Albert Rogers Crandall’s Smooth Green Snake (Opheodrys vernalis) from North Carolina

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Abstract - Opheodrys vernalis (Smooth Green Snake) is documented in North Carolina by only a single specimen collected in the western part of the state by Albert Rogers Crandall and deposited in 1871 at the Museum of Comparative Zoology, Harvard University, Cambridge, MA. Owing to a lack of additional material evidence, many authors have questioned the occurrence of the species in the state. We make the case that the museum tag on the extant Smooth Green Snake specimen was originally assigned to a Sceloporus undulatus (Eastern Fence Lizard) specimen collected by Crandall in western North Carolina, and that the tag was re-assigned between 1924 and 1941 to two Smooth Green Snake specimens. We conclude that the Harvard specimen has become disassociated from its data, and it therefore does not serve as a reliable locality record. Pending acquisition of evidence to the contrary, we recommend excluding North Carolina from the geographic range of Smooth Green Snakes.

Opheodrys vernalis (Harlan) (Smooth Green Snake) is perhaps the most enigmatic member of the reptile fauna of North Carolina. In the eastern US, the species’ range extends southward to at least Bland and Floyd counties in western Virginia (Conant and Collins 1998, Mitchell 2006), with putative, disjunct records in western North Carolina (reviewed in Mitchell 2006, Palmer and Braswell 1995). The species is documented—material evidence such as a specimen or photograph serves as proof of existence—in North Carolina by only a single specimen from the western part of the state that was deposited in 1871 at Harvard University’s Museum of Comparative Zoology (MCZ), Cambridge, MA. Owing to the paucity of material evidence, numerous authors have questioned the occurrence of the Smooth Green Snake in North Carolina (Beane et al. 2010, Martof et al. 1980), or have excluded it altogether from the state’s herpetofauna (Conant and Collins 1998, Gibbons and Dorcas 2005, Palmer and Braswell 1995). Herein, we investigate the veracity of the Harvard specimen (MCZ R-2287), the sole extant specimen of Smooth Green Snake from North Carolina, in the hope of shedding light on the existence of the species in the state.

The Harvard specimen. MCZ R-2287 is a well-preserved, young, female Smooth Green Snake that we have examined (Fig. 1). Palmer and Braswell (1995) provided a brief morphological description of the specimen. The sole tag on the specimen is metal and bears the number 2287 on one side.

The catalog entry (Fig. 2) for MCZ R-2287 is written in ink in Samuel Garman’s hand (MCZ curator, 1874–1911), as Tropidolepis undulatus Cuv. with North Carolina as the locality, and the additional label information, “on the French Broad, collected by A.R. Crandall, received from Mr. Crandall in 1871, with 1 number of specimens.” The top of the catalog page indicates that Garman cataloged the specimen in 1874, three years after it was received at MCZ. Tropidolepis undulatus is a junior synonym of Sceloporus undulatus (Bosc & Daudin in Sonnini & Latreille) (Eastern Fence Lizard). The name Tropidolepis undulatus Cuv. is crossed out in ink and replaced with Liopeltis vernalis, a junior synonym of O. vernalis, in Arthur Loveridge’s hand (MCZ Associate in Zoology 1924–1927; MCZ Curator, 1927–1957; Adler 1989). Liopeltis is crossed out in pencil and replaced with 

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Opheodrys in Joseph Martinez’s hand (a recent MCZ curatorial staff member), an annotation made sometime before 2000, after which MCZ ledgers were no longer annotated. The “1 number of specimens” entered by Garman is crossed out in ink and replaced with

![Figure 1. Opheodrys vernalis (MCZ R-2287), a specimen putatively collected by Albert Rogers Crandall on the French Broad River in western North Carolina.](image)

![Figure 2. Image of the Museum of Comparative Zoology, Harvard University, herpetology collection catalog illustrating the catalog entry for Albert Rogers Crandall’s 1871 specimens. MCZ R-2287 is the bottom entry in the image. Available at http://mczbase.mcz.harvard.edu/guid/MCZ:Herp:R-2287.](image)
a “2” in Loveridge’s hand. The “2” is crossed out in pencil and replaced with a “1”, with the added remark “1 to Butantan 5/31/29”, all in Thomas Barbour’s hand (MCZ Curator from 1911–1927, but continued to work in the MCZ herpetology collection until his death in 1946). The jar with the specimen contains a penciled label in Loveridge’s hand (Fig. 3) that reads: “2287. *Opheodrys* [written over an erased, but still legible, “*Liopeltis*”) *vernalis* (Harlan). On the French Broad, N. Carolina. A.R. Crandell [sic] leg et don. 1871”.

In summary, the catalog indicates that tag 2287 was assigned in 1874 to a single Eastern Fence Lizard specimen that was collected by Crandall on North Carolina’s French Broad River and deposited at MCZ in 1871. At least 50 years later, between the time that Loveridge began working at MCZ in 1924 and a citation of the Smooth Green Snake specimen by Grobman (1941), Loveridge reassigned 2287 from one Eastern Fence Lizard to two Smooth Green Snakes, without explanation. In 1929, one of those two snake specimens was transferred to the Instituto Butantan in São Paulo, Brazil. Our interpretation is that tag 2287 was removed, for an unknown reason, from Crandall’s cataloged Eastern Fence Lizard from North Carolina and reused on the Smooth Green Snake specimens, one of which was later sent to Brazil, without updating the data associated with that tag number. As such, tag 2287 has become disassociated from its data, and the Smooth Green Snake specimen bearing tag 2287 today may have originated from anywhere in the species’ range. Alternatively, Garman may have erroneously used the scientific name of the Eastern Fence Lizard for the Smooth Green Snake in his catalog, but this seems very unlikely because he would have been very familiar with both species. Moreover, the changing of one specimen to two in the catalog is a strong indication that the tag was being reused. Loveridge reorganized the MCZ herpetology collections, which until then had suffered from neglect (Adler 1989), and the re-assignment of tag 2287 may have occurred during that effort. J. Rosado searched the MCZ herpetology department’s archives and found no additional information regarding the history of this specimen. In May 2010, most of the Instituto Butantan’s preserved snake collection, once one of the largest in the world, was tragically lost in a fire (Kumar 2010); a recent search of the surviving

![Figure 3. A penciled label in Arthur Loveridge's hand that is contained in the jar with MCZ R-2287. The word “Liopeltis” was erased and replaced with “Opheodrys” (only weakly visible in reproduction).](image)
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The collector. Albert Rogers Crandall (1840–1926) may have been to North Carolina’s French Broad River before or during 1871, but his reptile collecting was geographically widespread in the eastern US and was by no means restricted to western North Carolina. Born in western New York, Crandall matriculated briefly at Alfred University, Alfred, NY, and later at Milton College, Milton, WI, where he graduated with B.A. and M.A. degrees. One year after graduation, he moved to Harvard University and spent the next five years as a student of geologist and paleontologist Nathaniel Southgate Shaler at the Museum of Comparative Zoology. During these years (~1868–1873), he used his summer vacations to collect specimens for the museum. His travels were extensive, from “… parts of Rhode Island, Massachusetts, and Maine to the Ottawa region of Canada, western New York, and along the Appalachian belt from the Catskills to northern Georgia, Alabama, and Mississippi” (Brown 1908: 865).

The MCZ also received and cataloged Crandall’s Smooth Green Snake specimen from West Virginia (MCZ R-2285) and *Nerodia sipedon* L. (Northern Water Snake) specimen from Tennessee (MCZ R-2286; Fig. 2) at the same time as MCZ R-2287, supporting the assertion that he collected reptiles over a large area before or during 1871.

The locality. The MCZ catalog stated only that MCZ R-2287 was found “on the French Broad” in North Carolina, but Grobman (1941) narrowed the capture locality to Madison County, NC. Madison is the northernmost of four counties in North Carolina through which the French Broad River passes, and he may have therefore considered it to be the most likely county from which Crandall’s specimen was taken. In a letter dated 9 April 1941, C.S. Brimley queried A.B. Grobman (all letters quoted herein are housed in the archives of the North Carolina Museum of Natural Sciences’ herpetology unit) as to whether his North Carolina locality referred to Madison County, or to the town of Madison in Rockingham County. On 22 April 1941, Grobman replied that, “the specimen upon which this record was based is in the Museum of Comparative Zoology (number 2287) and was collected in 1871 by A.R. Crandall. The locality data is [sic] as follows: On the French Broad, Madison County, North Carolina. I have no reason to doubt the validity of this record although it would be far more comforting to have some one else again collect *vernalis* in that region. The record is definitely from Madison County and not from Madison, Rockingham County.” Brimley (1944) repeated the Madison County locality on the basis of Grobman’s letter, and it has since been perpetuated in the literature (e.g., Huheey and Stupka 1967, Mitchell, 2006). DePoe et al. (1961) gave the North Carolina distribution of the Smooth Green Snake as “scattered areas of the mountains north of the French Broad River.”

Grobman’s confidence in the veracity of the MCZ specimen changed decades later. In a letter to W.M. Palmer dated 30 April 1984, he wrote, “My major concern is with the inclusion of *vernalis* in the herpetofaunal list of North Carolina …. With all the herpetological collecting that has been done in western North Carolina, I simply cannot believe, if the species occurs naturally, that no one has preserved a specimen of *vernalis* in the last hundred years. For that reason, I now think the MCZ specimen is based on inaccurate data. After all, if we can discard the Cones [sic] and Yarrow record with impunity, why then not the Crandell [sic] record?”

Other, non-vouchered North Carolina records. Coues and Yarrow (1878; the Cones and Yarrow record referred to by Grobman in his 1984 letter) reported Smooth Green Snakes as being “very common on the islands and mainland” at Fort Macon, Carteret County, in coastal North Carolina, but no supporting specimens are known (Grobman 1941). Because coastal North Carolina lies far outside of the geographic range of the Smooth Green Snake.
(Conant and Collins 1998), this record is attributed to a misidentified *Opheodrys aestivus* (L.) (Rough Green Snake) (Grobman 1941, Palmer and Braswell 1995), a similar species that is well documented in the area (Palmer and Braswell 1995).

Weller (1930) reported finding three Smooth Green Snakes (as well as the “commoner” Rough Green Snake) at Chimney Rock, Rutherford County, western North Carolina, but no supporting specimens are known (R. Drury and J.T. Collins, Jr., in Huheey and Stupka 1967; H. Mays, Cincinnati Museum of Natural History and Science, Cincinnati, OH, pers. comm. to B.L. Stuart, 17 September 2012; J.W. Ferner, Cincinnati Museum of Natural History and Science, Cincinnati, OH, pers. comm. to B.L. Stuart, 9 October 2012; R.M. Brown, University of Kansas Biodiversity Institute, Lawrence, KS, pers. comm. to B.L. Stuart, 11 December 2013; A. Nelson, Museum of Biological Diversity, The Ohio State University, Columbus, OH pers. comm. to B.L. Stuart, 17 December 2013).

In Palmer and Braswell (1995), R.L. Hoffmann reported two road-killed Smooth Green Snakes on the Blue Ridge Parkway in western North Carolina, near the McDowell–Mitchell County border, probably in the early 1950s, and in Buncombe County in 1962, but these were not preserved (Palmer and Braswell 1995). On 5 October 1981, Hoffmann wrote in a letter to Palmer that, “both specimens were dry and flat, beyond redemption it seemed at the time, so I didn’t even bother to pry them off the pavement to substantiate the records.” Although Hoffmann was very familiar with Smooth Green Snakes in Virginia (Hoffmann 1945, Mitchell 2006), the reportedly poor condition of the road-killed snakes introduces the possibility that these observations were also based on misidentified Rough Green Snakes. The Rough Green Snake is documented in North Carolina from McDowell and Buncombe counties (Palmer and Braswell 1995), and an Alleghany County specimen in the holdings of the North Carolina Museum of Natural Sciences (NCSM 58513) was collected at ~1095 m elevation (Beane and Palmer 2006), an elevation that exceeds those of Hoffmann’s Blue Ridge Parkway localities (Palmer and Braswell, 1995). Consequently, Rough Green Snakes cannot be excluded on the basis of geography.

*Do Smooth Green Snakes occur in North Carolina?* Determining the absence of a species is very challenging (Reed 1996, Thompson 2004), and we cannot exclude the possibility that Smooth Green Snakes do occur somewhere in western North Carolina, particularly given the proximity of Virginia records to the North Carolina state line (Mitchell 2006). However, we have shown that the sole existing Smooth Green Snake specimen from North Carolina (MCZ R-2287) is one that became disassociated from its original data, so there is no compelling reason to infer the specimen came from North Carolina. For that reason, we believe that the Smooth Green Snake should be removed from North Carolina’s herpetofauna, pending the acquisition of material evidence to the contrary.

If the species does occur in North Carolina, it would likely be found in the western part of the state above 340 m elevation (Mitchell 2006) on open, grassy sites similar to all known sites in Virginia (Mitchell 1994, 2006). Future search efforts should focus on such places, and researchers should appeal to biologists and resource managers to thoroughly document all green snakes encountered at mid- to upper elevations in western North Carolina.

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Literature Cited