

Note

Axanthism in Green Frogs (*Lithobates clamitans*) and an American Bullfrog (*Lithobates catesbeianus*) in Maine

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Abstract

We document eight cases of axanthism in Green Frogs (*Lithobates clamitans*) and one case in an American Bullfrog (*Lithobates catesbeianus*) in Maine. Although this mutation has been previously reported for both species, this is the first confirmed documentation of “blue” *L. clamitans* and *L. catesbeianus* from Maine.

Key words: Green Frog; *Lithobates clamitans*; American Bullfrog; *Lithobates catesbeianus*; amphibian; blue colour variant; axanthism; Maine

Although “blue” frogs have been documented since 1885 (Haller 1885; also cited in Berns and Uhler 1966), Jablonski *et al.* (2014) note that axanthism is one of the least known colour aberrations in anurans. Axanthism results from the absence or alteration of xanthophores, the dermal chromatophores responsible for red and yellow pigmentation (Berns and Narayan 1970). Normally, these xanthophores contain pteridines and carotinoids, which cause the underlying blue iridophores to appear green; in their absence, the skin appears blue (Berns and Narayan 1970). Berns and Uhler (1966) noted that blue Green Frogs (*Lithobates clamitans*) and Northern Leopard Frogs (*Lithobates pipiens*) have been recorded from northeastern United States (mentioning Maine specifically) and southeastern Canada, although they did not state which species were found in which state or province. Of 111 blue frogs they examined from throughout eastern North America, 100 were *L. clamitans*, 10 were *L. pipiens*, and one was an American Bullfrog (*Lithobates catesbeianus*; from Kentucky). Dodd (2013) cited reports of blue *L. clamitans* from Massachusetts, Delaware, and Virginia, but not Maine. Desroches and Rodrigue (2004) illus-

trated a blue *L. clamitans*; although not stated, it was presumably from Quebec. Dodd (2013) included a photograph of a blue *L. catesbeianus*, but did not give its locality, and Gilhen and Russell (2015) reported three blue *L. catesbeianus* from Nova Scotia.

On 9 June 2018, S.B.L., James A. Elliott, and A.M.O. found an axanthic adult male *L. clamitans* (Figure 1) in a small pool with emergent vegetation in an ~10-year-old clearcut in coniferous forest, T5 R11 WELS township, Piscataquis County, Maine, USA (46.116659°N, 69.211416°W). Roughly 20 additional wild-type conspecifics were also found at the same location. Axanthic *L. clamitans* (all adults) have also been photo-documented from the following localities in Maine: Washington, Knox County, 11 August 2010; Wiscasset, Lincoln County, 4 October 2013; Buxton, York County, mid-June 2017; Phillips, Franklin County, 16 August 2017; Raymond, Cumberland County, 16 September 2017; and Bethel, Oxford County, 15 July 2018 (MARAP 2019). Although these were coloured similarly to the individual in Figure 1 (i.e., metallic greenish-blue over the entire dorsum), an additional one, from Hurd's Pond, Swanville, Waldo County (44.476658°N,



FIGURE 1. Axanthic adult male Green Frog (*Lithobates clamitans*) from T5 R11 WELS township, Piscataquis County, Maine, USA, 9 June 2018. Photo: Scott B. Lindemann.

69.032297°W) was piebald blue-green (Figure 2).

In contrast to *L. clamitans*, only a single axanthic *L. catesbeianus* has been documented from Maine (MARAP 2019). A subadult (or small adult) female (Figure 3) was photographed at Headquarters Pond, Cobscook Bay State Park, Edmunds Township,

Washington County (44.849505°N, 67.167045°W) by Owen and Raymond Brown on 19 June 2011.

To our knowledge, these represent the first confirmed records of axanthic *L. clamitans* and *L. catesbeianus* from Maine. We do not know the true incidence of axanthic frogs in Maine. The MARAP database contains 773 records of *L. clamitans* and 445 of *L. catesbeianus*, but these records are not the result of systematic surveys, and the resulting ratios of axanthic frogs to normally pigmented ones (1:97 for *L. clamitans* and 1:445 for *L. catesbeianus*) are undoubtedly overestimates, as axanthic individuals are much more likely to be reported. Based on data from midwestern supply houses, Berns and Uhler (1966) estimated that out of a sample of roughly two million frogs, axanthics (mostly *L. clamitans*) occurred at a frequency of about 1:29 000, although in some local areas the rate was as high as 1:318 (22 of 7000). Our data support Berns and Uhler's (1966) finding that axanthism appears to be most common in *L. clamitans*. Like albinism, axanthism is presumably a heritable trait (Bechtel 1995). Whether there is a potential selective advantage or disadvantage to axanthism is unknown, but its rarity suggests that it is likely neutral or even potentially disadvantageous. Further documentation of axanthic specimens, such as those reported here, is conducive to an improved understanding of taxonomic and geographic patterns in this interesting colour aberration.



FIGURE 2. Piebald axanthic adult male Green Frog (*Lithobates clamitans*) from Swanville, Waldo County, Maine, USA, 27 June 2016. Photo: Trevor B. Persons.



FIGURE 3. Axanthic American Bullfrog (*Lithobates catesbeianus*) from Cobscook Bay State Park, Edmunds Township, Washington County, Maine, USA, 19 June 2011. Photo: Raymond Brown.

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