18 UNSM 9785	23-28 Aug 1988	Dawson	2 mi E, 2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
19 UNSM 9786	14 May 1988	Dawson	2 mi E, 2 mi S Gothenburg ²	Open cottonwood woodland with grassy understory
20 UNSM 15015	Jul-Aug 1991	Dawson	T11N, R25W, Sec. 36 ²	Open cottonwood woodland with grassy understory
21 UNSM 15016	Jul-Aug 1991	Dawson	T11N, R25W, Sec. 36 ²	Open cottonwood woodland with grassy understory
22 UNSM 15017	Jul-Aug 1991	Dawson	T11N, R25W, Sec. 36 ²	Open cottonwood woodland with grassy understory
23 UNSM 15018	Jul-Aug 1991	Dawson	T11N, R25W, Sec. 36 ²	Open cottonwood woodland with grassy understory
24 UNSM 15019	Jul-Aug 1991	Dawson	T11N, R25W, Sec. 36 ²	Open cottonwood woodland with grassy understory
25 UNSM 15020	Jul-Aug 1991	Dawson	T11N, R25W, Sec. 36 ²	Open cottonwood woodland with grassy understory
26 UNSM 15021	Jul-Aug 1991	Dawson	T11N, R25W, Sec. 36 ²	Open cottonwood woodland with grassy understory
27 UNSM 16282	6 Apr 1999	Hall ³	4.5 mi N, 1 mi E Prosser	Open cottonwood woodland with grassy understory
28 UNSM 19189	20 Apr 1997	Phelps	5 mi S, 2 mi W Elm Creek	Edge of riparian forest under cover board
29 FHSM 14700	26 Jun 2009	Hall	40.7941°N, 98.4007°W	On dirt road in tallgrass prairie adjacent to Platte River
30 FHSM 15628	24 Apr 2010	Hall	40.7924°N, 98.4451°W	On road between riparian forest and cornfield
31 FHSM 16161	24 Oct 2011	Kearney ⁴	40.6549°N, 99.1245°W	On road in prairie with scattered trees near riparian forest
32 FHSM 16163	28 Oct 2011	Hall	40.7985°N, 98.3978°W	On road in a small riparian forest surrounded by prairie
33 FHSM 16543	22 Jul 2013	Hall	40.8082°N, 98.3803°W	

	Date	County	Location	Habitat
34	sighting	Hall ⁵	40.7968°N, 98.4456°W	Tallgrass prairie under cover board in slough
35	sighting	Hall ⁵	40.7968°N, 98.4456°W	Tallgrass prairie under cover board in slough
36	sighting	Hall ⁵	40.7968°N, 98.4456°W	Tallgrass prairie in bucket in upland next to slough
37	sighting	Hall ⁵	40.7842°N, 98.4691°W	Tallgrass prairie under cover board in slough
38	sighting	Hall ⁵	40.7950°N, 98.4464°W	Tallgrass prairie in bucket in upland next to slough
39	sighting	Hall	40.7941°N, 98.4007°W	Edge of riparian forest under cover board (same loc. as #29)
40	sighting	Hall	40.7941°N, 98.4007°W	Edge of riparian forest under cover board (same loc. as #29)
41	sighting	Hall	40.7877°N, 98.4652°W	Near building in prairie with riparian forest nearby
42	sighting	Hall	40.7941°N, 98.4007°W	Edge of riparian forest under cover board (same loc. as #29)
43	sighting	Hall	40.7951°N, 98.4434°W	On dirt road in tallgrass prairie adjacent to Platte River
44	sighting	Hall	40.7899°N, 98.4662°W	Grassy habitat along intermittent slough in riparian forest
45	sighting	Buffalo	40.6680°N, 98.8897°W	Between riparian forest and agricultural field on dirt road
46	sighting	Buffalo	40.6699°N, 98.8860°W	On sidewalk in grassy habitat with nearby scattered trees
47	sighting	Buffalo	40.6699°N, 98.8860°W	On sidewalk in grassy habitat with nearby scattered trees
48	sighting	Dawson	40.8825°N, 100.1293°W ²	Open cottonwood woodland with grassy under-story

¹Specimen cited in Peyton (1989).

²All specimens and sightings were collected within 1.6 km of each other in an open cottonwood woodland, with some cover boards also along an adjacent drainage ditch dominated by open water and cattails when snakes were captured in the 1980s and 1990s (M. Peyton, in litt.). All individuals were collected within 50 m of each other at approximately N40.8825°N, 100.1293°W, except for the two first snakes (40.8852°N, 100.1464°W) captured at a nearby homestead. The cottonwood open woodland had a sandy substratum with about 5 cm of humus and dead grass, which appeared a bit more mesic than other areas without Red-bellied Snakes in the area. Some Red-bellied Snakes were observed regurgitating slugs upon capture from this site.

³Specimen cited in Ballinger and Beachly (1999).

⁴Specimen cited in Geluso (2012).

⁵Specimen cited in Geluso and Harner (2013b); these sightings represent the 5 individuals captured under cover boards or in 5-gal buckets associated with drift fences at our 64 trapping arrays from May to September 2010. Other observations (observation #29, 30, 39-44) were observed at the study site but not while checking herpetofaunal arrays and not specifically reported in Geluso and Harner (2013b) in their Table 1.

to emerge during hibernation or emerge earlier from hibernation (Jacob and Painter 1980, Burger et al. 1988, Blouin-Demers et al. 2000). Earlier emergence phenology, however, might increase the risk of fatality by biotic and abiotic factors, including increased predation and/or exposure to lethal environmental conditions (Jacob and Painter 1980, Forrest and Miller-Rushing 2010). In central Nebraska, Wiese et al. (2016) recently observed three adult North American Racers (*Coluber constrictor*) that likely died due to exposure to freezing temperatures in Hall County, Nebraska, on 30 January 2016, after an unusually warm period in late January.

Early emergence of Red-bellied Snakes might alter inter-species interactions, especially if above-ground activities coincide with an abundance of potential predators. The Big Bend Region of Platte River in south-central Nebraska is a major spring stopover site for migratory birds traversing the Central Flyway, notably cranes. More than 500,000 Sandhill Cranes stop along the Platte River for several weeks each spring, peaking middle to late March (Kinzel et al. 2006, Krapu et al. 2014). The Platte River also is within the center of the Whooping Crane migration corridor and is a region of high stopover use intensity (Pearse et al. 2015). Both species of cranes utilize habitat and food resources associated with the river, surrounding grasslands and wetlands, and nearby agricultural lands (e.g., Reinecke and Krapu 1986, Davis and Vohs 1993, Austin and Richert 2005). Sandhill Cranes often feed on grain, especially corn, but they also consume invertebrates, such as earthworms, snails, and insects (Reinecke and Krapu 1986), as well as small vertebrates (see references in Mullins and Bizeau 1978, Hunt and Slack 1989), including snakes (<https://www.youtube.com/watch?v=RVG4Yq6Hjkl>). Whooping Cranes are opportunistic feeders and tend to be more carnivorous than Sandhill Cranes (Hunt and Slack 1989, Davis and Vohs 1993) and have been observed preying on a Gulf Saltmarsh Watersnake (*Nerodia clarkii clarkii*) on wintering grounds (Geluso and Harner 2013a), Plains Leopard Frogs (*Lithobates blairi*) at stopover sites in south-central Nebraska (Geluso et al. 2013), and other small vertebrates throughout the migration corridor (Allen 1952). Because migratory cranes forage during the day, and Red-bellied Snakes are diurnal during spring (Ernst and Ernst 2003, Geluso and Harner 2013, this study), cranes might pose a predation risk for the snakes if future emergence and migration periods coincide. Furthermore, land managers have cleared vegetation, including riparian woodlands, within and adjacent to river channels for several decades to increase view widths for roosting cranes and promote use by migrating individuals (e.g., Jenniges and Peyton 2008 and references therein). Further studies are warranted to

better understand the abundance of this disjunct population of Red-bellied Snake, its use of riparian forests along the central Platte River, and interspecies interactions under changing climatic regimes.

Acknowledgments – We thank Andrew Pierson at the Iain Nicolson Audubon Center at Rowe Sanctuary for contributing information about crop rotations and tree species present in the forest, as well as informing us about additional recent sightings. We thank Mark Peyton for information on Red-bellied Snakes and their habitats in Dawson County. We thank Tom Labeledz for creating a report of the herpetofauna of Nebraska from the Division of Zoology and the University of Nebraska State Museum on 4 February 2016. One author (KG) queried the natural history collections at University of Nebraska at Kearney for Red-bellied Snakes. Previously, KG deposited specimens of this species at the Sternberg Museum, Hays, Kansas, and we thank Curtis Schmidt for museum related matters associated with this and other projects. We thank students from Purdue University, Ben Gottesman, Andrei Toca, and Camilo Vieira, for assistance in the field, especially Elisabeth Krueger for bringing the snake to our attention. We thank an anonymous reviewer for comments on an earlier version of this manuscript.

Literature Cited

- Allen RP. (1952) *The Whooping Crane*. Research Report 3 of the National Audubon Society, New York, NY. 246 pp.
- Austin JE, and Richert AL (2005) Patterns of habitat use by whooping cranes during migration: Summary from 1977–1999 site evaluation data. *Proceedings of the North American Crane Workshop* 9:79-104.
- Ballinger RE, and Beachly W. (1999) Geographic distribution: *Storeria occipitomaculata*. *Herpetological Review* 30(4):236-237.
- Ballinger RE, Lynch JD, and Smith GR. (2010) *Amphibians and Reptiles of Nebraska* (Oro Valley, Arizona: Rusty Lizard Press).
- Bathke DJ, Oglesby RJ, Rowe CM, and Wilhite DA. (2014) *Understanding and assessing climate change: Implications for Nebraska* (Lincoln, Nebraska: University of Nebraska-Lincoln).
- Blouin-Demers G, Prior KA, and Weatherhead PJ. (2000) Patterns of variation in spring emergence by Black Rat Snakes (*Elaphe obsoleta obsoleta*). *Herpetologica* 56(2):175-188.
- Burger J, Zappalorti RT, Gochfeld M, Boarman WI, Caffrey M, Doig V, Garber SD, Lauro B, Mikovsky M, Safina C, and Saliva J. (1988) Hibernacula and summer den sites of Pine Snakes (*Pituophis melanoleucus*) in the New Jersey Pine Barrens. *Journal of Herpetology* 22(4):425-433.
- Davis CA, and Vohs PA. (1993) Role of macroinvertebrates in spring diet and habitat use of Sandhill Cranes. *Transactions of the Nebraska Academy of Sciences* 20:81-86.
- Ernst CH, and Ernst EM. (2003) *Snakes of the United States and Canada* (Washington DC: The Smithsonian Institution).
- Fogell DD. (2010) *A Field Guide to the Amphibians and Reptiles of Nebraska* (University of Nebraska-Lincoln, Nebraska: Institute of Agriculture and Natural Resources).
- Forrest J, Miller-Rushing AJ. (2010) Toward a synthetic understanding of the role of phenology in ecology and evolution.

- Philosophical Transactions of the Royal Society B: Biological Sciences* 365(1555):3101-3112.
- Geluso K. (2012) Sixteen county records of herpetofauna from south-central Nebraska. *Collinsorum* 1(2-3):3-6.
- Geluso K, and Harner MJ. (2013a) Predation: *Nerodia clarkia clarkia* (Gulf Saltmarsh Watersnake). *Herpetological Review* 44(1):156-157.
- Geluso K, and Harner MJ. (2013b) Reexamination of herpetofauna on Mormon Island, Hall County, Nebraska, with notes on natural history. *Transactions of the Nebraska Academy of Sciences* 33:7-20.
- Geluso K, Krohn BT, Harner MJ, and Assenmacher MJ. (2013) Whooping Cranes consume Plains Leopard Frogs at migratory stopover sites in Nebraska. *The Prairie Naturalist* 45(2):91-93.
- Hunt HE, and Slack RD. (1989) Winter diets of Whooping and Sandhill Cranes in south Texas. *Journal of Wildlife Management* 53(4):1150-1154.
- Jacob JS, and Painter CW. (1980) Overwinter thermal ecology of *Crotalus viridis* in the north-central plains of New Mexico. *Copeia* 1980(4):799-805.
- Jenniges JJ, and Peyton MM. (2008) Management of lands along the Platte River from Elm Creek to Lexington, Nebraska, as crane habitat. *Proceedings of the North American Crane Workshop* 10:76-85.
- Kaul RB, Sutherland DM, and Rolfmeier SB. (2006) *The Flora of Nebraska* (Lincoln, Nebraska: School of Natural Resources, University of Nebraska-Lincoln).
- Kiesow AM. (2006) *Field Guide to Amphibians and Reptiles of South Dakota* (Pierre, South Dakota; South Dakota Department of Game and Fish, and Parks).
- Kinzel PJ, Nelson JM, Parker RS, and Davis LR. (2006) Spring census of Mid-continent Sandhill Cranes using aerial infrared videography. *Journal of Wildlife Management* 70(1):70-77.
- Krapu GL, Brandt DA, Kinzel PJ, and Pearse AT. (2014) Spring migration ecology of the Mid-continent Sandhill Crane population with an emphasis on use of the Central Platte River Valley, Nebraska. *Wildlife Monographs* 189(1):1-41.
- Lawson MP, Dewey KF, and Neild RE. (1977) *Climate Atlas of Nebraska* (Lincoln, Nebraska: University of Nebraska Press).
- Mullins WH, and Bizeau EG. (1978) Summer foods of Sandhill Cranes in Idaho. *The Auk* 95(1):175-178.
- Pearse AT, Brandt DA, Harrell WC, Metzger KL, Baasch DM, and Hefley TJ. (2015) Whooping crane stopover site use intensity within the Great Plains. *U.S. Geological Survey Open-File Report 2015-1166*, 12 p., <http://dx.doi.org/10.3133/ofr20151166>.
- Peyton MM. (1989) Geographic distribution: *Storeria occipitomaculata* (Redbelly Snake). *Herpetological Review* 20(1):13.
- Reinecke KJ, and Krapu GL. (1986) Feeding ecology of Sandhill Cranes during spring migration in Nebraska. *Journal of Wildlife Management* 50(1):71-79.
- Schneider R, Stoner K, Steinauer G, Panella M, and Humpert M. (2011) *The Nebraska Natural Legacy Project: State Wildlife Action Plan. 2nd ed.* (Lincoln, Nebraska: The Nebraska Game and Parks Commission).
- Wiese JD, Caven AJ, and Brinley Buckley EM. (2016) Eastern Racer (*Coluber constrictor*) mortality as a result of early emergence from man-made structure hibernaculum in south-central Nebraska. *Collinsorum* 5(1):3-5.