2021

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The Coleopterists Bulletin, 75(3): 512–515. 2021.

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Abstract

The federally endangered Salt Creek tiger beetle, *Ellipsoptera nevadica lincolniana* (Casey, 1916), is found only in the saline wetlands around Lincoln, Nebraska, USA. Low numbers of adults seen in the 1980s prompted a study to estimate adult numbers by visual counts. Population estimates were conducted from 1991 to 2020, and adult estimates ranged from a low of 115 in 1993 to a high of 777 in 2002. The beetle has disappeared from six out of twelve sites and the metapopulation has shrunk from three sites in 1991 to one site in 2020. Supplemental releases of laboratory reared larvae began in 2010, but success has been difficult to determine.

Keywords: endangered, Salt Basin, Lincoln, saline wetlands

DOI.org/10.1649/0010-065X-75.3.512

Introduction

The Salt Creek tiger beetle (SCTB), *Ellipsoptera nevadica lincolniana* (Casey, 1916), is an endemic, rare insect found only on the saline wetlands around Lincoln, Lancaster Co., Nebraska, USA. Formerly included in the genus *Cicindela* L., *Ellipsoptera* Dokhtouroff was recently elevated from a subgenus to a full genus by Duran and Gough (2019). SCTB is morphologically distinct (much reduced markings) from *E. nevadica knausii* (Leng, 1902), which occurs sporadically in western Nebraska, and as close as Talmo, Kansas, about 100 miles southwest of Lincoln. Populations of SCTB occur together with *Eunota togata latilabris* (Willis, 1967), *Eunota circumpicta salinae* (Vaurie, 1951), and *Cicindela fulgida fulgida* Say, 1823 (all Cicindelidae); however, SCTB prefer wetter, salty Salmo soils in contrast to the other species, which are found on the drier salt flats. Adults are found in early June to at least mid-July and have a two-year life cycle in the field (Spomer and Higley 1993).

SCTB was known to occur in the Salt Basin only on the west side of Lincoln along Interstate 80, and this area was frequented by collectors in the 1970s (Johnson 1975; Lawton 1972; Lawton and Willis 1974). During the mid-1980s, Mark Carter and the first author found an additional site north of Lincoln along N 27th St. (later called Arbor Lake), and Carter (1989) mentioned these two sites in his revision of Nebraska tiger beetles. However, numbers of SCTB were low, and few individuals (usually a dozen or less at any given time) were collected either during the day or at night using a blacklight. Despite the low numbers we found, it was surmised that SCTB was once quite common, based on many specimens with the same date being found in the University of Nebraska State Museum (Lincoln, Nebraska), American Museum of Natural History (New York City), and Snow Entomological Museum (Lawrence, Kansas) (Allgeier 2005). The SCTB was state listed as endangered in 2000 (NGPC 2000) and federally listed as endangered in 2005 (USFWS 2005).

Table 1. Status of sites with SCTB. Site 1 is metapopulation 1, site 2 is metapopulation 2, and sites 3–12 are metapopulation 3 of Fig. 1.

Site	Status
1. Capitol Beach	Present from 1991–1998; now extirpated
2. Jack Sinn WMA	Present from 1991–1998; now extirpated
3. NW 12th St.	Present from 1992–1996; absent from 1997–2009, present in 2010 and 2011, absent through 2020
4. Mill Road (ditch)	Present from 1991–1995; now extirpated
5. 1st St. (Little Salt WMA East)	Present from 1994–2019; decreasing, not seen in 2020
6. Arbor Lake (incl. feeders)	Present from 1991–2020; stable
7. Little Salt Creek N	Present from 1991–2020; stable to decreasing
8. Little Salt Creek S	Present from 1994–2020; decreasing
9. Roper property	Present from 2001–2020; decreasing
10. Dakota Springs	Present from 2005–2007; now extirpated?
11. Little Salt WMA	Present from 2014–2020; stable to decreasing
12. Shoemaker Marsh	Present from 1991–2020; increasing

Materials and Methods

During 1991, the first author began a search for additional colonies of SCTB around Lincoln and began estimating numbers of adults at the two known sites (sites 1 and 6 in Table 1). Using USGS soil survey maps, and with help from individuals in the Natural Heritage Program at Nebraska Game and Parks Commission, adults were found at additional localities representing three metapopulations (Fig 1), a metapopulation being defined as several populations of SCTB which do not come in contact with each other because of geographic barriers. These sites included 1) a small but well-known population along Interstate 80 near Capitol Beach in west Lincoln, which includes the type locality, 2) Jack Sinn Wildlife Management Area (WMA) along the border of Lancaster and Saunders Counties near the town of Ceresco, and 3) the largest population, found along Little Salt Creek north of Lincoln. Other sites within and outside of Lancaster Co. with remnant Salmo soils were extensively searched but did not provide suitable habitat because they were either too dry or not saline enough.

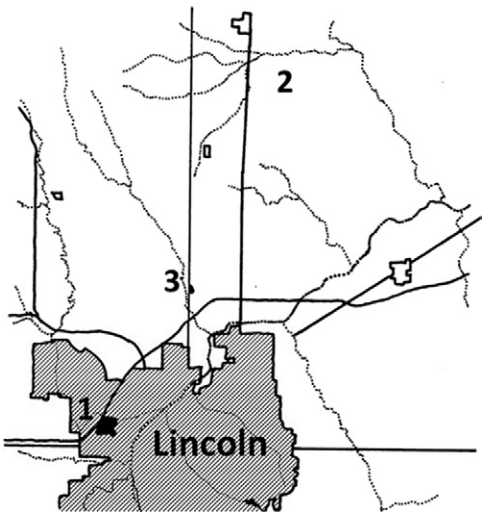

Fig. 1. Map showing metapopulations of SCTB, 1991.

Since 1991, sites with SCTB were monitored annually and adults visually counted by the first author during peak emergence, which occurred 2–3 weeks after adults were first seen, based on constant monitoring. Because populations were small and SCTB are relatively easy to approach compared to many other tiger beetle species, beetles could be approached to within about 2 m before they would fly, making them easy to observe. Visual counts were done in full sun from 1000 h to 1600 h by walking the habitat, often the center of the creek, and counting beetles on each side of the creek and along the sand bars on the creek. Areas with larger numbers of beetles were counted twice for consistency, and if numbers differed, the larger number was used in the total as we felt it represented the population at peak size more accurately. This approach is supported by the mark-recapture experiment conducted by Allgeier (2005) comparing Lincoln Index values with visual counts, in which visual counts were found to underestimate population size by 37–50% in two years when the population was over 500 adults.

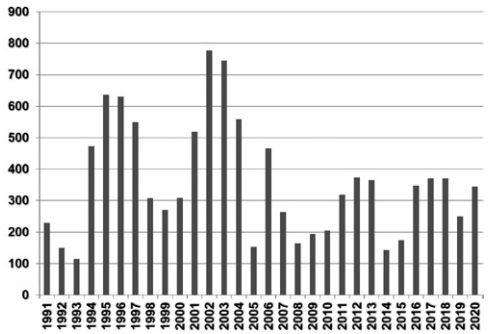

Fig. 2. Visual population estimates of all sites combined of adult SCTB, 1991–2020.

Supplemental Releases. In 2010, as a result of a partnership between the University of Nebraska, U. S. Fish & Wildlife Service, Nebraska Game & Parks Commission, Lower Platte South Natural Resource District, the city of Lincoln, Omaha's Henry Doorly Zoo, and Lincoln's Children's Zoo, we began rearing SCTB in the laboratory to supplement wild populations. Several trials were conducted to determine the correct soil type and mixture, salt content, and rearing containers (Spomer *et al.* 2015). Larval releases were done in early May and sometimes again in October, most often at the Arbor Lake and Shoemaker Marsh sites. Adult releases were made starting in 2016 in an attempt to circumvent some of the mortality events that occurred from flooding at some release sites. All adult releases were done after visual counts were made to avoid count bias.

Results and Discussion

Supplemental Releases. Unfortunately, we were unable to follow larvae to adult in the field. Despite attempts to track released larvae by marking the burrows into which they were released, larvae often plugged their burrows and made a new burrow inches away from the original burrow. Inevitably, flooding occurred after the May release, which wiped away any trace of the transplanted larvae, making it difficult to determine the success of these larval releases. While an attempt was made to census released adults, due to the small number of individuals released and difficulty in observing them, adult release success has not yet been determined.

Population estimates of SCTB from 1991 to 2020 are shown in Fig. 2. Numbers have fluctuated from a low of 115 in 1993 to a high of 777 in 2002. During the first few years of estimates, not all sites were known, so estimates are surely lower than actual numbers. Status of sites with SCTB over the years are compared in Table 1. The beetle has disappeared from six out of twelve sites, and the only metapopulation left as of 2020 is number 3.

Habitat at some sites (*e.g.*, Capitol Beach, Jack Sinn WMA) has changed dramatically since 1991, which explains the apparent extirpation of SCTB at these sites. In years with high rainfall, the surface salt is washed away from the exposed areas, allowing grasses to invade the open ground. The city of Lincoln has seen a nearly 40% increase in human population since 1991, and with this increase comes urban expansion as well as high prices on land and natural resources. The Saline Wetlands Partnership has purchased several good quality tracts of salt marsh since 1991. These include Arbor Lake, Shoemaker Marsh, Dakota Springs, and a newly acquired site, Marsh Wren Saline Wetland, which have been crucial for reintroductions of laboratory reared SCTB.

Land management is also an issue. While grazing in itself is not harmful and may open up habitat for SCTB, overgrazing can be detrimental because of trampling at stream crossings where SCTB congregate and has resulted in a decrease in beetles at two sites (sites 5 and 11) in recent years.

What does the future hold for SCTB? Although it has been discouraging to see the number of sites slowly disappear for 30 years, it has also been encouraging to see new sites purchased and managed for this endangered species. Although not quantifiable, supplemental releases appear to have at least kept the population somewhat stable over the last ten years. Future releases are planned at restored saline wetland locations where no current SCTB metapopulations exist. These releases will allow us to determine the success of releasing SCTB into restored wetlands and provide valuable data to the project.

Acknowledgments

Many people have helped with some of the surveys over the years. Leon Higley, Bill Allgeier, W. Wyatt Hoback, Tim Huntington, and Tierney Brosius were all part of the Insect Ecology lab at University of Nebraska-Lincoln and helped. Melissa Panella, Mercy Manzanares, Angelina Wright, and Lindsay Vivian helped out in later years. We thank the Nebraska Game & Parks Commission for administering Section 6 grant money from the U. S. Fish & Wildlife Service.

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(Received 4 November 2020; accepted 1 June 2021. Publication date 7 December 2021.)