# AMPHIBIAN AND REPTILE DISEASES

This section offers a timely outlet for streamlined presentation of research exploring the geographic distribution, host range, and impact of emerging amphibian and reptile pathogens, especially fungal infections and ranaviruses. Amphibian chytrid fungi, *Batrachochytrium dendrobatidis* and *B. salamandrivorans* are both linked to amphibian mass mortality episodes, yet both have also been detected in amphibians without disease. Snake fungal infections in snakes and turtles are not well known, but are being detected more frequently in the last few years and may be primary or secondary infections leading to local losses. Ranaviruses also cause mass mortality, infecting both amphibians and reptiles, but have not yet been linked to large-scale declines. For each of these pathogens, we know relatively little about the global distribution, host range, or impacts on host populations. To improve our understanding of the scope of this issue, we encourage submission of studies that illuminate the geographic distribution, host ranges, and impact of these pathogens on amphibian and reptile populations, including research on individual species or groups of species, wild or captive animals, native or non-native species, live animals or museum specimens, environmental samples, and, provided there is sufficient sampling[1], reports of non-detections.

We ask authors to: 1) restrict the Introduction of their paper to a maximum of one paragraph to highlight the context of their study; 2) briefly include both field and laboratory Methods; 3) present Results in a Table, although a map might also be useful, and limited text; and 4) have a short discussion of a maximum of three paragraphs to touch upon key findings. Please include the following information in submissions as appropriate: coordinates and description of sampling areas (or please note if locations are extremely sensitive to reveal, and provide general area instead); species name(s) and life history stages examined, as well as other species present; whether samples were collected randomly or just from dead or moribund animals; date of specimen collection; evidence of unusual mortality; numbers of positive and negative samples; disposition of voucher specimens; name of collaborative laboratory or researcher conducting histological sections or PCR analyses; and names of cooperative land owners or land management agencies. We encourage researchers to conduct post-mortem examinations when possible to identify the cause of death when reporting mortalities. We aim to expedite the review and publication process! Please e-mail submissions directly to Associate Editor, Dr. Dede Olson.

Upon publication, we encourage authors to import their data to online disease reporting portals for rapid communication with researchers and natural resource managers. The Global Bd Mapping Project is available at: Bd-maps.net. The Global Ranavirus Reporting System is available at: https://mantle.io/grrs. The Bsal online portal is under construction at AmphibiaWeb.org.

[1]If a sample of 30 individuals of a particular life history stage of a particular species yields no positive results, and the diagnostic test is highly sensitive, one can conclude that the prevalence of infection is less than 10% with 95% confidence. With a sample of 10 an infection in one of four individuals could go undetected. We encourage researchers to collect sufficient samples so that negative results are meaningful.

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## First Report of *Batrachochytrium dendrobatidis* in *Atelognathus reverberii*, a Threatened Species in Argentina

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Patagonia and other Andean regions of Argentina have many species of conservation concern because of local endemism or restricted regional distribution, and several threat factors including habitat alteration, chemical contamination, invasive species, and emerging diseases (Vaira et al. 2012). Since the first report of *Batrachochytrium dendrobatidis* (*Bd*) in Argentina in 2002, the pathogenic fungus has been reported in 14 of 23 provinces of the country, infecting numerous amphibian species in diverse environments (Herrera et al. 2005; Barrionuevo and Mangione 2006; Fox et al. 2006; Arellano et al. 2009; Ghirardi et al. 2009, 2012, 2014; Gutierrez et al. 2010; Delgado et al. 2012; Lescano et al. 2013). Many of these reports have addressed infection of endangered species inhabiting Andean regions, such as *Telmatobius atacamensis* and *T. pisanoi* in the northern Andes (Barrionuevo and Magione 2006) or *Alsodes pehuenche* and


FIG. 1. Study site on the Somuncurá Plateau (A) and the Laguna Azul (blue circle), Argentina. Collection site of *Atelognathus reverberii* individuals (star) on the banks of the Laguna Azul (B).

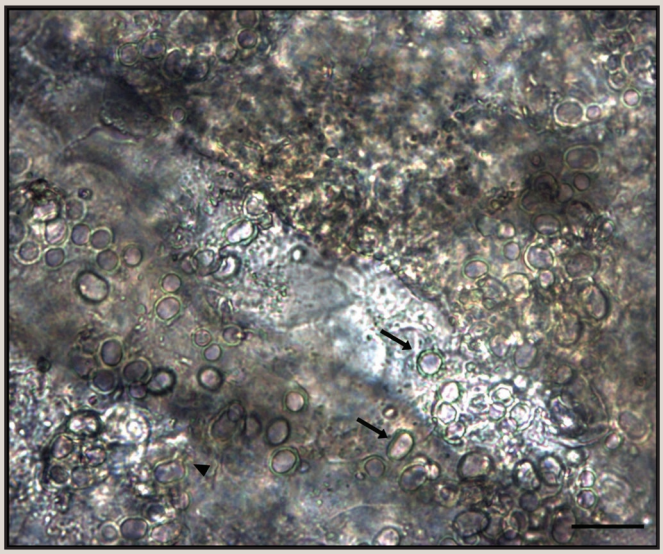

FIG. 2. Fresh skin surface (without stain) from the hind limbs of *Atelognathus reverberii* infected with *Batrachochytrium dendrobatidis* (400×) in Argentina. Arrows indicate zoosporangia and arrowhead a discharge tube. Scale bar = 20 µm.

*Atelognathus patagonicus* in the southern Andes (Fox et al. 2006; Ghirardi et al. 2014), with mortality recorded in the last species.

The Laguna Raimunda Frog, *Atelognathus reverberii* (Cei 1969), is an endemic species of conservation concern associated with permanent and temporary lagoons between 920 and 1200 m elevation in the Provinces of Chubut and Rio Negro (Cei 1969; Martinazzo et al. 2011). This frog, which has a fragmented distribution within its 500 km$^2$ range (Úbeda et al. 2004), is classified as Vulnerable in Argentina (Vaira et al. 2012) and is listed as Endangered by the IUCN Red List (Úbeda et al. 2004). The reproductive biology of the species is unknown, yet a relatively low reproductive potential is supported (Vaira et al. 2012). These attributes suggest that *A. reverberii* may be highly vulnerable to *Bd*-related population declines (see Bielby et al. 2008). Herein we provide the first report of the presence of *Bd* in *A. reverberii*, and associated mortality supporting a disease threat for this rare species.

In January 2015, during a field survey of this species in the Somuncurá Plateau, a Natural Protected Area of Río Negro Province, Argentina (41.288738°S, 66.831912°W; 1182 m elev.; Fig. 1), we found 11 dead *A. reverberii* individuals within a 0.6-m diameter and 1.5-m deep pit, holding 30-cm water in the bottom. These water pits, locally named "jagüeles," are dug by local residents near water bodies to obtain water for human and cattle consumption. The dead frogs were collected using latex rubber gloves (which were changed between specimens), and fixed in a solution of 10% formaldehyde. We analyzed shed skin from the hind limbs of all fixed individuals through direct examination without stain, under a compound optical microscope at 400× magnification. Specimens were deposited at the Colección Herpetológica del Museo de La Plata, Argentina (MLP A 5758–A 5768).

All dead individuals had excessive shed skin, which is one of the clinical signs of chytridiomycosis. We detected *Bd* zoosporangia in 100% (N = 11) of the shed skin samples analyzed (Fig. 2). Samples were compared with previous *Bd*-infected shed skin (Arellano, unpubl. data), some of which belonged to frogs in controlled *Bd* experimental infections with very high zoospore treatment doses ($6 \times 10^4$ zoospore/ml). Due to the comparability of zoospore densities between these new and experimental skin samples, the natural infection of *A. reverberii* appeared to be very high. Based on previous studies of *Bd* in Argentina (Fox et al. 2006; Ghirardi et al. 2014; Bd-maps.net, accessed 2 June 2015), our detection of infection in *A. reverberii* is the southernmost record of *Bd* in this area of the central Patagonian steppe, and is near to the known southernmost extent of *Bd* in South America (in Chile, 43.78°S; Bourke et al. 2011).

In March 2015, we revisited the study area and found a high density of *A. reverberii* individuals (>100) hiding under rocks at the edge of Laguna Azul (the highest wetland of the area). A great number of individuals (~50%) were observed in a very weakened state and another ~10% were dead under the rocks, although these samples were not analyzed (Fig. 3).

The fact that we found dead and very weak individuals during the survey, added to the excessive shed skin seen in all the individuals, is very worrying, since this frog is potentially vulnerable to losses (Bielby et al. 2008) and is currently affected by several human-related activities. Other amphibian species on the Plateau, including *Pleurodema somuncuriensis*, an aquatic frog recently reported with *Bd* infection (Kacoliris, pers. comm.), are also listed as critically endangered (IUCN) (Úbeda and Lavilla 2004). Because many Argentinian regions remain unsurveyed for *Bd* and there are many endemic species or species with restricted distributions that are of significant concern (Vaira et al. 2012), much more extensive *Bd* sampling focused on these species is warranted to set priorities for future conservation actions.

FIG. 3. *Atelognathus reverberii* in Argentina. Appearance of a normal (left) and weakened (right) individual.

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