Catalogue of American Amphibians and Reptiles 929

Palis, J. G., T. A. Gorman, and G. B. Pauly.
2022. *Ambystoma bishopi.*

Ambystoma bishopi Goin
Reticulated Flatwoods Salamander

Ambystoma cingulatum bishopi Goin 1950:300. Type-locality, "about 5 miles north of Pensacola, Escambia County, Florida, [USA]." [34.158731, -117.995482]. Holotype, Carnegie Museum 29137, adult female, collected 7 May 1949 by Harvard E. Nygren (not examined by authors).

Ambystoma (Linguaelapsus) cingulatum bishopi Tihen 1958:3.

Linguaelapsus cingulatum Freytag 1959:84 [by implication].

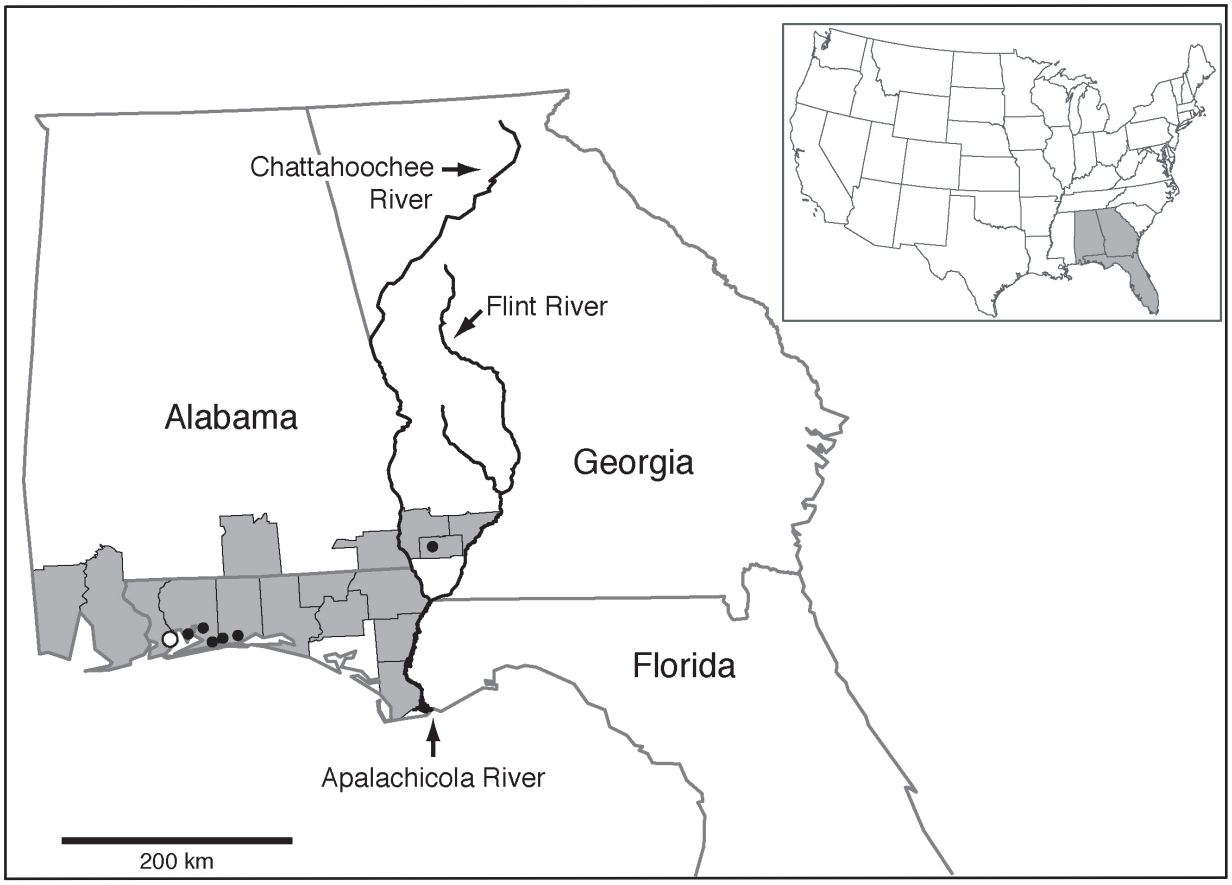
Ambystoma bishopi Pauly, Piskurek, and Shaffer 2007:426.

Ambystoma (Linguaelapsus) bishopi Dubois and Raffaëlli 2012:148.

CONTENT. No subspecies are recognized.

DESCRIPTION. *Ambystoma bishopi* is a moderately-sized (up to 76 mm SVL and 135 mm TL), slender-bodied ambystomatid salamander having a relatively short, pointed snout, with adults weighing from 4.5 to 10.5 grams (adult male and gravid female, respectively; Palis 1996, 1997a). The dorsum of the head, body, and tail is generally bluish-black to black and covered with fine, irregular, light gray lines that form a net-like or cross-banded pattern (Figure 1). Ventro-lateral gray flecks are concentrated on the body and tail. The venter is gray-black with gray specks. Teeth are arranged as follows: vomerine in 2–3 rows, premaxillary-maxillary in 3–6 rows, and mandibular in 3–5 rows (Goin 1950). The number of costal grooves ranges from 14–16; general-

Figure 1. Adult *Ambystoma bishopi* from Santa Rosa County, Florida. Photograph by Pierson Hill.



Map. Distribution of *Ambystoma bishopi*. The white circle represents the type locality, and the black circles indicate sites where this species has been documented since 2010 (six breeding sites in three counties). Shaded counties are those for which *Ambystoma bishopi* has been documented.

ly 14 (Pauly et al. 2007). Males have a slightly enlarged cloacal region during breeding season. Males also have a slightly taller and wider tail, but sexual dimorphism is not pronounced (Pauly et al. 2007).

The aquatic, pond-type larvae are boldly patterned with stripes from the mid-dorsum down the sides as follows: pale tan mid-dorsal stripe, grayish-black dorsolateral stripe, pale cream midlateral stripe, blue-black lateral stripe, and pale yellow ventrolateral stripe (Figure 2; Palis 1996). The head has two distinct black stripes, one extending from the snout, through the eyes, to the base of the gills and the other extending along the length of the upper jaw. The throat is unpigmented and the venter similar or dusky in appearance. Larvae are capable of attaining 47 mm SVL and 96 mm TL before metamorphosis (Palis 1996).

DIAGNOSIS. The following morphological characters separate *Ambystoma bishopi* from its sister species, *Ambystoma cingulatum*: *Ambystoma bishopi* has, on average, fewer costal grooves; a shorter tail, forelimbs, hindlimbs, and head; and a narrower, shallower head (Goin 1950, Pauly et al. 2007). *Ambystoma bishopi* also tends to have vomerine teeth arranged in two rows with an average of 13.2 teeth per patch, whereas *Ambystoma cingulatum* tends to have vomerine teeth arranged in three rows with an average of 15.6 teeth per patch (Goin, 1950). Larvae of *Ambystoma talpoideum* are most likely to be confused with larval *Ambystoma bishopi* because both exhibit a light, midlateral stripe. *Ambystoma talpoideum* larvae, however, are crossbanded dorsally, and large individuals have a dark, midventral stripe.

PHYLOGENETIC RELATIONSHIPS. *Ambystoma bishopi* is most closely related to the Frosted Flatwoods Salamander, *Ambystoma cingulatum* (Pauly et al. 2007, 2012; J. Williams et al. 2013; see Nomenclatural History for further discussion). All relevant morphological, allozyme, and DNA sequence studies have also recovered *Ambystoma annulatum* as the sister taxon of the two flatwoods salamanders (T. Jones et al. 1993; Kraus 1988; Shaffer et al. 1991; J. Williams et al. 2013).

Relationships of the *annulatum-cingulatum-bishopi* clade to other ambystomatid salamanders are not yet well established (T. Jones et al. 1993; Shaffer et al. 1991; J. Williams et al. 2013). Tihen (1958) proposed that *Ambystoma cingulatum cingulatum, Ambystoma cingulatum bishopi*, *Ambystoma annulatum, Ambystoma barbouri, Ambystoma mabeei,* and *Ambystoma texanum* are in the subgenus *Linguaelapsus*. This result is strongly supported by morphological analyses (T. Jones et al. 1993; Kraus 1988; Shaffer et al. 1991), but not by analyses of allozymes or DNA sequences (Bogart 2003; Shaffer et al. 1991; J. Williams et al. 2013), many of which recover strong support for the non-monophyly of *Linguaelapsus*.

PUBLISHED DESCRIPTIONS. The most detailed descriptions of variation in morphological characters were provided by Goin (1950), Martof and Gerhardt (1965), and Pauly et al. (2007). Descriptions focused mostly on color patterns were published by Bartlett and Bartlett (2011), Conant (1958), Mitchell and Gibbons (2010), and R. Powell et al. (2016); variation in color pattern was discussed by Enge (2019) but the morphometric and meristic traits of *A. bishopi* and *A. cingulatum* were inversely assigned. A general summary of previous descriptions was provided by LaClaire (2008) and United States Fish and Wildlife Service (2009). Descriptions of young larvae were provided by Goin (1950), Orton (1942), and Pa-

Figure 2. Larval *Ambystoma bishopi* from Santa Rosa County, Florida. Photograph by Pierson Hill.

lis (1995b). Larval descriptions of *Ambystoma bishopi* were compared to Frosted Flatwoods Salamander larvae by Mecham and Hellman (1952). A description of *Ambystoma bishopi* larvae published by Telford (1955) was subsequently determined to be based upon misidentified specimens (Kuss 1988). Eggs have not been described in the literature but, based on unpublished field observations and on published photographs (Gorman et al. 2014), appear to be similar to eggs of *Ambystoma cingulatum* (Anderson and Williamson 1976).

ILLUSTRATIONS. The information below details illustrations verified as *Ambystoma bishopi*; illustrations labeled as *Ambystoma cingulatum* but lacking locality data were excluded even though there is a chance they might be of *Ambystoma bishopi* (see Nomenclatural History).

Color photographs of adult *Ambystoma bishopi* were published by Bailey at al. (2006), Bartlett and Bartlett (1999, 2011), Buhlmann (2016), Buhlmann et al. (2010), Conant and Collins (1998), Enge (2019), Graham et al. (2015), Hipes and Printiss (2002), Hipes et al. (2001), Jackson and Hipes (2005), Jensen and Stevenson (2008), C. Jones et al. (2018), Krysko et al. (2011), Means (2004), Mitchell and Gibbons (2010), Palis and Jensen (1995), R. Powell et al. (2016), Surdick (2016), and Walls and Farmer (2020). **Black-and-white photographs** of adults were provided by Ashton (1992), Carr and Goin (1955), and Mount (1975, 1996). A black-and-white photograph labeled as *Ambystoma cingulatum bishopi* was included in a field guide published by Conant (1958). That same photo was later treated as "pattern variation" within *Ambystoma cingulatum* by Conant (1975), then colorized and still treated as "pattern variation" within *Ambystoma cingulatum* by Conant and Collins (1991a, 1991b, 1998), and then later labeled as *Ambystoma bishopi* by R. Powell et al. (2016). **Black-and-white drawings** of dorsolateral and ventral views of adults, as well as the open mouth of an adult were provided by Goin (1950).

Color photographs of juvenile *Ambystoma bishopi* were presented by Buhlmann (2016), Buhlmann et al. (2010), Fenolio et al. (2014), Krysko et al. (2011), Mitchell and Gibbons (2010) and Walls and Farmer (2020). **Black-and-white photographs** of juveniles were published by Altig and McDiarmid (2015) and K. Jones et al. (2012).

Color photographs of larval *Ambystoma bishopi* were published by Altig and McDiarmid (2015), Buhlmann (2016), Buhlmann et al. (2010), Crump (2015), Fenolio et al. (2014), Floyd and Stevenson (2018), Hipes and Norden (2003), Hipes and Printiss (2002), Hipes et al. (2001), Jackson and Hipes (2005), Krysko et al. (2019), Means (2004), O'Donnell et al. (2017), Palis (1993a), Printiss and Hipes (2000), Surdick (2016) and Walls and Farmer (2020). A **black-and-white photograph** of a larva was published by Ashton (1992). **Black-and-white drawings** of larvae were presented by Hardy and Olmon (1974) and Orton (1942). Images taken with a scanning electron microscope of premaxillary tooth morphology, premaxilla of the adult, and premaxilla of the metamorphosing larva were provided by Beneski and Larsen (1989; John Beneski, personal communication).

Images of **eggs** were published by Gorman et al. (2014) and Walls and Farmer (2020).

DISTRIBUTION. *Ambystoma bishopi* inhabits longleaf pine (*Pinus palustris*)-wiregrass (*Aristida stricta*) flatwoods and savannas on the Gulf Coastal Plain of the United States, and breeds in isolated wetlands, typically dominated by pond cypress (*Taxodium ascendens*) (Palis 1996, 1997b). Historically *Ambystoma bishopi* ranged westward from the Apalachicola-Flint River system from extreme southwestern Georgia across the Florida Panhandle and extreme southern Alabama to Mobile County, in southwestern Alabama (Pauly et al. 2007; R. Powell et al. 2016; O'Donnell et al. 2017; Semlitsch et al. 2017). A record from New Orleans, Louisiana (Boulenger 1882, 1896) was considered like-

ly to be *Ambystoma talpoideum* (Goin 1950; see also Martof 1968). Similarly, three larval specimens from Newton County, Mississippi (Telford 1955) and a verbal report from Harrison County, Mississippi are also claimed to be misidentifications (Kuss 1988, Stuart et al. 2008; see also Lohoefener and Altig 1983). The species was last documented in Alabama in 1981 (T. Jones et al. 1982), and it is hypothesized to be extirpated from the state (Anonymous 2017; Bailey et al. 2004; Graham et al. 2015; Means 2004; Semlitsch et al. 2017; Walls and Farmer 2020). A purported 2003 sighting in Alabama (Stuart et al. 2008) was based on a misidentified larval *Ambystoma talpoideum* (Godwin 2003).

State-level or rangewide distribution maps for *Ambystoma bishopi* were provided by Ashton and Ashton (1988), Bartlett and Bartlett (1999, 2011), Enge (2019), Goin (1950), Hipes et al. (2001), Jensen (1999), Krysko et al. (2011), Means (1986, 2004), Mount (1975, 1996), Pauly et al. (2007, 2012), O'Donnell et al. (2017), Semlitsch et al. (2017), and Walls and Farmer (2020). The range of *Ambystoma bishopi* was incorrectly mapped as strictly west of the Apalachicola and Chattahoochee rivers by Mitchell and Gibbons (2010), thus inadvertently excluding southwestern Georgia. Maps of critical habitat were provided by LaClaire (2008) and United States Fish and Wildlife Service (2009).

The map provided in this account differs from that of O'Donnell et al. (2017) and Semlitsch et al. (2017), which was also published in Walls and Farmer (2020). The distributions mapped in those studies were based upon the United States Geological Survey's North American Amphibian Atlas (Katie O'Donnell and Jaime Barichivich, personal communications). Those studies reported three localities of *Ambystoma bishopi* in southeastern Lee County, Georgia (two of which are only 320 m [0.2 mi] apart and are not visible as distinct localities in the published maps). Those would represent the northeasternmost records of *Ambystoma bishopi*. However, all three plotted localities actually relate to a single specimen, University of Georgia (UG) 1627, collected 3 March 1962 by H. Carl Gerhardt 12.7 mi NE of Albany in Worth County. That specimen was transferred to the North Carolina State Museum (NCSM), then to the Savannah Science Museum (SSM), and then possibly to Georgia Southern University (GSU; data were transferred but it is not currently clear whether the specimen reached GSU). The specimen is currently lost (Lance McBrayer, personal communication). Through these various transfers, several errors were introduced into the locality data such that localities of 12.5 and 11.0 mi NE of Albany also exist in databases (e.g., Martof and Gerhardt [1965] reported this specimen as NCSM 15, collected 12.5 mi NE of Albany, Worth County). The specimen is from Worth County (Carl Gerhardt, personal communication), collected only a short distance east of the Flint River. Thus, this specimen is not *Ambystoma bishopi* but *Ambystoma cingulatum* and is the northwesternmost locality for that species.

FOSSIL RECORD. None (Holman 2006).

PERTINENT LITERATURE. Assessing the flatwoods salamander literature is complicated by the changing taxonomy of this lineage. Although populations inhabiting the Gulf Coastal Plain west of the Apalachicola-Flint Rivers are now referred to as *Ambystoma bishopi* (Pauly et al. 2007), they have previously been referred to as *Ambystoma cingulatum* (prior to 1950 and then again 1965 through 2006) or as *Ambystoma cingulatum bishopi,* (generally 1950 to 1964). For works treating all flatwoods salamanders as belonging to a monotypic *Ambystoma cingulatum,* we have attempted to determine the geographic origin of specimens examined or the location of relevant fieldwork so that we can classify the work as being about *Ambystoma bishopi* or *Ambystoma cingulatum* (sensu Pauly et al. 2007). We have attempted to include all research pertaining to flatwoods salamanders west of the Apalachicola-Flint

Rivers in this account. Work not sufficiently addressed elsewhere in this account is listed here by topic: **activity/activity cycles** (Brooks et al. 2019b; Erwin et al. 2016; Palis 1997a; Palis and Means 2005; S. Powell et al. 2015), **anatomy and morphology (**Beneski and Larsen 1989), **behavior** (Beneski et al. 1995; K. Jones et al. 2012; S. Powell et al. 2015), **captive husbandry** (Fenolio et al. 2014), **conservation and management** (Bishop 2005; Bishop and Haas 2005; Brooks and Haas 2021; Brooks et al. 2019a; Chandler 2014; Chandler et al. 2016, 2017, 2021; Cox et al. 1994; Cox and Kautz 2000; Endries et al. 2009; Enge 2005a, 2005b, 2005c; Florida Department of Agriculture and Consumer Services Division of Forestry 2010; Florida Fish and Wildlife Conservation Commission 2001; Gorman 2009; Gorman and Haas 2013, 2014, 2015; Gorman et al. 2009, 2013; Jensen 1999; C. Jones et al. 2018; K. Jones et al. 2015, 2018; LaClaire 2008; Miranda-Castro 2021; Mount 1976; O'Donnell et al. 2017; Palis 1996; Palis and Enge 2005, 2006; Palis and Hammerson 2008; Semlitsch et al. 2017; Sutter et al. 2001; United States Fish and Wildlife Service 2009, 2015), **diet** (Goin 1950; Jensen 1999; Whiles et al. 2004), **disease** (S. Williams et al. 2020), **ecology and natural history** (Brooks et al. 2019a, 2019b; Chandler et al. 2015; Erwin et al. 2016; Gorman et al. 2014; Jensen 1999; K. Jones et al. 2012; Means 1972; Palis 1995b, 1996, 1997a, 1997b, 1997c; S. Powell et al. 2013, 2015; Sutter et al. 2001), **evolution and phylogeny** (McKnight and Shaffer 1997), **general accounts** (Bartlett and Bartlett 1999, 2011; Endries et al. 2009; Enge 2019; Floyd and Stevenson 2018; Means 1986, 2004; Mitchell and Gibbons 2010; Mount 1975, 1996; Palis and Hammerson 2008; R. Powell et al. 2016; Reichling 2008; Shupe 2019), **genetics** (Pauly et al. 2007, 2012; Shaffer et al. 1991, Wendt 2017; Wendt et al. 2021; S. Williams et al. 2020, 2021), **geographic distribution** (Carr 1940; Jensen and Johnson 1998; Jensen and Stevenson 2008; T. Jones et al. 1982; Meshaka and Babbitt 2005; Mount 1976; Mount et al. 1984; Palis 1995a; Shupe 2019; Sutter et al. 2001; Williamson and Moulis 1994a, 1994b), **growth** (Brooks et al. 2020), **habitat** (Jensen 1999; Palis 1996, 1997b, 1997c; Palis and Means 2005), **key – adults** (Carr 1940; R. Powell et al. 2012, 2019), **key – eggs** (Altig and McDiarmid 2015), **key – larvae** (Altig and Ireland 1984; Altig and McDiarmid 2015), **larval descriptions** (Hardy and Olmon 1974; Orton 1942; Palis 1996, 1997c), **larval growth** (Palis 1995b), **larval period** (Palis 1995b), **longevity** (Brooks et al. 2020; Palis and Means 2005), **parasitism** (Whiles et al. 2004), **reproduction** (Gorman et al. 2014), **surveys and habitat assessments (**Bishop 2004; Buhlmann 2016; Buhlmann et al. 2010; Cox and Kautz 2000; Farmer et al. 2016; Godwin 1993, 1994, 2003; Gorman et al. 2016; Guyer 2001; Haas and Gorman 2011, 2013; Haas et al. 2012, 2014; Hipes 2003; Hipes and Printiss 2002; Jackson and Hipes 2005; Means 2013; Moulis 1995; Mount 1980; Palis 1993b, 1994; Palis and Jensen 1995; Printiss and Hipes 1997, 2000; Seyle 1994; Smith et al. 2006; Surdick 2016; Vitt 1981; Walters et al. 2006a, 2006b), **systematics and taxonomy** (Goin 1950; Martof and Gerhardt 1965; Pauly et al. 2007, 2012), **survey methods** (Bishop et al. 2006; Goldberg et al. 2018; McKee et al. 2015; Palis 1996, 1997c), and **vulnerability assessment** (Millsap et al. 1990; Palis and Hammerson 2008; Reece and Noss 2014).

NOMENCLATURAL HISTORY. All flatwoods salamanders were originally described as the single species, *Ambystoma cingulatum* by Cope (1867). Later, after examining specimens across much of the known range of flatwoods salamanders, Goin (1950) proposed recognizing two distinct subspecies: *Ambystoma cingulatum bishopi,* the Reticulated Salamander, for populations on the Gulf Coastal Plain from southwestern Georgia and the Panhandle of Florida west to Mobile Bay, and *Ambystoma cingulatum cingulatum,* the

Frosted Salamander, for populations on the Atlantic Coastal Plain, from Duval County, Florida north to southern coastal South Carolina. At that time, flatwoods salamanders were not known from the Gulf Coastal Plain east of the Apalachicola River such that a 105-km gap was thought to exist between the ranges of the two subspecies. Standard reference works followed the proposed subspecies of Goin (1950): Carr and Goin 1955; Chermock 1952; Conant et al. 1956a, 1956b; Conant 1958; Martof 1956; and Schmidt 1953. However, although the common names recommended by Goin (1950) were used by Carr and Goin (1955) and Schmidt (1953), Bishop's Reticulated Salamander was used to refer to *Ambystoma cingulatum bishopi* by Chermock (1952), the Western Reticulated Salamander was used for *Ambystoma cingulatum bishopi* and the Eastern Reticulated Salamander was used for *Ambystoma cingulatum cingulatum* by Martof (1956), and the expanded common names, Reticulated Flatwoods Salamander and Frosted Flatwoods Salamander, were used by Conant et al. (1956a, 1956b) and Conant (1958).

Morphological variation across the range of flatwoods salamanders for both adults and larvae were examined by Martof and Gerhardt (1965). Based on their examination and the discovery of flatwoods salamanders on the Gulf Coastal Plain immediately east of the Apalachicola-Flint Rivers, they concluded that subspecies were not warranted. Standard reference guides followed this recommendation, once again recognizing a monotypic *Ambystoma cingulatum* (Ashton 1976; Collins et al. 1978 [and subsequent editions through Collins and Taggart 2002 and Highton et al. 2001]; Conant 1975; Petranka 1998). Although most of the morphological study conducted by Martof and Gerhardt (1965) was based on adults, it is important to note that larvae were also examined; eight of those larvae were thought to be *Ambystoma cingulatum cingulatum* (Schwartz and Etheridge 1954), but were later determined to be *Ambystoma mabeei* (Hardy and Olmon 1974).

The nomenclature changed again when Pauly et al. (2007) proposed recognizing *Ambystoma bishopi* and *Ambystoma cingulatum* as distinct species based on studies of morphology, mitochondrial DNA sequences, and allozymes, with the Apalachicola-Flint River system, a common biogeographic barrier in the southeastern United States, as the boundary separating the ranges of these two species. This result was supported by later studies of nuclear sequence data (Pauly et al. 2012, J. Williams et al. 2013). Pauly et al. (2007, 2012) recommended the common names Reticulated Flatwoods Salamander for *Ambystoma bishopi* and Frosted Flatwoods Salamander for *Ambystoma cingulatum* (note however an inadvertent error that reverses the common names on p. 424 of Pauly et al. 2007). The recognition of two species of flatwoods salamanders and the recommended common names have been followed in standard references (Collins and Taggart 2009; Highton et al. 2017; R. Powell et al. 2016; Tilley et al. 2008, 2012). The SSAR names lists, however, incorrectly list Pauly et al. (2007) as being published in 2006 (Highton et al. 2017; Tilley et al. 2008, 2012). The common name Reticulated Gerrymander was proposed by Mitchell (2017).

ETYMOLOGY. The specific epithet *bishopi* refers to Sherman C. Bishop (Beolens et al. 2013; Goin 1950).

COMMENT. The two species of flatwoods salamanders, *Ambystoma bishopi* and *Ambystoma cingulatum*, are some of the most imperiled salamanders in the United States (LaClaire 1999, 2008; Palis and Hammerson 2008; United States Fish and Wildlife Service 2009, 2015; Walls and Farmer 2020). Flatwoods salamanders were listed as federally threatened in 1999 (LaClaire 1999). Following taxonomic separation of *Ambystoma bishopi*

and *Ambystoma cingulatum*, the United States Fish and Wildlife Service uplisted *Ambystoma bishopi* to federally endangered (United States Fish and Wildlife Service 2009). *Ambystoma bishopi* are likely extirpated from Alabama (Anonymous 2017; Bailey et al. 2004; Graham et al. 2015; Means 2004; Semlitsch et al. 2017), are currently known from only two breeding wetlands on a single state managed area in southwestern Georgia, and from 25 breeding wetlands distributed among five public properties in western Florida (Katie O'Donnell, personal communication; Walls and Farmer 2020). The United States Fish and Wildlife Service considers all breeding wetlands within 3.2 km (2 mi) of each other to be the same breeding site; thus, at present there are only six known breeding sites (Map).

ACKNOWLEDGMENTS. We thank John Beneski, Jr., Edmund Brodie., Jr., and Fred Kraus for clarifying which species of flatwoods salamander they studied; Mark Bailey, Kurt Buhlmann, Kevin Enge, Thomas Floyd, Robert Gundy, Jim Godwin, Dan Hipes, Dale Jackson, and John Jensen for sharing unpublished reports; E. Pierson Hill for providing salamander images; Katie O'Donnell for providing up-to-date occupancy data; and Jaime Barichivich, Nikole Castleberry, Carl Gerhardt, Lance McBrayer, and Katie O'Donnell for help resolving the history of Worth County flatwoods salamander localities.

LITERATURE CITED

Altig, R. and P. H. Ireland. 1984. A key to salamander larvae and larviform adults of the United States and Canada. Herpetologica 40:212–218.

Altig, R. and R. W. McDiarmid. 2015. Handbook of Larval Amphibians of the United States and Canada. Comstock Publishing Associates, Ithaca, New York and London, United Kingdom. xvi + [2] + 345 pp.

Anderson, J. D. and G. K. Williamson. 1976. Terrestrial mode of reproduction in *Ambystoma cingulatum*. Herpetologica 32:214–221.

Anonymous. 2017. Amphibians checklist. Pp. 195–201 *in* Amphibians and reptiles (R. Clay, J. J. Apodaca, M. A. Bailey, G. R. Cline, J. C. Godwin, S. P. Graham, J. B. Jensen, K. R. Marion, B. Means, D. H. Nelson, J. A. Stiles, and T. Wibbels, committee members and authors) in Alabama Wildlife. Volume 5 (E. Shelton-Nix, editor). The University of Alabama Press, Tuscaloosa, Alabama.

Ashton, R. E., Jr. 1976. Endangered and Threatened Amphibians and Reptiles in the United States. Society for the Study of Amphibians and Reptiles, Herpetological Circular 5. v + 65 pp.

Ashton, R. E., Jr. 1992. Flatwoods salamander. *Ambystoma cingulatum* (Cope). Family Ambystomatidae. Order Caudata. Pp. 39–43 *in* Rare and Endangered Biota of Florida. Volume III. Amphibians and Reptiles (P. E. Moler, editor). University Press of Florida, Gainesville, Florida.

Ashton, R. E., Jr. and P. S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Windward Publishing, Inc., Miami, Florida. 191 pp.

Bailey, M. A., J. N. Holmes, K. A. Buhlmann, and J. C. Mitchell. 2006. Habitat Management Guidelines for Amphibians and Reptiles of the Southeastern United States. Technical Publication HMG-2. Partners in Amphibian and Reptile Conservation, Montgomery, Alabama. iv + 84 pp.

Bailey, M. A., M. J. Aresco, G. R. Cline, G. W. Folkerts, J. C. Godwin, C. Guyer, M. H. Hughes, J. B. Jensen, K. R. Marion, D. B. Means, P. E. Moler, R. H. Mount, D. H. Nelson, M. G. Peterson, E. C. Soehren, D. W. Speake, and T. Wibbels. 2004. Amphibians and reptiles. Pp. 101–132 *in* Alabama Wildlife. Volume 1. A Checklist

of Vertebrates and Selected Invertebrates: Aquatic Mollusks, Fishes, Amphibians, Reptiles, Birds, and Mammals (R. A. Mirarchi, editor). The University of Alabama Press, Tuscaloosa, Alabama.

Bartlett, R. D. and P. P. Bartlett. 1999. A Field Guide to Florida Reptiles and Amphibians. Gulf Publishing Company, Houston, Texas. xvi + 280 pp.

Bartlett, R. D. and P. P. Bartlett. 2011. Florida's Frogs, Toads, and other Amphibians. A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida. ix + 188 + [1] pp., 71 photographic plates.

Beneski, J. T., Jr. and J. H. Larsen, Jr. 1989. Interspecific, ontogenetic, and life history variation in the tooth morphology of mole salamanders (Amphibia, Urodela, and Ambystomatidae). Journal of Morphology 199:53–69.

Beneski, J. T., Jr., J. H. Larsen, Jr., and B. T. Miller. 1995. Variation in the feeding kinematics of mole salamanders (Ambystomatidae: *Ambystoma*). Canadian Journal of Zoology 73:353–366.

Beolens, B., M. Watkins, and M. Grayson. 2013. The Eponym Dictionary of Amphibians. Pelagic Publishing, Exeter, United Kingdom. xiii + [3] + 244 pp.

Bishop, D. C. 2004. Summary of Surveys for Florida Bog Frogs and Flatwoods Salamanders on Eglin Air Force Base through 2004. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. v + 28 pp.

Bishop, D. C. 2005. Ecology and Distribution of the Florida Bog Frog and Flatwoods Salamander on Eglin Air Force Base. Unpublished Ph.D. Dissertation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. xv + 175 pp.

Bishop, D. C. and C. A. Haas. 2005. Burning trends and potential negative effects of suppressing wetland fires on flatwoods salamanders. Natural Areas Journal 25:290–294.

Bishop, D. C., J. G. Palis, K. M. Enge, D. J. Printiss, and D. J. Stevenson. 2006. Capture rate, body size, and survey recommendations for larval *Ambystoma cingulatum* (Flatwoods Salamanders). Southeastern Naturalist 5:9–16.

Bogart, J. P. 2003. Genetics and systematics of hybrid species. Pp. 109–134 *in* Reproductive Biology and Phylogeny of Urodela (D. M. Sever, editor). Science Publishers, Inc., Enfield, New Hampshire.

Boulenger, G. A. 1882. Catalogue of the Batrachia Gradientia S. Caudata and Batrachia Apoda in the Collection of the British Museum. Second Edition. Trustees of the British Museum, London, United Kingdom. viii + [2] + 127 pp., Plates 1–9.

Boulenger, G. A. 1896. Catalogue of the Batrachia Gradientia S. Caudata and Batrachia Apoda in the Collection of the British Museum. Second Edition. Reprinted. Trustees of the British Museum, London, United Kingdom. viii + [2] + 127 pp., Plates 1–9.

Brooks, G. C. and C. A. Haas. 2021. Using historical dip net data to infer absence of flatwoods salamanders in stochastic environments. PeerJ 9:e12388.

Brooks, G. C., J. A. Smith, E. A. Frimpong, T. A. Gorman, H. C. Chandler, and C. A. Haas. 2019a. Indirect connectivity estimates of amphibian breeding wetlands from spatially explicit occupancy models. Aquatic Conservation: Marine and Freshwater Ecosystems 29:1815–1825.

Brooks, G. C., J. A. Smith, T. A. Gorman, and C. A. Haas. 2019b. Discerning the environmental drivers of annual migrations in an endangered amphibian. Copeia 107:270–276.

Brooks, G. C., T. A. Gorman, Y. Yiao, and C. A. Haas. 2020. Reconciling larval and adult sampling methods to model growth across life-stages. PLoS ONE 15:e0237737.

Buhlmann, K. A. 2016. Habitat Restoration,

Persistence, and Recovery of Flatwoods Salamander (*Ambystoma bishopi*) on the U.S. Navy's Holley OLF Santa Rosa County, Florida. Final Report Submitted to Naval Facilities Engineering Command, Milton, Florida. 36 pp.

Buhlmann, K. A., B. S. Metts, and A. M. Grosse. 2010. Final Annual Report. Flatwoods Salamanders (*Ambystoma bishopi*) on the U.S. Navy's OLF Holley Field Milton, Florida. Results of 2009–2010 Surveys. Report submitted to Naval Facilities Engineering Command, Jacksonville and Milton, Florida. Savannah River Ecology Laboratory, Aiken, South Carolina. 27 pp.

Carr, A. F., Jr. 1940. A Contribution to the Herpetology of Florida. University of Florida Publication, Biological Science Series 3:1–118.

Carr, A. and C. J. Goin. 1955. Guide to the Reptiles, Amphibians and Fresh-water Fishes of Florida. University of Florida Press, Gainesville, Florida. ix + 341 pp. [Reprinted 1959, 1969].

Chandler, H. C. 2014. The Effects of Climate Change and Long-Term Fire Suppression on Ephemeral Pond Communities in the Southeastern United States. Unpublished M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. xiv + 127 pp.

Chandler, H. C., C. A. Haas, and T. A. Gorman. 2015. The effects of habitat structure on winter aquatic invertebrate and amphibian communities in pine flatwoods wetlands. Wetlands 35:1201–1211.

Chandler, H. C., A. L. Rypel, Y. Jiao, C. A. Haas, and T. A. Gorman. 2016. Hindcasting historical breeding conditions for an endangered salamander in ephemeral wetlands of the southeastern USA: Implications of climate change. PLoS ONE 11:e0150169.

Chandler, H. C., D. L. McLaughlin, T. A. Gorman, K. J. McGuire, J. B. Feaga, and C. A. Haas. 2017. Drying rates of ephemeral wetlands: Implications for breeding amphibians. Wetlands 37:545–557.

Chandler, H. C., J. C. Colón-Gaud, T. A. Gorman, K. Carson, and C. A. Haas. 2021. Does long-term fire suppression impact leaf litter breakdown and aquatic invertebrate colonization in pine flatwoods wetlands? PeerJ 9:c12534.

Chermock, R. L. 1952. A key to the amphibians and reptiles of Alabama. Geological Survey of Alabama, Museum Paper 33. 88 pp.

Collins, J. T. and T. W. Taggart. 2002. Standard Common and Current Scientific Names for North American Amphibians, Turtles, Reptiles, & Crocodilians. Fifth Edition. The Center for North American Herpetology, Lawrence, Kansas. iv + 44 pp.

Collins, J. T. and T. W. Taggart. 2009. Standard Common and Current Scientific Names for North American Amphibians, Turtles, Reptiles, and Crocodilians. Sixth Edition. The Center for North American Herpetology, Lawrence, Kansas. iv + 44 pp.

Collins, J. T., J. E. Huheey, J. L. Knight, and H. M. Smith. 1978. Standard Common and Current Scientific Names for North American Amphibians and Reptiles. Society for the Study of Amphibians and Reptiles, Herpetological Circular 7. iv + 36 pp.

Conant, R. 1958. A Field Guide to Reptiles and Amphibians of the United States and Canada East of the 100th Meridian. Houghton Mifflin Company, Boston, Massachusetts. xv + [3] + 366 pp., 40 plates.

Conant, R. 1975. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Second Edition. Houghton Mifflin Company, Boston, Massachusetts. xviii + 429 pp., 48 plates.

Conant, R. and J. T. Collins. 1991a. A Field Guide to Reptiles and Amphibians.

Eastern and Central North America. Third Edition. Houghton Mifflin Company, Boston, Massachusetts. xviii + [2] + 450 pp., 48 plates.

Conant, R. and J. T. Collins. 1991b. Reptiles and Amphibians of Eastern and Central North America. The Fiftieth Anniversary Edition, Roger Tory Peterson Field Guides. The Easton Press, Norwalk, Connecticut. xvii + [2] + 450 pp., 48 plates.

Conant, R. and J. T. Collins. 1998. A Field Guide to Reptiles & Amphibians. Eastern and Central North America. Third Edition, Expanded. Houghton Mifflin Company, Boston, Massachusetts. xviii + 616 pp.

Conant, R., F. R. Cagle, C. J. Goin, C. H. Lowe, Jr., W. T. Neill, M. G. Netting, K. P. Schmidt, C. E. Shaw, R. C. Stebbins, and C. M. Bogert. 1956a. Common names for North American amphibians and reptiles. Copeia 1956:172–185.

Conant, R., F. R. Cagle, C. J. Goin, C. H. Lowe, Jr., W. T. Neill, M. G. Netting, K. P. Schmidt, C. E. Shaw, R. C. Stebbins, and C. M. Bogert. 1956b. Common names for North American Amphibians and Reptiles (Reprinted from Copeia, 1956, No. 3, pp. 172–185), Plus an Index to Common Names. [Publishing authority not specified, but appears to be the American Society of Ichthyologists and Herpetologists; at least some offprints of the paper published in Copeia included a note stating 'A special reprint of this list, including an index to common names, will soon be available for purchase from the ASIH at a nominal sum."]. 26 pp.

Cope, E. D. 1867. A review of the species of Amblystomidae. Proceedings of the Academy of Natural Sciences of Philadelphia 19:166–211.

Cox, J. A. and R. S. Kautz. 2000. Habitat Conservation Needs of Rare and Imperiled Wildlife in Florida. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. viii + 156 pp.

Cox, J., R. Kautz, M. MacLaughlin, and T. Gilbert. 1994. Closing the Gaps in Florida's Wildlife Habitat Conservation System. Recommendations to meet Minimum Conservation Goals for Declining Wildlife Species and Rare Plant and Animal Communities. Office of Environmental Services, Florida Game and Fresh Water Fish Commission, Tallahassee, Florida. iii + [1] + 239 pp.

Crump, M. 2015. Eye of Newt and Toe of Frog, Adder's Fork and Lizard's Leg. The Lore and Mythology of Amphibians and Reptiles. The University of Chicago Press, Chicago, Illinois. viii + 320 pp.

Dubois, A. and J. Raffaëlli. 2012. A new ergotaxonomy of the order Urodela Duméril, 1805 (Amphibia, Batrachia). Alytes 28:77–161.

Endries, M., B. Stys, G. Mohr, G. Kratimenos, S. Langley, K. Root, and R. Kautz. 2009. Wildlife Habitat Conservation Needs in Florida. Updated Recommendations for Strategic Habitat Conservation Areas. Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute Technical Reports. FWRI Technical Report TR-15. x + 178 pp.

Enge, K. M. 2005a. Management Recommendations for the Flatwoods Salamander on Point Washington State Forest. Report Submitted to Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. 21 pp.

Enge, K. M. 2005b. Management Recommendations for the Flatwoods Salamander on Holley Naval Outlying Landing Field. Draft Report to Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. 19 pp.

Enge, K. M. 2005c. Management Recommendations for the Flatwoods Salamander on Pine Log State Forest. Draft Report to Florida Fish and Wildlife Conservation Commission, Tallahassee,Florida. 18 pp.

Enge, K. M. 2019. *Ambystoma bishopi* Goin 1950. Reticulated flatwoods salamander. *Ambystoma cingulatum* Cope 1868. Frosted flatwoods salamander. Pp. 74–77 *in* Amphibians and Reptiles of Florida (K. L. Krysko, K. M. Enge, and P. E. Moler, editors). University of Florida Press, Gainesville, Florida.

Erwin, K. J., H. C. Chandler, J. G. Palis, T. A. Gorman, and C. A. Haas. 2016. Herpetofaunal communities in ephemeral wetlands embedded within longleaf pine flatwoods of the Gulf Coastal Plain. Southeastern Naturalist 15:431–447.

Farmer, A., B. Harris, P. Hill, K. Enge, C. Haas, T. Gorman, K. Jones, J. Mott, S. Walls, J. Barichivich, and K. O'Donnell. 2016. A Statewide Species and Habitat Assessment for the Reticulated Flatwoods Salamander, Frosted Flatwoods Salamander, and Striped Newt. Section 6 Annual Report. Reptile and Amphibian Research Subsection, Wildlife Research Section, Fish and Wildlife Research Institute. Florida Fish and Wildlife Conservation Commission, n.l. 29 pp.

Fenolio, D. B., T. A. Gorman, K. C. Jones, M. Mandica, L. Phillips, L. Melde, H. Mitchell, and C. A. Haas. 2014. Rearing the federally endangered reticulated flatwoods salamander, *Ambystoma bishopi*, from eggs through metamorphosis. Herpetological Review 45:62–65.

Florida Department of Agriculture and Consumer Services Division of Forestry. 2010. Ten-Year Resource Management Plan for the Pine Log State Forest. Bay and Washington Counties. Florida Department of Environmental Protection, Tallahassee, Florida. [5] + 45 pp.

Florida Fish and Wildlife Conservation Commission. 2001. Management Plan. Flatwoods Salamander. *Ambystoma cingulatum*. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. 61 pp.

Floyd, T. M. and D. J. Stevenson. 2018. *Ambystoma bishopi* Goin, 1950. Georgia Biodiversity Portal. Accessed at https://georgiabiodiversity.org/natels/profile?es_id=33638. Archived by Internet Archive at https://web.archive.org/web/20220421194731/https://georgiabiodiversity.org/natels/profile?es_id=33638 on 21 April 2022. [Original account compiled March 2009 by J. Jensen and D. Stevenson; revised December 2018].

Freytag, G. E. 1959. Zur Anatomie und systematischen Stellung von *Ambystoma schmidti* Taylor 1938 und verwandten Arten. Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich 104:79–89.

Godwin, J. C. 1993. Alabama Endangered Wildlife Project. Flatwoods Salamander (*Ambystoma cingulatum*) Inventory. Contract Number: 93-CNR-100. Alabama Natural Heritage Program, Montgomery, Alabama. 10 pp.

Godwin, J. C. [1994]. Status Survey for the Flatwoods Salamander, *Ambystoma cingulatum*, in Alabama, 1992–93 and 1993–94. Alabama Natural Heritage Program, Montgomery, Alabama. 38 pp. [Publication date not printed on Report; inferred from 1993-1994 date range].

Godwin, J. C. 2003. Flatwoods Salamander (*Ambystoma cingulatum*) Survey, 2002–2003. A Report Prepared for The Alabama Department of Conservation and Natural Resources. Alabama Natural Heritage Program, Montgomery, Alabama. 17 pp.

Goin, C. J. 1950. A study of the salamander, *Ambystoma cingulatum*, with the description of a new subspecies. Annals of the Carnegie Museum 31:299–320, Plate 1.

Goldberg, C. S., K. M. Strickler, and A. K. Fremier. 2018. Degradation and dispersion limit environmental DNA detection of rare amphibians in wetlands: Increasing efficacy of sampling designs. Science of the

Total Environment 633:695–703.

Gorman, T. A. 2009. Ecology of Two Rare Amphibians of the Gulf Coastal Plain. Unpublished Ph.D. Dissertation. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. xviii + 160 pp.

Gorman, T. A. and C. A. Haas. 2013. Final Report: Experimental Restoration of Pine Flatwoods Wetlands. Department of Defense Legacy Resource Management Program. Virginia Tech, Blacksburg, Virginia. 21 pp.

Gorman, T. A. and C. A. Haas. 2014. Final Report: Evaluation of Mechanical Mid-story Removal as a Tool to Restore Endangered Species Habitat. Department of Defense Legacy Resource Management Program. Virginia Tech, Blacksburg, Virginia. 21 pp.

Gorman, T. A. and C. A. Haas. 2015. Final Report: Evaluation of Mechanical Mid-story Removal as a Tool to Restore Endangered Species Habitat. Department of Defense Legacy Resource Management Program. Virginia Tech, Blacksburg, Virginia. ii + 24 pp.

Gorman, T. A., C. A. Haas, and D. C. Bishop. 2009. Factors related to occupancy of breeding wetlands by flatwoods salamander larvae. Wetlands 29:323–329.

Gorman, T. A., C. A. Haas, and J. G. Himes. 2013. Evaluating methods to restore amphibian habitat in fire-suppressed pine flatwoods wetlands. Fire Ecology 9:96–109.

Gorman, T. A., S. D. Powell, K. C. Jones, and C. A. Haas. 2014. Microhabitat characteristics of egg deposition sites used by reticulated flatwoods salamanders. Herpetological Conservation and Biology 9:543–550.

Gorman, T. A., C. A. Haas, H. C. Chandler, and K. C. Jones. 2016. Hurlburt Mitigation Monitoring: Restoration of Wetlands for Reticulated Flatwoods Salamanders. Annual Report for Year 4 (May 2015 – February 2016). 2015–2016. Virginia Tech, Blacksburg, Virginia. 12 pp.

Graham, S. P., D. A. Steen, M. Bailey, J. C. Godwin, J. Stiles, S. Stiles, T. Langkilde, and C. Guyer. 2015. The Amphibians and Reptiles of Conecuh National Forest, Escambia and Covington Counties, Alabama. Alabama Museum of Natural History Bulletin 32. University of Alabama, Tuscaloosa. 111 pp.

Guyer, C. 2001. Monitoring of Flatwoods Salamanders at Mayhaw Wildlife Management Area. Final Report for FY 2000. Report submitted to Georgia Department of Natural Resources, Nongame-Endangered Wildlife Program. 3 pp.

Haas, C. A. and T. A. Gorman. 2011. Studies of the Fauna of the Longleaf Pine Ecosystem on Eglin Air Force Base, Florida: Endangered Species Management and Community Interactions. 2006–2008 Report on Amphibian Monitoring. Virginia Tech, Blacksburg, Virginia. Unpaginated [19 pp.].

Haas, C. A. and T. A. Gorman. 2013. Final Report: Restoration of Pine Flatwoods Wetlands on Eglin Air Force Base. Virginia Tech, Blacksburg, Virginia. 12 pp.

Haas, C. A., T. A. Gorman, S. J. Goodman, K. C. Jones, and B. R. Rincon. [2012]. Studies of the Fauna of the Longleaf Pine Ecosystem on Eglin Air Force Base, Florida: Endangered Species Management and Community Interactions. 2009-2011 Report on Amphibian & Reptile Monitoring. Virginia Tech, Blacksburg, Virginia. 28 pp. [Publication date not printed on Report; inferred from 2009-2011 date range].

Haas, C. A., T. A. Gorman, K. C. Jones, and J. G. Palis. 2014. Flatwoods Salamander Surveys: Interim Report. [Report submittted to United States Fish and Wildlife Service]. Virginia Polytechnic and State University, Blacksburg, Virginia. Unpaginated [9 pp.].

Hardy, J. D., Jr. and J. Olmon. 1974. Restriction of the range of the Frosted Salamander, *Ambystoma cingulatum* based on a comparison of the larvae of *Ambystoma cingulatum* and *Ambystoma mabeei.* Herpetologica 30:156–160.

Highton, R., S. G. Tilley (Chair), and D. B. Wake. 2001 ("2000"). Caudata – Salamanders. Pp. 18–30 *in* Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding (Crother, B. I. [Committee Chair], J. Boundy, J. A. Campbell, K. de Queiroz, D. R. Frost, R. Highton, J. B. Iverson, P. A. Meylan, T. W. Reeder, M. E. Seidel, J. W. Sites, Jr., T. W. Taggart, S. G. Tilley, and D. B. Wake, Committee on Standard English and Scientific Names). Society for the Study of Amphibians and Reptiles, Herpetological Circular 29.

Highton, R. (Chair), R. M. Bonett, and E. L. Jockusch. 2017. Caudata - Salamanders. Pp. 25–37 *in* Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding. Eighth Edition (by R. M. Bonett, J. Boundy, F. T. Burbrink, B. I. Crother, K. de Queiroz, D. R. Frost, R. Highton, J. B. Iverson, E. L. Jockusch, F. Kraus, K. L. Krysko, A. D. Leaché, E. M. Lemmon, R. W. McDiarmid, J. R. Mendelson III, P. A. Meylan, T. W. Reeder, S. Ruane, and M. E. Seidel, Committee on Standard English and Scientific Names). Society for the Study of Amphibians and Reptiles Herpetological Circular 43.

Hipes. D. [2003]. Field Survey for Flatwoods Salamander on Under-surveyed Publicly Owned Lands in Florida. Final Report 2002–2003. Florida Natural Areas Inventory, [Tallahassee, Florida]. Unpaginated [8 pp.]. [Publication date not printed on Report; inferred from 2002-2003 date range].

Hipes, D. and H. Norden. 2003. Rare Plant and Animal Inventory of Air Force Special Operations Command, Hurlburt Field, Florida. Final Report. Florida Natural Areas Inventory, Tallahassee, Florida. viii + 33 + [35] pp.

Hipes, D. and D. Printiss. 2002. Flatwoods Salamander Survey of Hurlburt Field, Florida. Florida Natural Areas Inventory, Tallahassee, Florida. iii + 14 pp.

Hipes, D., D. R. Jackson, K. NeSmith, D. Printiss, and K. Brandt. 2001. Field Guide to the Rare Animals of Florida. Florida Natural Areas Inventory, Tallahassee, Florida. Un-paginated [311 pp.].

Holman, J. A. 2006. Fossil Salamanders of North America. Indiana University Press, Bloomington, Indiana. xiii + [3] + 232 + [1] pp.

Jackson, D. R. and D. L. Hipes. 2005. Management Guidance Document for the Flatwoods Salamander on Eglin Air Force Base and Hurlburt Field, Florida. Final Report. Florida Natural Areas Inventory, Tallahassee, Florida. 87 + [3] + 8 + 9 pp.

Jensen, J. B. 1999. Flatwoods salamander. *Ambystoma cingulatum*. Pp. 92–93 *in* Protected Animals of Georgia (T. W. Johnson, J. C. Ozier, J. L. Bohannon, J. B. Jensen, and C. Skelton, editors). Nongame – Endangered Wildlife Program, Nongame Wildlife – Natural Heritage Section, Wildlife Resources Division, Georgia Department of Natural Resources.

Jensen, J. B. and S. A. Johnson. 1998. *Ambystoma cingulatum* (Flatwoods Salamander). Herpetological Review 29:244.

Jensen, J. B. and D. J. Stevenson. 2008. Flatwoods salamander. *Ambystoma cingulatum*. Pp. 133–135 *in* Amphibians and Reptiles of Georgia (J. B. Jensen, C. D. Camp, W. Gibbons, and M. J. Elliott, editors). The University of Georgia Press,

Athens, Georgia.

Jones, C. N., D. L. McLaughlin, K. Henson, C. A. Hass, and D. A. Kaplan. 2018. From salamanders to greenhouse gases: Does upland management affect wetland functions? Frontiers in Ecology and Environment 16(1):14–19.

Jones, K. C., P. Hill, T. A. Gorman, and C. A. Haas. 2012. Climbing behavior of flatwoods salamanders (*Ambystoma bishopi* / *A. cingulatum*). Southeastern Naturalist 11:537–542.

Jones, K. C., B. K. Rincon, T. A. Gorman, C. A. Haas, and R. M. Engeman. 2015. Multi-trophic level feeding interactions among two native and two non-native species: Implications for the endangered Reticulated Flatwoods Salamander (*Ambystoma bishopi*). Collinsorum 4(3):6–7.

Jones, K. C., T. A. Gorman, B. K. Rincon, J. Allen, C. A. Haas, and R. M. Engeman. 2018. Feral swine *Sus scrofa*: a new threat to the remaining breeding wetlands of the Vulnerable reticulated flatwoods salamander *Ambystoma bishopi*. Oryx 52:669–676.

Jones, T. R., J. C. Godwin, and T. Lamb. 1982. *Ambystoma cingulatum* (Flatwoods Salamander). Herpetological Review 13:51.

Jones, T. R., A. G. Kluge, and A. J. Wolf. 1993. When theories and methodologies clash: A phylogenetic reanalysis of the North American ambystomatid salamanders (Caudata, Ambystomatidae). Systematic Biology 42:92–102.

Kraus, F. 1988. An empirical evaluation of the use of the ontogeny polarization criterion in phylogenetic inference. Systematic Zoology 37:106–141.

Krysko, K. L., K. M. Enge, and P. E. Moler. 2011. Atlas of Amphibians and Reptiles in Florida. Final Report, Project Agreement 08013, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. iv + 524 pp.

Krysko, K. L., K. M. Enge, and P. E. Moler. 2019. Amphibians and Reptiles of Florida. University of Florida Press, Gainesville, Florida. xvi + 706 + [1] pp.

Kuss, B. D. 1988. A Search for Populations of the Flatwoods Salamander (*Ambystoma cingulatum*) in Mississippi. End of Year Report. Prepared for the Mississippi Commission on Wildlife Conservation. Unpaginated [18 pp.].

LaClaire, L. V. [United States Fish and Wildlife Service]. 1999. Endangered and threatened wildlife and plants; final rule to list the flatwoods salamander as a threatened species. Federal Register 64(62):15691–15704.

LaClaire, L. V. [United States Fish and Wildlife Service]. 2008. Endangered and threatened wildlife and plants; proposed endangered status for reticulated flatwoods salamander; proposed designation of critical habitat for frosted flatwoods salamander and reticulated flatwoods salamander; proposed rule. Federal Register 73(157):47258–47324.

Lohoefener, R. and R. Altig. 1983. Mississippi Herpetology. Mississippi State University Research Center at National Space Technology Laboratories Bulletin 1. vi + 66 pp.

Martof, B. S. 1956. Amphibians and Reptiles of Georgia. A Guide. University of Georgia Press, Athens, Georgia. viii + 94 pp.

Martof, B. S. 1968. *Ambystoma cingulatum*. Catalogue of American Amphibians and Reptiles 57:57.1–57.2.

Martof, B. S. and H. C. Gerhardt. 1965. Observations on the geographic variation in *Ambystoma cingulatum*. Copeia 1965:342–346.

McKee, A .M., D. L. Calhoun, W. J. Barichivich, S. F. Spear, C. S. Goldberg, and T. C. Glenn. 2015. Assessment of environmental DNA for detecting presence of imperiled aquatic

amphibian species in isolated wetlands. Journal of Fish and Wildlife Management 6:498–510.

McKnight, M. L. and H. B. Shaffer. 1997. Large, rapidly evolving intergenic spacers in the mitochondrial DNA of the salamander family Ambystomatidae (Amphibia: Caudata). Molecular Biology and Evolution 14:1167–1176.

Means, D. B. 1972. Notes on the autumn breeding biology of *Ambystoma cingulatum* (Cope) (Amphibia: Urodela: Ambystomatidae). Association of Southeastern Biologists Bulletin 19:84–85.

Means, D. B. 1986. Special concern. Flatwoods salamander. *Ambystoma cingulatum* (Cope). Family Ambystomatidae. Order Caudata. Pp. 42–43 *in* Vertebrate Animals of Alabama in Need of Special Attention (R. H. Mount, editor). Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama.

Means, D. B. 2004. Flatwoods salamander. *Ambystoma cingulatum* (Cope). Pp. 19–20 *in* Alabama Wildlife. Volume 3. Imperiled Amphibians, Reptiles, Birds, and Mammals (R. E. Mirarchi, M. A. Bailey, T. M. Haggerty, and T. L. Best, editors). The University of Alabama Press, Tuscaloosa, Alabama.

Means, R. P. M. 2013. *Ambystoma bishopi*: Survey and Status of Designated Critical Habitat. Final Report submitted to the U.S. Fish and Wildlife Service. Coastal Plains Institute, [Tallahassee, Florida]. [5] + 72 pp.

Mecham, J. S. and R. E. Hellman. 1952. Notes on the larvae of two Florida salamanders. The Quarterly Journal of the Florida Academy of Sciences 15:127–133.

Meshaka, W. E., Jr. and K. J. Babbitt (editors). 2005. Amphibians and Reptiles. Status and Conservation in Florida. Krieger Publishing Company, Malabar, Florida. xvi + 318 pp.

Millsap, B. A., J. A. Gore, D. E. Runde, and S. I. Cerulean. 1990. Setting priorities for the conservation of fish and wildlife species in Florida. Wildlife Monographs 111:3–57.

Miranda-Castro, L. 2021. Endangered and threatened wildlife and plants: Four draft recovery plans. Federal Register 86(57):16232-16233.

Mitchell, D. W. 2017. Amphibians of the World: The Nature Lover's Life List. Including Many New and More Systematic English Names. Privately Published, [no place of publication provided]. i-xvi, 17-571 + [2] pp.

Mitchell, J. and W. Gibbons. 2010. Salamanders of the Southeast. The University of Georgia Press, Athens, Georgia. [4] + 324 pp.

Moulis, R. A. 1995. A survey of Suitable Habitat in Southwestern Georgia for the Gopher Frog (*Rana capito* ssp.), Striped Newt (*Notophthalmus perstriatus*), and Flatwoods Salamander (*Ambystoma cingulatum*). Report to U.S. Fish and Wildlife Service, Jackson Field Office, Jackson, Mississippi. 43 pp.

Mount, R. H. 1975. The Reptiles and Amphibians of Alabama. Auburn University Agricultural Experiment Station, Auburn, Alabama. vii + [1] + 347 pp.

Mount, R. H. 1976. Amphibians and reptiles. Pp. 66–79 *in* Endangered and Threatened Plants and Animals of Alabama. The Results of a Symposium Sponsored by Game and Fish Division of the Alabama Department of Conservation and Natural Resources and Alabama Museum of Natural History, The University of Alabama (H. Boschung, editor). Alabama Museum of Natural History Bulletin 2.

Mount, R. H. [1980]. Survey for the Presence or Absence of Threatened or Endangered Reptiles and Amphibians, Conecuh National Forest, Alabama. Report

submitted to The United States Forest Service. Auburn University, Auburn, Alabama. [2] + 108 + [19] pp. [Publication date not printed on Report; 1980 date in pencil on bottom of cover page in John Palis library].

Mount, R. H. 1996. The Reptiles and Amphibians of Alabama. The University of Alabama Press, Tuscaloosa, Alabama. xi + [1] + 347 pp.

Mount, R. H., W. Adams, R. E. Ashton, Jr., J. S. Brown, W. E. Cooper, Jr., W. Cox, J. L. Dobie, G. W. Folkerts, W. R. Garstka, D. R. Jackson, K. R. Marion, D. B. Means, and D. W. Speake. 1984. Amphibians and reptiles. Pp. 15–24 *in* Vertebrate Wildlife in Alabama. Alabama Agriculture Experiment Station, Auburn University, Alabama.

O'Donnell, K. M., A. F. Messerman, W. J. Barichivich, R. D. Semlitsch, T. A. Gorman, H. G. Mitchell, N. Allan, D. Fenolio, A. Green, F. A. Johnson, A. Keever, M. Mandica, J. Martin, J. Mott, T. Peacock, J. Reinman, S. S. Romañach, G. Titus, C. McGowan, and S. C. Walls. 2017. Structured decision making as a conservation tool for recovery planning of two endangered salamanders. Journal for Nature Conservation 37:66–72.

Orton, G. 1942. Notes on the larvae of certain species of *Ambystoma*. Copeia 1942:170–172.

Palis, J. G. 1993a. Flatwoods salamanders. Florida Wildlife 47:13–15.

Palis, J. G. 1993b. A Status Survey of the Flatwoods Salamander, *Ambystoma cingulatum*, in Florida. Florida Natural Areas Inventory, Tallahassee, Florida. iii + 29 pp.

Palis, J. G. 1994. A Flatwoods Salamander Survey of Tyndall Air Force Base, Bay County, Florida. Appendix 3 [unpaginated] *in* Biological Survey of Tyndall Air Force Base. Final Report. Report by the Florida Natural Areas Inventory, Tallahassee, Florida. ix + 86 + 3 unpaginated appendices.

Palis, J. G. 1995a. *Ambystoma cingulatum* (Flatwoods Salamander). Herpetological Review 26:103.

Palis, J. G. 1995b. Larval growth, development, and metamorphosis of *Ambystoma cingulatum* on the Gulf Coastal Plain of Florida. Florida Scientist 58:352–358.

Palis, J. G. 1996. Flatwoods salamander (*Ambystoma cingulatum* Cope). Natural Areas Journal 16:49–54.

Palis, J. G. 1997a. Breeding migration of *Ambystoma cingulatum* in Florida. Journal of Herpetology 31:71–78.

Palis, J. G. 1997b. Distribution, habitat, and status of the flatwoods salamander (*Ambystoma cingulatum*) in Florida, USA. Herpetological Natural History 5:53–65.

Palis, J. G. 1997c. Species profile: Flatwoods salamander (*Ambystoma cingulatum*) on Military Installations in the Southeastern United States. Technical Report SERDP-97-6. US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. [2] + 19 +[1] pp.

Palis, J. G. and K. M. Enge. 2005. Management Recommendations for the Flatwoods Salamander at International Paper Company Site FL-057-002, Santa Rosa County, Florida. Report submitted to the Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. 19 pp.

Palis, J. G. and K. M. Enge. 2006. Management Recommendations for the Flatwoods Salamander on Garcon Point Water Management Area and Yellow River Marsh Preserve State Park. Report submitted to the Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. 25 pp.

Palis, J. G. and G. Hammerson. 2008. *Ambystoma cingulatum*. The IUCN Red List of Threatened Species. Version 2021.3. Available at https://www.iucnredlist.org/species/1099/3236962. Archived by

Internet Archive at https://web.archive.org/web/20211027030536/https://www.iucnredlist.org/species/1099/3236962 on 6 April 2022.

Palis, J. G. and J. B. Jensen (D. R. Jackson, Project Supervisor). 1995. Distribution and Breeding Biology of the Flatwoods Salamander (*Ambystoma cingulatum*) and Gopher Frog (*Rana capito*) on Eglin Air Force Base, Florida. Final Report. Florida Natural Areas Inventory, Tallahassee, Florida. v + 32 + [3] pp., Figures 1-7, 8 unpaginated appendices [182 pp.].

Palis, J. G. and D. B. Means. 2005. *Ambystoma cingulatum* Cope, 1867 (1868). Flatwoods salamander. Pp. 608–609 *in* Amphibian Declines. The Conservation Status of United States Species (M. Lannoo, editor). The University of California Press, Berkeley, California.

Pauly, G. B., O. Piskurek, and H. B. Shaffer. 2007. Phylogeographic concordance in the southeastern United States: the flatwoods salamander, *Ambystoma cingulatum*, as a test case. Molecular Ecology 16:415–429.

Pauly, G. B., S. H. Bennett, J. G. Palis, and H. B. Shaffer. 2012. Conservation and genetics of the frosted flatwoods salamander (*Ambystoma cingulatum*) on the Atlantic coastal plain. Conservation Genetics 13:1–7.

Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press. Washington, D.C., and London, United Kingdom. xvi + 587 pp., 172 plates.

Powell, R., J. T. Collins, and E. D. Hooper, Jr. 2012. Key to the Herpetofauna of the Continental United States and Canada. Second Edition, Revised and Updated. University Press of Kansas, Lawrence, Kansas. viii + 152 pp.

Powell, R., J. T. Collins, and E. D. Hooper, Jr. 2019. Key to the Herpetofauna of the Continental United States and Canada. Third Edition, Revised and Updated. University Press of Kansas, Lawrence, Kansas. viii + 172 pp.

Powell, R., R. Conant, and J. T. Collins. 2016. Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Fourth Edition. Houghton Mifflin Harcourt Publishing Company, Boston, Massachusetts and New York, New York. xiii + 494 pp.

Powell, S. D., K. C. Jones, T. A. Gorman, and C. A. Haas. 2013. *Ambystoma bishopi* (Reticulated Flatwoods Salamander). Egg survival after fire. Herpetological Review 44:290–291.

Powell, S. D., T. A. Gorman, and C. A. Haas. 2015. Nightly movements and use of burrows by reticulated flatwoods salamanders (*Ambystoma bishopi*) in breeding wetlands. Florida Scientist 78:149–155.

Printiss, D. J. and D. L. Hipes. 1997. Rare Plant, Rare Vertebrate, and Natural Community Survey of Naval Air Station Whiting Field, Blackwater River Recreation Area, and Outlying Landing Fields Harold, Santa Rosa, Holley, Site 8A, Pace, Spencer, Wolf, Barin, Summerdale, and Silverhill. Final Report. Submitted to the U.S. Department of Defense. Florida Natural Areas Inventory, Tallahassee, Florida. viii + 50 pp.

Printiss, D. and D. Hipes. 2000. Flatwoods Salamander Survey and Habitat Evaluation of Eglin Air Force Base, Hurlburt Field, and Tyndall Air Force Base. Final Report to U.S. Department of Defense, U.S. Air Force. Florida Natural Areas Inventory, Tallahassee, Florida. vii + 34 pp.

Reece, J. S. and R. F. Noss. 2014. Prioritizing species by conservation value and vulnerability: a new index applied to species threatened by sea-level rise and other risks in Florida. Natural Areas Journal 34:31–45.

Reichling, S. B. 2008. Reptiles and Amphibians of the Southern Pine Woods. University Press of Florida, Gainesville, Florida. xxi + 252 pp., 100 photographic plates.

Schmidt, K. P. 1953. A Check List of North American Amphibians and Reptiles. Sixth Edition. American Society of Ichthyologists and Herpetologists. viii + 280 pp.

Schwartz, A. and R. Etheridge. 1954. New and additional herpetological records from the North Carolina Coastal Plain. Herpetologica 10:167–171.

Semlitsch, R. D., S. C. Walls, W. J. Barichivich, and K. M. O'Donnell. 2017. Extinction debt as a driver of amphibian declines: An example with imperiled flatwoods salamanders. Journal of Herpetology 51:12–18.

Seyle, W. 1994. Distribution and Status of the Gopher Frog (*Rana capito*) and Flatwoods Salamander (*Ambystoma cingulatum*) in Georgia. Final report to U.S. Fish and Wildlife Service, Jackson Field Office, Jackson, Mississippi. iii + 21 pp.

Shaffer, H. B., J. M. Clark, and F. Kraus. 1991. When molecules and morphology clash: A phylogenetic analysis of the North American Ambystomatid salamanders (Caudata: Ambystomatidae). Systematic Zoology 40:284–303.

Shupe, S. 2019. Florida Wildlife Encyclopedia. An Illustrated Guide to Birds, Fish, Mammals, Reptiles, and Amphibians. Skyhorse Publishing, New York, New York. x + 252 pp.

Smith L. L., D. A. Steen, J. M. Stober, M. C. Freeman, S. W. Golladay, L. M. Conner, and J. Cochrane. 2006. The vertebrate fauna of Ichauway, Baker County, GA. Southeastern Naturalist 5:599–620.

Stuart, S. N., M. Hoffmann, J. S. Chanson, N. A. Cox, R. J. Berridge, P. Ramani, and B. E. Young, (editors). 2008. Threatened Amphibians of the World. Lynx Edicions, Barcelona, Spain; International Union for the Conservation of Nature, Gland, Switzerland; and Conservation International, Arlington, Virginia, USA. xv + [1] + 758 pp.

Surdick, J. 2016. Escribano Point Wildlife Management Area 2015–2016 Drift Fence Animal Survey. Florida Natural Areas Inventory, Tallahassee, Florida. iv + 34 pp.

Sutter, R. D., J. J. Bachant, D. R. Gordon, and A. R. Litt. 2001. An Assessment of the Desired Future Conditions for Focal Conservation Targets on Eglin Air Force Base. Report prepared for Natural Resources Branch, Eglin Air Force Base. The Nature Conservancy, Gainesville, Florida. 151 pp.

Telford, S. R., Jr. 1955 ("1954"). A description of the larvae of *Ambystoma cingulatum bishopi* Goin, including an extension of the range. Quarterly Journal of the Florida Academy of Sciences 17:233–236.

Tihen, J. A. 1958. Comments on the osteology and phylogeny of ambystomatid salamanders. Bulletin of the Florida State Museum, Biological Sciences 3:1–50.

Tilley, S. G. (Chair), R. Highton, and D. B. Wake. 2008. Caudata – Salamanders. Pp. 13– 23 *in* Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding. Sixth Edition (J. Boundy, F. T. Burbrink, J. A. Campbell, B. I. Crother [Committee Chair], K. de Queiroz, D. R. Frost, R. Highton, J. B. Iverson, F. Kraus, R. W. McDiarmid, J. R. Mendelson III, P. A. Meylan, T. W. Reeder, M. E. Seidel, S. G. Tilley, and D. B. Wake, Committee on Standard English and Scientific Names). Society for the Study of Amphibians and Reptiles Herpetological Circular 37.

Tilley, S. G. (Chair), R. Highton, and D. B. Wake. 2012. Caudata – Salamanders. Pp. 23–31 *in* Scientific and Standard English Names of Amphibians and Reptiles of

North America North of Mexico, with Comments Regarding Confidence in Our Understanding. Seventh Edition (J. Boundy, F. T. Burbrink, J. A. Campbell, B. I. Crother [Committee Chair], K. de Queiroz, D. R. Frost, D. M. Green, R. Highton, J. B. Iverson, F. Kraus, R. W. McDiarmid, J. R. Mendelson III, P. A. Meylan, R. A. Pyron, T. W. Reeder, M. E. Seidel, S. G. Tilley, and D. B. Wake, Committee on Standard English and Scientific Names). Society for the Study of Amphibians and Reptiles Herpetological Circular 39.

United States Fish and Wildlife Service. 2009. Endangered and threatened wildlife and plants; determination of endangered status for reticulated flatwoods salamander; designation of critical habitat for frosted flatwoods salamander and reticulated flatwoods salamander; final rule. Federal Register 74(26):6700–6774.

United States Fish and Wildlife Service. 2015. Reticulated Flatwoods Salamander (*Ambystoma bishopi*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Southeast Region, Panama City, Florida. 46 pp.

Vitt, L. J. 1981. Part II: Reptiles and Amphibians. Pp. 27–31 *in* A Survey of the Status, Distribution, and Abundance of Potentially Threatened and Endangered Vertebrate Species in Georgia (J. Laerm, editor). Final Report to the Department of Natural Resources. The State of Georgia.

Walls, S. and A. Farmer. 2020. Species Status Assessment for the Reticulated Flatwoods Salamander (*Ambystoma bishopi*). Version 1.0. Panama City Field Office, Panama City, Florida for the U.S. Fish and Wildlife Service, South Atlantic – Gulf Region. 97 pp.

Walters, J. R., C. A. Haas, L. A. Blanc, D. C. Bishop, J. Kowalsky, and T. Gorman. [2006a]. Studies of the Fauna of the Longleaf Pine Ecosystem on Eglin Air Force Base, Florida: Endangered Species Management and Community Interactions. Project Report. Describing Research Conducted on Eglin Air Base, Florida During the Period January 2001 – December 2005. Report Submitted to Eglin Air Force Base. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 78 pp. [Publication date not printed on Report; inferred from 2001-2005 date range].

Walters, J., C. A. Haas, L. A. Blanc, D. C. Bishop, J. Kowalsky, and T. Gorman. 2006b. Studies of Fauna at Eglin Air Force Base. Annual Report to Eglin Air Force Base. Virginia Polytechnic and State University, Blacksburg, Virginia. 81 pp.

Wendt, A. S. 2017. A Population Genetic Investigation of the Reticulated Flatwoods Salamander (*Ambystoma bishopi*) on Eglin Air Force Base. Unpublished M.S. Thesis, Georgia Southern University, Statesboro, Georgia. [4] + 159 pp.

Wendt, A., C. A. Haas, T. Gorman, and J. H. Roberts. 2021. Metapopulation genetics of endangered reticulated flatwoods salamanders (*Ambystoma bishopi*) in a dynamic and fragmented landscape. Conservation Genetics 22:551–567.

Whiles, M. R., J. B. Jensen, J. G. Palis, and W. G. Dyer. 2004. Diets of larval flatwoods salamanders, *Ambystoma cingulatum*, from Florida and South Carolina. Journal of Herpetology 38:208–214.

Williams, J. S., J. H. Niedzwiecki, and D. W. Weisrock. 2013. Species tree reconstruction of a poorly resolved clade of salamanders (Ambystomatidae) using multiple nuclear loci. Molecular Phylogenetics and Evolution 68:671–682.

Williams, S. T., C. A. Haas, J. H. Roberts, and S. S. Taylor. 2020. Depauperate major histocompatibility complex variation in the endangered reticulated flatwoods

salamander (*Ambystoma bishopi*). Immunogenetics 72:263-274.

Williams, S. T., J. P. Elbers, and S. S. Taylor. 2021. Population structure, gene flow, and sex-biased dispersal in the reticulated flatwoods salamander (*Ambystoma bishopi*): Implications for translocations. Evolutionary Applications 14:2231–2243.

Williamson, G. K. and R. A. Moulis. 1994a. Distribution of Amphibians and Reptiles in Georgia. Volume 1—Maps. Special Publication No. 3. Savannah Science Museum, Savannah, Georgia. [14] pp., 195 maps.

Williamson, G. K. and R. A. Moulis. 1994b. Distribution of Amphibians and Reptiles in Georgia. Volume 2—Locality Data. Special Publication No. 3. Savannah Science Museum, Savannah, Georgia. [16] + 712 pp.

JOHN G. PALIS, Palis Environmental Consulting, P.O. Box 387, Jonesboro, Illinois 62952, USA (jpalis@yahoo.com); **THOMAS A. GORMAN**, Aquatic Resources Division, Washington State Department of Natural Resources, 1111 Washington Street SE, Olympia, Washington 98504 USA (thomas.gorman@dnr.wa.gov); **GREGORY B. PAULY**, Department of Herpetology and Urban Nature Research Center, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, USA (gpauly@nhm.org).

Primary editors for this account, Christopher J. Bell and Travis J. LaDuc.

Published 25 May 2022 and Copyright © 2022 by the Society for the Study of Amphibians and Reptiles.