First Survey of the Chytrid Fungus, *Batrachochytrium dendrobatidis*, in Amphibian Populations of Gabon, Africa

First associated with amphibian declines in 1998 from amphibian populations in Australia and Panama, the amphibian chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*) has since been detected in amphibian populations in all continents except Antarctica, and additional mass-mortalities thought to be caused by *Bd* are continually being observed (Berger et al. 1998, 2004; Bosch et al. 2001; Lips 1998; Lips et al. 2003, 2006). Weldon et al. (2004) found *Bd* on amphibian specimens collected from South Africa in the 1930s, the earliest date of a *Bd* record, and suggested that *Bd* originated in the continent of Africa. Analyses of museum specimens by Soto-Azat (2010) corroborated this hypothesis. Yet to date, *Bd* surveillance in Africa has been limited. The few studies that have been carried out have confirmed the presence of *Bd* in Africa, including: 1) in Uganda, six amphibian species tested positive for *Bd* (Goldberg et al. 2007); 2) in Kenya, *Bd* was found in all of amphibian populations sampled in several habitat types (Kielgast et al. 2009); 3) in eastern Democratic Republic of Congo, *Bd* was detected in two species (Greenbaum et al. 2008); and 4) evidence of *Bd* was found in amphibians in Okomu National Park, Nigeria (Imsen 2009; Reeder et al., in press). In light of the confirmed existence of *Bd* in Africa, regions where data are lacking warrant surveys for this pathogen.

Gabon is located in the equatorial region of the Atlantic coast of Central Africa (Fig. 1), contains an exceptionally high diversity of amphibian species (IUCN 2004), and is in close proximity to the West African forests that have been denoted a global biodiversity “hotspot” (Myers et al. 2000). Yet to date, no *Bd* sampling has been conducted in Gabon. In fact, there are remarkably few published reports of *Bd* surveys from the tropical forests of Central and West Africa (www.Bd-maps.net): two studies in Cameroon (Blackburn et al. 2010; Dougherty-Bone et al. 2008) and one study in the Democratic Republic of Congo (DRC) (Greenbaum et al. 2008). Our aim was to determine the incidence of *Bd* in amphibian populations in Gabon. The results of our study contribute to the expanding body of literature on the global distribution of *Bd* and aid the determination of priority areas for amphibian conservation in equatorial Africa.

Surveys were conducted from July through September 2008, months coinciding with the dry season, in three regions of Gabon: Lastoursville (-0.816815*S, 12.708026*E), located on the banks of the Ogooué River in eastern Gabon; Lébamba (-2.210605*S, 11.476516*E); and the Station d’Études des Gé- rilles et Chimpanzés (SEGC), located within the 4970 km² Lopé National Park (0.166667*S, -0.266667*E) (Fig. 1). The Lastours- ville and Lébamba region contain extensive Guineo-Congolian tropical forest (Plana 2004), though much of our sampling occurred in villages and agricultural areas that have been cleared of forest. SEGC lies in a lowland area featuring savan-
absent as well (Blackburn et al. 2010; Doherty-Bone et al. 2008), but differ from the surveys done in eastern DRC, where Bd was detected (Inaouen 2009; Reeder et al., in press). Despite our findings, continued surveillance of Bd in Gabon and the Central African region is warranted. Skerratt et al. (2008) reported that 59 animals should be sampled to detect Bd when prevalence is low, hence we cannot rule out the possibility that Bd occurs on our sampled species at our sampled sites in Gabon at a low prevalence rate. Furthermore, in an extinction-risk assessment for Bd, Gabon occurred in an area of both high susceptibility to Bd and high amphibian richness (see Figure 2B in Rödder et al. 2009). Thus, our report should not discourage future surveys of Bd prevalence in Gabon but rather act as a reference by which to plan and execute more focused and expansive Bd monitoring activities in this region.

Acknowledgments.—We thank the Centre National de Recherche en Science et Technologie for research authorization in Gabon and the Agence Nationale des Parcs Nationaux for park authorization in Lopé. We are grateful to the Centre International de Recherches Médicales de Franceville (CIRMF) for hosting the research at SEG. We would like to thank N. Pilotte, M. Oliphant, M. Laumanns, and T. Frost for assistance with amphibian surveys in Gabon; D. Blackburn, M. Rödel, O.S.G. Pauwels, J. Harvey, and T. Fretey for assistance with species identification; El Museo Nacional de Ciencias Naturales (CSIC) for providing laboratory resources for this study; and V. Vredenburg and T. Garner for assistance with manuscript revisions.

Literature Cited


Batrachochytrium dendrobatidis (Bd) is behaving as an invasive pathogen in many parts of the new world where it has been associated with massive amphibian declines in native populations (Berger et al. 1998; Lips et al. 2006; Lips et al. 2008; Soto-Azat et al. 2010). Bd has also been found on various Pipidae species in South Africa, Malawi and Cameroon from as early as the 1930s, suggesting a widespread historical prevalence on the continent (Soto-Azat et al. 2010; Weldon et al. 2004). Despite these observations, many areas in Africa have not been systematically surveyed for Bd. Contemporary Bd distribution data are sorely lacking in West and Central Africa, including for Gabon (http://www.bd-maps.net). Yet, such data may prove critical in assessing the risk of Bd infection to amphibians on the continent, and identifying its ultimate origin.

In November to December 2009, we surveyed amphibians for Bd at two lowland areas in Gabon (Fig. 1). The first site was located in the SW region of the country around the town of Gamba (2.78676°S, 0.04551°E; elevation 0–100 m). The area is a coastal plain covered by a mosaic of rainforest patches interspersed with open, seasonally inundated grasslands (Alonso et al. 2006). The second site was at the Libreville campus and surrounding areas of L’Ecole Nationale des Eaux et Forêts training center in the NW region of the country (0.6030167°N, 9.3372667°E; elevation 0–100 m). It is covered by primary and secondary rainforest with many streams, but most amphibians at this site were found in temporary wetlands formed in open grassy areas adjacent to the forest. At each site we opportunistically searched for amphibians in forests, streams, wetlands and ditches. Amphibians were captured with a gloved hand and were brought indoors for processing where they were swabbed with a sterile cotton swab (10 strokes on the belly and thigh.

**Batrachochytrium dendrobatidis** Not Detected on Amphibians from Two Lowland Sites in Gabon, Africa