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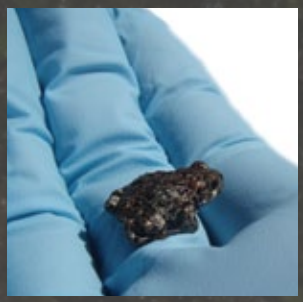
First New Frog Discovery for Angola in 40 Years

Chela Mountain Reed Frog (*Hyperolius chelaensis*). Photo: W. Conradie.

Conservation Evidence

Amphibian Conservation Call for Evidence



ARMI/ASG Seed Grant Awards Now Available

You can call them Snot Otters, but don't call Hellbenders Extinct

Call them snot otters, devil dogs, mud cats, mollyhuggers or Allegheny alligators but a team of Ohio conservationists are dedicated to making certain the endangered Eastern hellbender is never called Extinct.

The first release of human-reared hellbenders in Ohio occurred on Jun. 15, 2012 and marks an important step in the Ohio Division of Wildlife's Conservation Plan to reverse the precipitous decline of the species by expanding their range into previously occupied streams to eventually establish multiple self-sustaining populations in Ohio.

The nine released hellbenders were reared in a dedicated hellbender facility at the Columbus Zoo and Aquarium from eggs collected in 2007 by the Oglebay Good Zoo (Wheeling, WV). They were released into a stream in eastern Ohio where hellbenders were once found. The stream was once severely impacted by pollution but has since recovered and is one of the highest quality waterways in the state.

Scientists from the Columbus Zoo and Aquarium and the Ohio Department of Natural Resources released the hellbenders after Zoo veterinarians performed health screenings and surgically implanted radio-transmitters to enable the animals to be tracked. Blood samples and skin swabs will be collected from the released hellbenders at the end of the summer and compared with those collected prior to the release. Veterinarians from the Columbus Zoo and the Wilds have been conducting research on the health of Ohio and West Virginia hellbenders since 2006. Data from this project will inform future hellbender reintroductions in Ohio.

The release of the hellbenders is the culmination of a partnership involving several Ohio institutions and agencies. Since 2006, the Ohio Hellbender Partnership has been regularly meeting to discuss hellbender conservation in the state. The partnership includes representatives of:

- Ohio Division of Wildlife
- Columbus Zoo and Aquarium
- the Wilds
- Oglebay Good Zoo
- Ohio EPA
- Jefferson County Soil and Water Conservation District
- Belmont County Soil and Water Conservation District
- United States Fish and Wildlife Service
- Toledo Zoo
- Akron Zoo
- Ohio University, Eastern

Larval hellbenders from an egg mass collected in Ohio in 2011 are currently being reared at the Columbus Zoo and Aquarium and will be used for future releases. The partnership's capacity to rear hellbenders is being increased through renovations and expansions of facilities in Ohio zoos.

The eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) is the largest amphibian in Ohio and one of the largest salamanders in the world, reaching a total length of up to 25 inches and weighing nearly three pounds. With their wrinkled body and tiny eyes, the hellbender is supremely adapted to a life spent mostly under large rocks in rivers and large creeks where they feed on crayfish and take in oxygen through their highly vascularized skin.

A 2006-2009 survey of the eastern hellbender in Ohio determined an 82% decline

The Columbus Zoo and Aquarium is home to more than 10,000 animals representing over 575 species from around the globe. The Zoo complex is a recreational and education destination that includes the 22-acre Zoombezi Bay water park and 18-hole Safari Golf Club. The Columbus Zoo and Aquarium also operates the Wilds, a 10,000-acre conservation center and safari park located in southeastern Ohio. The Zoo is a regional attraction with global impact; contributing more than $1 million annually to support over 70 conservation projects worldwide. A 501(c)(3) nonprofit organization, the Columbus Zoo has earned Charity Navigator's prestigious 4-star rating.

Scientists from the Columbus Zoo and Aquarium and the Ohio Department of Natural Resources release the hellbenders.

in the relative abundance of individuals in streams where they were found during surveys conducted in the mid-1980s. In the Ohio watersheds where hellbenders remain, populations consist of only old, large individuals, indicating the lack of successful reproduction. Most remaining populations in Ohio do not appear self-sustaining and without intervention the hellbender will likely disappear from Ohio waterways.

The hellbender is an important part of Ohio's natural heritage and their presence indicates clean water and healthy habitats. Causes of the hellbender's decline include impoundments (dams), excessive siltation, pollution, disease, and persecution and collection. The species ranges from New York to Georgia and west to Missouri and were once found throughout the Ohio River drainage basin, including the Ohio River. Similar population declines have been noted by researchers throughout the hellbender's range, and the species is considered threatened or endangered in most states.

Funding for this project was provided by the United States Fish and Wildlife Service through a State Wildlife Grant, donations to the Division of Wildlife's Diversity Program, and the Columbus Zoo and Aquarium's Conservation Fund.

Understanding the Impact of Chemical Pollution on Amphibians

By Andrés Egea-Serrano, Rick A. Relyea & Miguel Tejedo

Amphibians are the most threatened vertebrate group in the world, with 41% of all species threatened (*1, 2*). The hypothesized causes of these declines include habitat loss, climate change, emergent diseases, introduced species, and chemical pollutants. Within the realm of pollutants, there has been a tremendous amount of research during the past decade. To assess what these studies have taught us, we conducted a meta-analysis of amphibian toxicology studies that have used environmentally relevant concentrations (*3*).

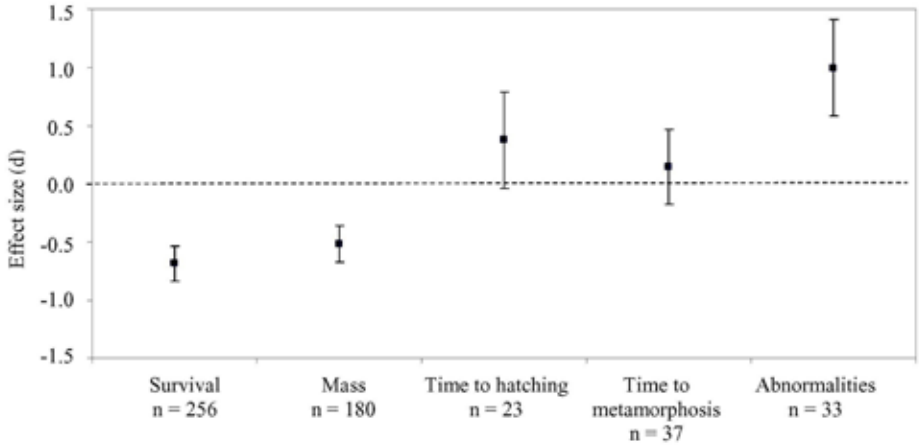


Fig. 1: Mean effect of chemicals on some amphibian life history traits. Error bars: 95% confidence intervals.

We found that lethal and sublethal effects of chemicals were widespread. Averaged across all pollutants, environmentally relevant concentrations caused a 7.5% decrease in mass, a 14.3% decrease in survival, and a 535% increase of the frequency of malformations (Figure 1). These results agree with previous reviews based on vote-counting methods, but such studies have low statistical power. Because our analysis used statistically powerful meta-analytic techniques, and considered only ecologically relevant concentrations, our study represents the first quantitative review to have produced robust and realistic conclusions on the impact of pollution on amphibians, including both the direction of different effects as well as the size of these effects. Moreover, our approach also allowed us to analyze the differences among *a priori* defined groups such as chemical types, experimental venues, and developmental stages (Figure 2).

Our comparisons among chemical types found that amphibian survival was reduced by exposure to road de-icers, pesticides, wastewater pollutants, and nitrogenous compounds. We also found that amphibian mass was reduced when exposed to nitrog-

enous compounds. Amphibian malformations increased in frequency when exposed to wastewater pollutants.

Our comparisons of experimental venues found that the effect of pollutants on survival was larger in enclosures than in mesocosms or experiments conducted in the laboratory. However, reductions in mass due to pollutant exposure was significant under laboratory conditions but not under mesocosm or enclosure conditions.

Our comparisons of developmental stages found that embryonic and larval exposures to pollutants both caused reductions in survival and mass, but only embryonic exposures caused significant increases in abnormalities. However, significant differences among developmental stages only arose for mass, with larger impacts when the exposure began in the embryonic stage.

Several other factors including pathogenic organisms and UV-B radiation are increasingly common in the environment and, consequently, they can interact with pollutants. Although some individual studies have shown synergistic interactions between pollutants and other factors, our meta-analysis of interactive effects on amphibian survival did not detect a significant interaction across all studies that met our criteria.

In conclusion, our meta-analysis of amphibian studies has demonstrated that pollutants present at environmentally relevant concentrations have substantial negative effects on amphibian survival, growth, and abnormalities. As is often the case, there are areas in which more research needs to be done, including more studies on interactions between pollutants and other factors and more studies in more natural experimental venues. In addition, there is a need for more studies that integrate approaches considering physiological, demographic and community scales to determine the real impact that pollutants may have on amphibian populations, especially under a scenario of increased Earth temperatures due to predicted global warming. These effects of pollutants on amphibians are not just a concern for amphibians, but may also apply to other vertebrates (particularly fish).

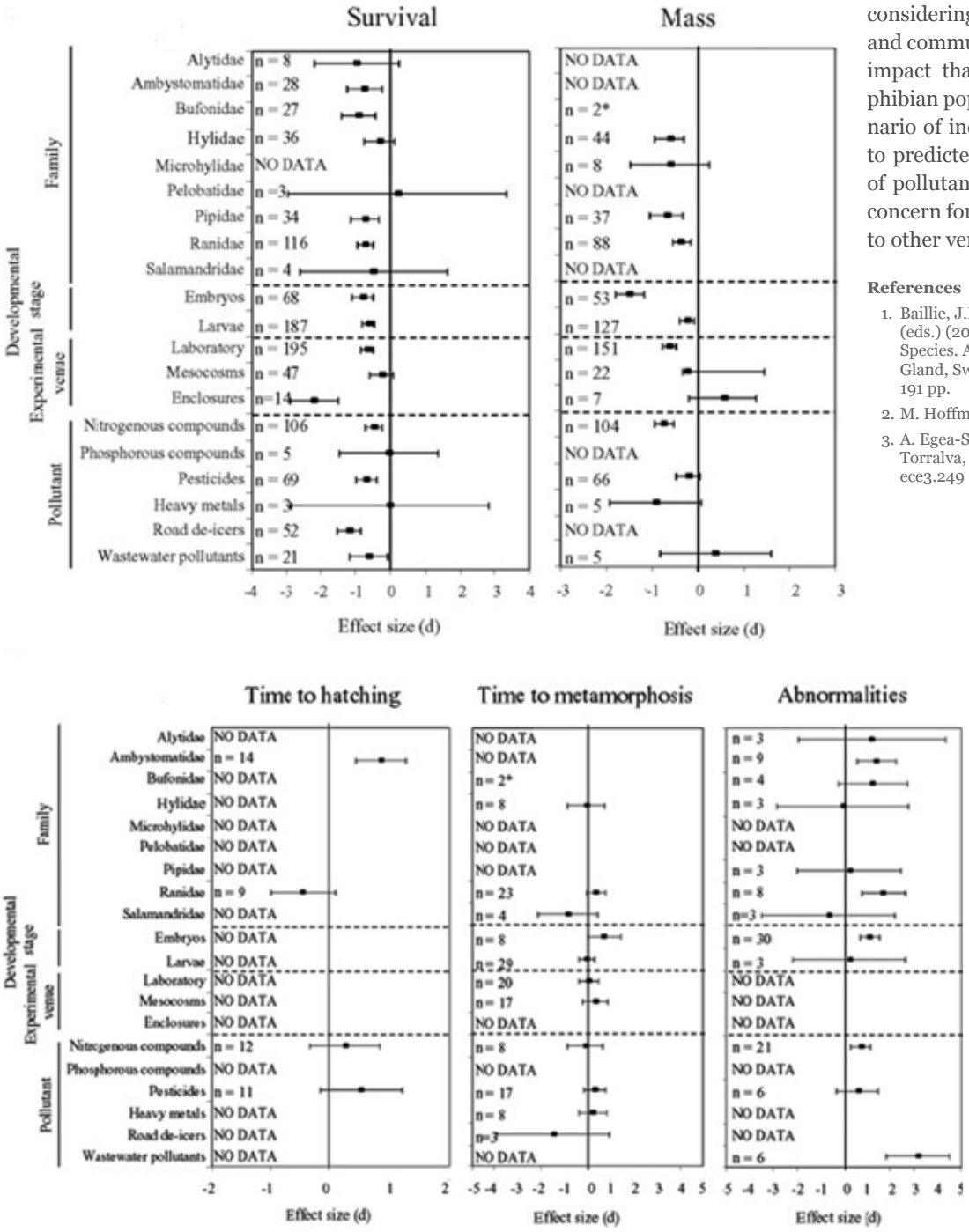


Fig. 2: Mean effect of pollutants on survival, mass, time to hatching, time to metamorphosis, and abnormality frequency for the categories considered for the *a priori* defined groups. Notice the different scales for each variable shown. Error bars: 95% confidence intervals.

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