REPTILES & AMPHIBIANS

Anophthalmia in a Marbled Globular Frog, *Uperodon systoma* (Schneider 1799), from Gujarat, India

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The global decline in amphibian population has drawn the attention of scientists for several decades. About 32% of amphibian species are at risk of extinction, while 43% are declining in number (Stuart et al. 2004). This trend is a result of no single cause but the interactive effects of five major factors: Atmospheric change, environmental pollutants, habitat modification, invasive species, and pathogens (Hayes et al. 2010). Although developmental failure resulting from these factors may not result is immediate death, deformities often lead to reproductive failure (Hayes et al. 2010) and hence population declines. Malformations often are caused by environmental factors that affect development during larval stages and the worldwide degree of variation in malformations suggests multiple causes. Major causes that have been identified include alien species, overexploitation, environmental degradation, UV radiation, contaminants, and

Fig. 1. A pair of Marbled Globular Frogs (*Uperodon systoma*) from an agricultural field in Vadusan Village, Danta, Banaskatha District, Gujarat, India. The female (bottom left) was active and appeared to be healthy, whereas the male (upper left and right) had an anophthalmic left orbit. Photographs by Jaydeep Maheta.

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diseases (Hussain 2012). Of these, however, environmental degradation and pollution, especially from the agricultural sector, are the major inducers of malformation (Ouellet et al. 1997; Marco et al. 1999; Sparling et al. 2015; Koleshka and Jablonski 2016). Johnson et al. (2001) described malformation as abnormal development triggered when external factors affect metamorphosis, disrupt hormonal systems (Orton and Tyler 2015), and cause permanent structural defects. Anophthalmia, a common ocular malformation in anurans, is characterized by the absence of one or both eyes (Ramalho et al. 2017; Meteyer 2000). Herein we report anophthalmia (missing eye) in a Marbled Globular Frog (*Uperodon systoma*).

Uperodon systoma, listed by the IUCN as being of Least Concern (LC) (Das et al. 2004), is widely distributed in southern India and also is known to occur in Sri Lanka, Bangladesh, Nepal, and Pakistan (Frost 2021). These frogs are completely fossorial and come to the surface only during the monsoon season (AmphibiaWeb 2021) for breeding (Das et al. 2004).

After heavy rainfall at 2245 h on 8 June 2020, we encountered two Marbled Globular Frogs (one male and one female) in an agricultural field in Vadusan Village, Danta, Banaskatha District, near the Aravalli Mountain Range in northern Gujarat, India (24°08'51.5"N, 72°46'51.8"E). The frogs were measured and released at the site where they were found.

The female frog was active and appeared to be healthy, whereas the male (SVL 60 mm) was missing its left eye (Fig. 1). Because we detected no signs of injury, we assumed that eye loss was not predator-mediated. Because the incident reported herein occurred in an agricultural area, we surmise that the malformation likely was triggered by agricultural pesticides or environmental pollution. To the best of our knowledge, this is the first case of anophthalmia recorded in *Uperodon systoma*.

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Literature Cited

AmphibiaWeb. 2021. *Uperodon systoma*. Marbled Balloon Frog. University of California, Berkeley, California, USA. <https://amphibiaweb.org/cgi/amphib_query?where-genus=Uperodon&where-species=systoma>.

Das, I., S. Dutta, K. Manamendra-Arachchi, A. de Silva, and M.S. Khan. 2004. *Uperodon systoma* (errata version published in 2018). *The IUCN Red List of Threatened Species* 2004: e.T58023A136598792. https://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58023A11718129.en.

Frost, D.R. 2021. *Amphibian Species of the World: An Online Reference*. Version 6.1. American Museum of Natural History, New York, New York, USA. https://doi.org/10.5531/db.vz.0001. <https://amphibiansoftheworld.amnh.org/index.php>.

Hayes, T.B., P. Falso, S. Gallipeau, and M. Stice. 2010. The cause of global amphibian declines: a developmental endocrinologist's perspective. *Journal of Experimental Biology* 213: 921–933. htpps://doi.org/10.1242/jeb.040865.

Hussain, Q.A. 2012. Global amphibian declines: a review. *International Journal of Biodiversity and Conservation* 4(10): 348–357.

Johnson, P.T., K.B. Lunde, E.G. Ritchie, J.K. Reaser, and A.E. Launer. 2001. Morphological abnormality patterns in a Californian amphibian community. *Herpetologica* 57: 336–352.

Koleska, D. and D. Jablonski. 2016. Two cases of unclear hindlimb malformation in *Bombina variegata. Ecologica Montenegrina* 9: 56–58. https://doi.org/10.37828/em.2016.9.10.

Marco, A., C. Quilchano, and A.R. Blaustein. 1999. Sensitivity to nitrate and nitrite in pond-breeding amphibians from the Pacific Northwest, USA. *Environmental Toxicology and Chemistry* 18: 2836–2839. https://doi.org/10.1002/etc.5620181225.

Meteyer, C.U. 2000. *Field Guide to Malformation of Frogs and Toads with Radiographic Interpretations*. Biological Science Report 2000-0005. U.S. Geological Survey, Reston, Virginia, USA.

Orton, F. and C.R. Tyler. 2015. Do hormone-modulating chemicals impact on reproduction and development of wild amphibians? *Biological Reviews* 90: 1100–1117. https://doi.org/10.1111/brv.12147.

Ouellet, M., J. Bonin, J. Rodrigue, J.L. DesGranges, and S. Lair. 1997. Hindlimb deformities (ectromelia, ectrodactyly) in free-living anurans from agricultural habitats. *Journal of Wildlife Diseases* 33: 95–104. https://doi.org/10.7589/0090-3558-33.1.95.

Ramalho, W.P., F. Maffei, V. Guerra, D.P. da Silva, L.R. de Matos, and L.J. Vieira. 2017. Anophthalmia in adults of two Amazonian treefrogs (Anura: Hylidae). *The Herpetological Bulletin* 139: 43–44.

Sparling, D.W., J. Bickham, D. Cowman, G.M. Fellers, T. Lacher, C.W. Matson, and L. McConnell. 2015. In situ effects of pesticides on amphibians in the Sierra Nevada. *Ecotoxicology* 24: 262–278. https://doi.org/10.1007/s10646-014-1375-7.

Stuart, S.N., J.S. Chanson, N.A. Cox, B.E. Young, A.S. Rodrigues, D.L. Fischman, and R.W. Waller. 2004. Status and trends of amphibian declines and extinctions worldwide. *Science* 306: 1783–1786. https://doi.org/10.1126/science.1103538.