for August in Thunder Bay is 73% (www.en.climate-data.org; 15 October 2022).

Post-breeding or "rain calls" in *P. crucifer* have been documented as occurring sporadically from August to December in Connecticut, Florida, Maine, Massachusetts, Michigan, New Brunswick, New Hampshire, and Tennessee (see summary and refs. in Dodd 2013. Frogs of the United States and Canada, Vol. 1. John Hopkins University Press, Baltimore, Maryland. 460 pp.). These calls generally occur during unusually humid, warm, and cloudy conditions, or prior to precipitation, but the purpose of late season or arboreal calls is unknown (Dodd 2013, *op. cit.*). Solitary male *P. crucifer* may call from tree canopies long after the breeding season (Dodd 2004. The Amphibians of the Great Smoky Mountains National Park. University of Tennessee Press, Knoxville, Tennessee. 304 pp.). Our record of a solitary male calling from a tree canopy occurred during a period of high relative humidity and shortly after rainfall. It is also the first documented record for post-breeding calls for this species in Ontario to our knowledge.

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***PULCHRANA GRANDOCULA* (Big-eyed Frog). ENDOPARASITES.** *Pulchrana grandocula* is known from Mindanao, Basilan, Biliran, Bohol, Samar, Leyte, Camiguin and Dinagat Islands, Philippines (Frost 2023. Amphibian Species of the World: An Online Reference. Version 6.1; https://amphibiansoftheworld.amnh.org; 3 Jan 2023). We know of no helminth species reported from *P. grandocula* and herein establish the helminth list for this species.

Ten *P. grandocula* females collected June 2014 (mean SVL = 58.7 mm ± 2.6 SD, range: 57–63 mm) and deposited in the Sam Noble Oklahoma Museum of Natural History (OMNH), University of Oklahoma, Norman, Oklahoma, USA as OMNH 45181, 45185, 45193, 45195, 45196, 45201, 45203, 45205, 45208, 45213 were examined. The frogs were from Mt. Huraw, Uno Barangay, San Jose de Buan Municipality, Western Samar Province, Philippines (12.02562°N, 125.03429°E; WGS 84; 209 m elev.). The frogs had been preserved in 10% neutral buffered formalin and maintained in 70% ethanol. The body cavity was opened and the digestive tract was removed. The esophagus, stomach, small and large intestines were opened with a surgical steel razor blade and the contents were examined for helminths utilizing a dissecting microscope. The body cavity was also searched. Each helminth was removed with jeweler's forceps, cleared in a drop of lactophenol on a glass slide, a cover slip was added and the preparation was studied under a compound microscope. Found were two helminth species: 4 individuals of the nematode *Aplectana samarensis* (3 females, 1 male) in the large intestines of 3/10 frogs (prevalence = number infected/number examined × 100% = 30%; mean number helminths = 1.3 ± 0.5 SD, range: 1–2) and 12 individuals (7 females, 5 males) of the acanthocephalan *Pseudoacanthocephalus nickoli* in the small intestines of 6/10 frogs (prevalence = 60%; mean number helminths = 2.0 ± 1.2 SD, range: 1–4).

Identifications were made by comparison with the original descriptions for *A. samarensis* (Bursey et al. 2018. Acta Parasitol. 63:474–478) and *P. nickoli* (Tkach et al. 2013. Syst. Parasitol. 85:11–26). *Pulchrana grandocula* is the sixth reported host to harbor *A. samarensis*. Other hosts are *Limnonectes magnus* (Bursey et al. 2018. *op. cit.*), *L. macrocephalus, L. visayanus, L. woodworthi* (Goldberg et al. 2019. Pac. Sci. 73:177-186) and *P. similis* (Goldberg and Bursey 2020. Herpetol. Rev. 51:823). *Pulchrana similis* (Goldberg and Bursey 2020, *op. cit.*), *Sanguirana luzonensis* (as *Rana luzonensis)* (Tkach et al. 2013, *op. cit.*) and *P. grandocula* are currently the only known hosts to harbor *P. nickoli*. Voucher helminths were deposited in the Harold W. Manter Parasitology Laboratory (HWML), The University of Nebraska, Lincoln, Nebraska, USA as *Aplectana samarensis* (HWML 118143) and *Pseudocanthorhynchus nickoli* (HWML 118144). *Aplectana samarensis* and *Pseudocanthorhynchus nickoli* in *P. grandocula* represent new host records.

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***RANA DRAYTONII* (California Red-legged Frog). LARVAL MALFORMATION.** Many species of amphibians worldwide have been reported with a variety of physical or morphological malformations (de Souza et al. 2020. Herpetol. Notes 14:31–41). In the United States, amphibians have been reported to have numerous types of malformations that were attributed to a variety of mechanisms (Meteyer 2000. Field Guide to Malformation of Frogs and Toads, Biological Sciences Report USGS/BRD/BSR-2000-005, US Department of Interior, US Geological Survey, 16 pp.; Blaustein and Johnson 2003. Front. Ecol. Environ. 1:87–94). In California, several authors have reported malformations in the adult forms of two Ranid species: *Rana draytonii* and *R. boylii* (Foothill Yellow-legged Frog), each with a different reason for the origin of the malformation (Kupferberg et al. 2009. Copeia 2009:529–537; Johnson et al. 2013. Nature 494:230–234; Alvarez et al. 2021. Northwest. Nat. 102:258–260). These malformations typically include supernumery and subnumery limbs (Meteyer 2000, *op. cit.*), but also include a variety of other physical anomalies. A specific malformation, bifurcation of the tail, is relatively common in squamates but is reported as very rare in amphibian larvae (Henle et al. 2012 J. Herpetol. 46:451–455). In a review of malformations of amphibian larvae, Henle et al. (2012, *op. cit.*) found only 19 individuals reported from 13 species whose larvae had bifurcated tails. We collected larvae of *R. draytonii* and noted a single larva with a bifurcated tail, which we believe is the first report of bifurcation in the tail of a California amphibian.

While conducting a peer-level workshop focused on the identification and natural history of *R. draytonii*, we collected approximately 37 larvae from a constructed pond in Michigan Bluff, Eldorado County, California, USA (39.04039°N, 120.73295°W; WGS 84; 1046 m elev.). We placed larvae in clear viewing containers so their developmental stages could be determined (see: Gosner 1960. Herpetologica 16:183–190.), and individuals could be counted. Upon close inspection, we noted a single larva with an irregular bifurcation of the tail (Fig. 1). After 5 years of annual monitoring of this site, malformations of larvae and adults has only been reported one other time, with a single larva showing anophthalmia (Alvarez et al. 2023. Herpetol. Rev. 54:108).

Many amphibian researchers have posited on the causes of various malformations, including metals, pesticides, herbicides, petrochemicals, chemical pollutants, retinoids and steroids, and

PHOTO BY MIRA FALICKI

FIG. 1. Larval *Rana draytonii* with a bifurcated tail collected from a constructed pond in Michigan Bluff, California, USA, June 2022.

retinoid and steroid-mimics, all of which have been reported to cause malformations in amphibians (Hall and Henry 1992. Herpetol. J. 2:65–71; Chambon 1993. Gene 135:223–228.; Kirk 1998. Herpetol. Rev. 19:51–53; Marco et al. 1999. Environ. Toxicol. Chem. 18:2836–2839; Hayes et al. 2002. P. Natl. Acad. Sci. 99:5476–5480; Degitz 2003. Toxicol. Sci. 74:139–146). Still other researchers have indicated that parasitic infections, ultraviolet radiation, and climate warming may also generate malformations in anurans (Johnson et al. 2001. Herpetologica 57:336–352; Ankley et al. 2002. Environ. Sci. Technol. 36:2853–2858; Schoff et al. 2003. J. Wildlife. Dis. 39:510–521).

Buskirk and McCollum (2000. J. Exper. Biol. 203:2149–2158) reported that tail morphology plays a critical role in predator avoidance. Specifically, they noted length and depth may impact swimming ability. We suspect that the individual we collected had such a minor malformation that it may not affect swimming performance. Additionally, this larva, which we characterized as Gosner stage 38 (see: Gosner 1960, *op. cit.*), was nearing transformation, which would likely result in no expression of a malformation and would not impact future fitness.

Our work allows us to annually sample many populations of ranid frogs in California, and we only rarely note a malformed amphibian of any species or life stage; this is the first instance of a tail bifurcation in any ranid species we have sampled. Further, we believe this is the first report of tail bifurcation in the threatened frog, *R. draytonii*.

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***RANA ONCA* (Relict Leopard Frog). METAMORPHOSIS and OVERWINTERING TADPOLES.** Although *Rana onca* was once believed by some researchers to be extinct, natural populations of these frogs had persisted in Arizona and Nevada (Jaeger et al. 2001. Copeia 2001:339–354). Since then, a multiagency effort has established several translocated populations to supplement the few remaining natural ones (Bradford et al. 2004. Southwest. Nat. 49:218–228; Fed. Reg. 81(194):69434–69437). Little has been published about the larval ecology of *R. onca,* a critical phase of the anuran life cycle (Bradford et al. 2005. *In* Lannoo [ed.], Amphibian Declines, The Conservation Status of United States Species, pp. 567–568. University of California Press, Berkeley, California; Drake 2010. Herpetol. Rev. 41:198–199; Dodd 2013. Frogs of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland. 982 pp.). Herein, we document the metamorphosis and overwintering of *R. onca* tadpoles following translocations and *in situ* reproduction in a refugium population.

On 29 May 2018, 100 lab-raised, recently metamorphosed, *R. onca* were released into a newly constructed 0.02-ha refugium consisting of two interconnected ponds established at the 73-ha Springs Preserve in Las Vegas, Clark County, Nevada, USA (36.17463°N, 115.18406°W; WSG 84) (Saumure et al. 2021. *In* P.S. Soorae [ed.]. Global Conservation Translocation Perspectives: 2021. Case Studies from Around the Globe, pp. 76–81. International Union for the Conservation of Nature, Gland, Switzerland). By 3 October 2018, four of these recently metamorphosed frogs had reached the size of large adults (SVL = 75–84 mm) (Saumure et al. 2022. Herpetol. Rev. 53:108–110).

Over three dates from 27 March through 9 May 2019, an additional 101 large tadpoles and 111 metamorphosed frogs were translocated to the refugium ponds as part of a 5-year conservation protocol to supplement demographic and genetic diversity in the newly established population. On 25 April 2019, the first newly hatched *R. onca* tadpoles from *in situ* reproduction were observed in the ponds (Saumure et al. 2022, *op. cit.*), and by 10 August 2019, many newly metamorphosed *R. onca* were observed. A visual encounter survey (VES) conducted on 22 August 2019 documented four large adults, 190 newly metamorphosed frogs, and a single large tadpole. On 12 September 2019, seven tadpoles were captured in baited Gee minnow traps during a survey for *Empetrichthys latos* (Pahrump Poolfish), which were also previously released in the ponds. One of these tadpoles had developed all four limbs (Gosner Stage 42–44; Gosner 1960. Herpetologica 16:183–190). The remaining six tadpoles only had posterior limbs (Gosner Stage 36–39), with total lengths of 90–96 mm. During mark-recapture surveys for *R. onca* on 15 October and 7 November 2019, a total of 12 adults, 178 juveniles, and two tadpoles were captured. One of these tadpoles had developed posterior limbs (Gosner Stage 39–40; Fig. 1) and was comparable in size to the tadpoles captured in September. The second tadpole was estimated from photographs to be approximately 20 mm in total length and had not developed posterior limbs (Gosner Stage 25–26).

In 2020, no laboratory-raised *R. onca* were translocated to the refugium ponds; the Springs Preserve was closed to external personnel because of a Covid-19 pandemic quarantine. On 6 May 2020, however, a tadpole with posterior limbs (Gosner Stage 40–41; Fig. 2) was captured and photographed, confirming that *R. onca* can overwinter as tadpoles, a developmental strategy long suspected from field observations at other *R. onca* sites. On 25 August 2020, a VES documented 16 adults, 65 juveniles, and 5 tadpoles. Later, on 16 September 2020, 41 *R. onca* tadpoles were captured in baited Gee minnow traps during another *E. latos* survey.