Simpson, J. F. III. 2013. An Assessment of a Herpetofaunal Community in Hamilton County, Tennessee: Baseline Ecology, Species Richness, and Relative Abundance. Master's Thesis, University of Tennessee, Chattanooga. 79 pp.

Simpson, J. F., D. S. Armstrong, and T. P. Wilson. 2010. Geographic distribution: *Pseudacris crucifer*. Herpetol. Rev. 41:241.

———, and T. P. Wilson. 2009. Geographic distribution: *Acris gryllus*. Herpetol. Rev. 40:233.

Sokal, R. R., and F. J. Rohlf. 1995. Biometry. W.H. Freeman and Co., New York. 887 pp.

Venesky, M. D., and F. M. Brem. 2008. Occurrence of *Batrachochytrium dendrobatidis* in southwestern Tennessee, USA. Herpetol. Rev. 39:319–320.

Vredenburg, V. T., and C. Briggs. 2009. Chytrid swab protocol. <http://www.amphibiaweb.org/chytrid/swab_protocol.html> Accessed 11 April 2014.

Weldon, C., L. H. du Preez, A. D. Hyatt, R. Muller, and R. Speare. 2004. Origin of the amphibian chytrid fungus. Emerg. Infect. Dis. 10:2100–2105.

Wilson, T. P., C. B. Manis, S. L. Moss, R. M. Minton, E. Collins and T. M. Wilson. 2012. New distributional records for reptiles from Tennessee, USA. Herpetol. Rev. 43:111–112.

Herpetological Review, 2015, 46(1), 41–45.

Chytrid Fungus (*Batrachochytrium dendrobatidis*) Undetected in the Two Orders of Seychelles Amphibians

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Infection by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*) is a major driver in global amphibian declines (Berger et al. 1998; Skerratt et al. 2007) and can occur in all three orders of Amphibia, having been most recently documented in the Gymnophiona (Doherty-Bone et al. 2013; Gower et al. 2013). *Bd* has been detected in 71 countries and 695 amphibian species (Olson and Ronnenberg 2014) but to our knowledge no screening for its presence or anecdotal evidence of chytridiomycosis has been reported from the Seychelles Archipelago, a biodiversity hotspot (Myers et al. 2000) with a very high proportion (86%) of endemic amphibian genera (Poynton 1999) (Fig. 1).

Eleven of the 12 species of Seychelles amphibians (Table 1) are globally significant. The four species of sooglossid frog are unique in being the only amphibian family endemic to an island group, and the three genera of caecilians (all endemic, comprising a radiation of six species) are the only gymnophionan genera confined to islands. The single hyperoliid frog species occurring here is endemic to the Seychelles, leaving the single ptychadenid frog as the only non-endemic amphibian (Nussbaum 1984). Being primarily fossorial, caecilians are considered difficult study organisms

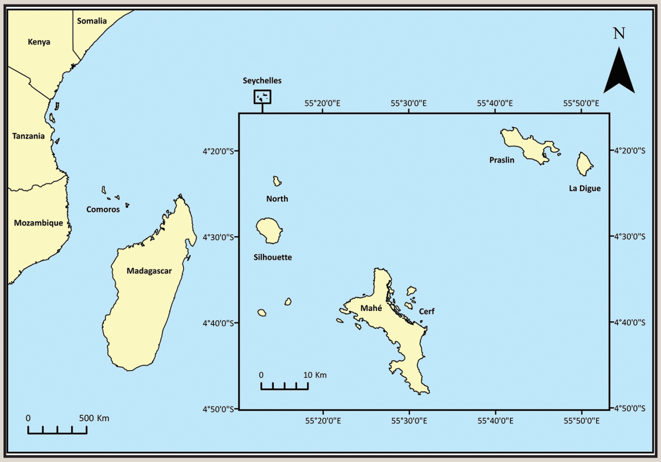

Fig. 1. Location map showing the position of the Seychelles Archipelago in relation to the African coast and Madagascar. Zoomed panel shows the main inner islands. Map generated using ArcMap 10.1 (ESRI 2012).

and collection usually requires dedicated digging (Gower and Wilkinson 2005), such that there have been few caecilian *Bd* field surveys (Gower et al. 2013). Similarly, sooglossid frogs are cryptic in their habits, undergoing direct development as part of a completely terrestrial life cycle in often inaccessible, elevated areas of moist forest (Nussbaum 1984; Nussbaum and Wu 2007). In contrast, the Seychelles Treefrog (*Tachycnemis seychellensis*: see Maddock et al. 2014), and the likely introduced Mascarene Ridged Frog (*Ptychadena mascareniensis*: see Vences et al. 2004) can be easier to encounter, forming breeding aggregations around marshes, streams, and temporary pools, especially in the evening (*T. seychellensis*) and/or after rain events (*P. mascareniensis*) (Nussbaum 1984). *Bd* is known to infect *P. mascareniensis* in mainland Africa (www.bd-maps.net/surveillance/s_species.asp; accessed 3 March 2014; Goldberg 2007), while Olson et al. (2013) identified a 50% prevalence of *Bd* in African Hyperoliidae, the family to which *T. seychellensis* belongs.

Between May 2010 and March 2013, skin swabs were taken from wild-caught caecilians and metamorphosed anurans at multiple locations across six of the Seychelles' inner islands (Fig. 2). All sampled specimens were swabbed alive and within 24 hours of capture, using rayon-tipped MW100 fine-tip swabs (Medical Wire and Equipment, Corsham, Wiltshire, England). Swabbing protocol generally followed best-practice methods available at the time (e.g., Smith 2011). However, our sampling was undertaken by three separate research groups operating over the period, with differing primary research aims. Therefore, some deviation from standard biosecurity protocol did occur, including capture and initial handling of amphibians without gloves, and (although infrequent) housing more than one animal (but always of the same species) in the same plastic bag upon capture. The principle aim was to gather a representative sample from sites within broadly separate locations, and not to swab every individual encountered or captured. A large proportion of sooglossid frog swabbing was undertaken in the field by a single person (JL). These mostly very small anurans (except for individuals of *Sooglossus thomasseti* measuring greater than 25 mm snout–vent length) were cleaned of debris and soil by transferring them to a small plastic zip-lock bag and rinsing with fresh water sourced at the sampling locality. Although this rinsing may have removed some zoospores, it was performed to reduce the increased likelihood of PCR inhibition. The water was then drained and the animal gently restrained and swabbed within the

TABLE 1. Distribution of Seychelles amphibians (adapted from Nussbaum 1984), including the 2009 discovery of Sooglossidae on Praslin (Taylor et al. 2012) and their IUCN Red List status (IUCN 2013): LC – Least Concern; EN – Endangered; CR – Critically Endangered. Caecilian taxonomy follows Wilkinson et al. (2011).

Order	Family	Species	Islands present	Conservation status
Anura	Hyperolidae	*Tachycnemis seychellensis*	La Digue, Mahé, Praslin, Silhouette	LC
Anura	Ptychadenidae	*Ptychadena mascareniensis*	Cerf, Curieuse, Frégate, Grand Soeur, La Digue, Mahé, North[a], Praslin, Silhouette	LC
Anura	Sooglossidae	*Sooglossus sechellensis*	Mahé, Praslin, Silhouette	EN
Anura	Sooglossidae	*Sooglossus thomasseti*	Mahé, Silhouette	CR
Anura	Sooglossidae	*Sechellophryne gardineri*	Mahé, Silhouette	EN
Anura	Sooglossidae	*Sechellophryne pipilodryas*	Silhouette	CR
Gymnophiona	Indotyphlidae	*Grandisonia alternans*	Félicité, Frégate, La Digue, Mahé, St. Anne, Silhouette	LC
Gymnophiona	Indotyphlidae	*Grandisonia larvata*	Félicité, La Digue, Mahé, Praslin, St. Anne, Silhouette	LC
Gymnophiona	Indotyphlidae	*Grandisonia sechellensis*	Mahé, Praslin, Silhouette	LC
Gymnophiona	Indotyphlidae	*Hypogeophis brevis*	Mahé	EN
Gymnophiona	Indotyphlidae	*Hypogeophis rostratus*	Cerf, Curieuse, Félicité, Frégate, Grand Soeur, La Digue, Mahé, Praslin, St. Anne, Silhouette	LC
Gymnophiona	Indotyphlidae	*Praslinia cooperi*	Mahé, Praslin	EN

[a] New locality record

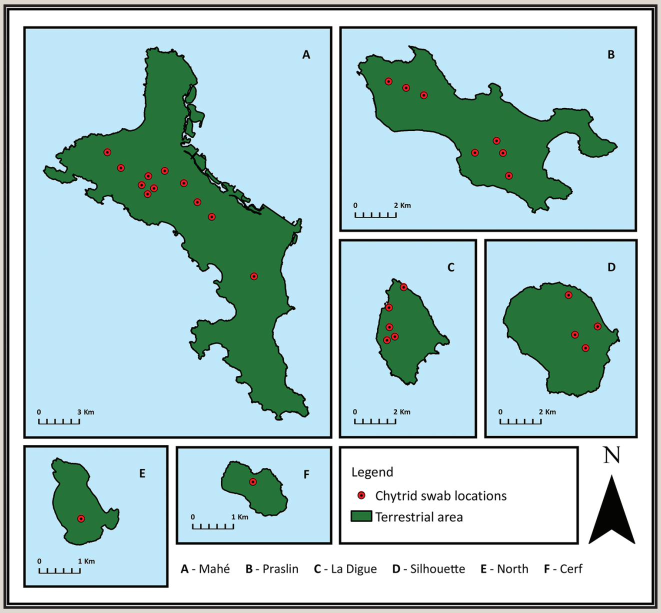

FIG. 2. Sampling localities for *Batrachochytrium dendrobatidis* across the Seychelles inner islands. Map generated using ArcMap 10.1 (ESRI 2012).


IMAGE BY JIM LABISKO

FIG. 3. *Sooglossus sechellensis* from Mahé, Seychelles Archipelago.


IMAGE BY DAVID GOWER

FIG. 4. *Grandisonia alternans* from Silhouette, Seychelles Archipelago.

bag, removing the need for direct handling and minimizing risk of cross-contamination. Larger anurans, and sooglossid frogs processed when field assistance was available, were sampled using the standard technique (Smith 2011). Caecilians were swabbed dorsally, laterally, and ventrally along the length of the body, and also around the vent and head. Gloves were changed between each individual except where two or more specimens had been housed in the same plastic bag. All amphibians not retained as vouchers as part of broader research aims were released at their place of capture. Swabs were kept in the dark and transferred to cool storage, mostly refrigerated within 12 h and frozen within one week of completed fieldwork.

DNA extractions and quantitative real time Taqman® polymerase chain reaction (qPCR) assays were performed at the Institute of Zoology (London, UK), using methods adapted from Boyle et al. (2004). DNA was extracted from swabs using bead beating with 0.5 mm silica beads and 60 µl PrepMan Ultra (Hyatt et al. 2007). The qPCR amplifications were performed in 25 µl reactions using *Bd* primers ITS-1 (forward): 5'-CCT TGA TAT AAT ACA GTG TGC CAT ATG TC-3' and 5.8S (reverse): 5'-AGC CAA GAG ATC CGT TGT CAA A-3', specific to the ITS-1/5.8S region of rDNA (Boyle et al. 2004). Standards of 100, 10, 1 and 0.1 *Bd* DNA genomic equivalents and negative controls were used in each run. Bovine serum albumin (BSA) was included in the TaqMan® master mix, to reduce inhibition of the PCR (Garland et al. 2010). Each sample was run in duplicate and no amplification in either replicate indicated a negative result.

A total of 291 skin swabs were obtained from Seychelles amphibians, representing 10 of the 12 species known to occur across the archipelago. All 213 anurans and 78 caecilians tested negative for *Bd* (comprising 66 *Sooglossus sechellensis* [Fig. 3]; 13 *S. thomasseti*, 14 *Sechellophryne gardineri*, 99 *Tachycnemis seychellensis*, 21 *Ptychadena mascareniensis*, 18 *Grandisonia alternans* [Fig. 4], 7 *G. larvata*, 10 *G. sechellensis*, 6 *Hypogeophis brevis*, 23 *H. rostratus*, 14 unidentified caecilians) (Table 2). No macroscopic presentation of chytridiomycosis-like symptoms or associated mortality was observed in any sampled individual, or in any amphibian encountered during the fieldwork. Our results suggest a widespread absence of *Bd* between 2010 and 2013 across six of the eleven amphibian-inhabited islands of the Seychelles archipelago. Some caution should be exercised in interpreting our results as indicating that the Seychelles are free of *Bd*. Many of the locations sampled were in close proximity to one another and/or linked by contiguous habitat, and so could be described as a single location for the purposes of achieving the recommended minimum sample size of 30 amphibians per site (Smith 2011), but the temporal differences between site surveys and overall limited sampling invariably resulted in this not being achieved (Table 2), leading to the possibility of type II errors. Also, the recommendation for sampling >59 individuals to detect *Bd* when infection rate is low (Skerratt et al. 2008) was achieved for only two species sampled (*T. seychellensis, S. sechellensis*), two islands sampled (Mahé and Praslin), and for the two pooled samples of all anurans and all caecilians. Prevalence of *Bd* infection in anurans indicates seasonal peaks in the cooler months (Berger et al. 2004; Retallick et al. 2004; Kriger and Hero 2007) even with little seasonal temperature variation (Whitfield at al. 2012). Sampling of Seychelles amphibians was not undertaken during the two (historically) coolest months of July and August. However, housing more than one animal in the same capture bag, although limited in occurrence, increased the opportunity for cross-contamination from chytrid zoospores, making detection of *Bd* more likely by fostering false-positive results for infection.

Table 2. Numbers of amphibians sampled for *Batrachochytrium dendrobatidis* across six Seychelles islands. No samples were *Bd*-positive. Sampling localities shown in Fig. 2.

Species	Island	No. of sampling sites	No. of individuals sampled
Ptychadena mascareniensis	Mahé	1	1
	North	1	17
	Praslin	1	1
	Silhouette	1	2
Sechellophryne gardineri	Mahé	2	9
	Silhouette	2	5
Sooglossus sechellensis	Mahé	7	25
	Praslin	4	39
	Silhouette	2	2
Sooglossus thomasseti	Mahé	4	8
	Silhouette	2	5
Tachycnemis seychellensis	La Digue	2	11
	Mahé	3	42
	Praslin	5	32
	Silhouette	1	14
Grandisonia alternans	Mahé	4	6
	Silhouette	2	12
Grandisonia larvata	Mahé	2	2
	Praslin	2	4
	Silhouette	1	1
Grandisonia sechellensis	Mahé	2	6
	Praslin	1	1
	Silhouette	1	3
Hypogeophis brevis	Mahé	2	6
Hypogeophis rostratus	Cerf	1	2
	La Digue	2	4
	Mahé	1	4
	Praslin	2	6
	Silhouette	2	7
Unidentified caecilian	Praslin	2	4
	Silhouette	1	10

Direct development—a reproductive mode adopted by the Sooglossidae and at least one Seychelles caecilian (*H. rostratus*; Nussbaum 1984)—may provide a limiting factor to the transmission of *Bd* between and among amphibians (Todd 2007; but see Longo and Burrowes 2010). The probably more vagile *T. seychellensis* and *P. mascareniensis* require water bodies for aquatic larval development, and potentially present more suitable hosts for the dispersal and spread of *Bd*. Due to previous evidence of human-mediated trans-oceanic dispersal (Vences et al. 2004), *P. mascareniensis* in particular may lend itself to continuing introduction and transportation by way of tourist and/or domestic traffic, especially among the main islands of Mahé, Praslin, and La Digue (Fig. 1). This species' propensity for dispersal was evidenced first-hand during fieldwork following the discovery of a novel, reproducing population on North Island. Similarly, and despite no currently recorded infection or capacity as a host for *Bd* (www.bd-maps.net/surveillance/s_species.asp; accessed 21 September 2014), the recent discovery of Asian Common Toads (*Duttaphrynus melanostictus*) on the east coast of Madagascar, having likely arrived in shipping containers from Asia (Kolby 2014a), highlights a further risk to Seychelles endemic fauna as a potential disease vector. The significantly shorter shipping distances among Madagascar, the Mascarenes, and Seychelles islands undoubtedly elevates the risk of further human-mediated dispersal of this potentially invasive species.

Links between climate, temperature, and *Bd* have been documented (see Pounds et al. 2006; Bosch et al. 2007; Lips et al. 2008; Rohr and Raffel 2010; Olson et al. 2013). In tropical regions, elevated, moist, and riparian habitats are home to amphibian species considered most likely to be severely threatened by *Bd* (Wake and Vredenburg 2008). The endemic Seychelles amphibians fall into at least two, and often all three of these categories which, combined with their restricted range, highlights the requirement for targeted conservation measures (Sodhi et al. 2008). In light of the recent discovery of *Bd* in Malagasy anurans (Kolby 2014b), and given the potential susceptibility of Seychelles amphibians, continued disease monitoring warrants consideration as part of ongoing conservation work for this globally significant amphibian community. Effective implementation of Seychelles' recently approved Biosecurity Act (Animal and Plant Biosecurity Act, 2014) is consistent with maintaining such vigilance.

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Literature Cited

Animal and Plant Biosecurity Act. 2014. Seychelles. Available online: <http://www.seychellestradeportal.gov.sc/content/article/sanitary-and-phytosanitary-measures>. Accessed 20 February 2015.

Berger, L., R. Speare, P. Daszak, D. E. Green, A. A. Cunningham, C. L. Goggin, R. Slocombe, M. A. Ragan, A. D. Hyatt, K. R. McDonald, H. B. Hines, K. R. Lips, G. Marantelli, and H. Parkes. 1998. Chytridiomycosis causes amphibian mortality associated with population declines in the rain forests of Australia and Central America. PNAS 95:9031–9036.

———, ———, H. B. Hines, G. Marantelli, A. D. Hyatt, K. R. McDonald, L. F. Skerratt, V. Olsen, J. M. Clarke, G. Gillespie, M. Mahony, N.

Sheppard, C. Williams, M. J. Tyler. 2004. Effect of season and temperature on mortality in amphibians due to chytridiomycosis. Aust. Vet. J. 82:434–439.

Bosch, J., L. M. Carrascal, L. Duran, S. Walker, and M. C. Fisher. 2007. Climate change and outbreaks of amphibian chytridiomycosis in a montane area of central Spain; is there a link? P. Roy. Soc. B-Biol. Sci. 274:253–260.

Boyle, D. G., D. B. Boyle, V. Olsen, J. A. T. Morgan, and A. D. Hyatt. 2004. Rapid quantitative detection of chytridiomycosis (*Batrachochytrium dendrobatidis*) in amphibian samples using real-time Taqman® PCR assay. Dis. Aquat. Org. 60:141–148.

Doherty-Bone, T. M., N. L. Gonwouo, M. Hirschfeld, T. Ohst, C. Weldon, M. Perkins, M. T. Kouete, R. K. Browne, S. P. Loader, D. J. Gower, M. W. Wilkinson, M. O. Rödel, J. Penner, M. F. Barej, A. Schmitz, J. Plötner, and A. A. Cunningham. 2013. *Batrachochytrium dendrobatidis* in amphibians of Cameroon, including first records for caecilians. Dis. Aquat. Org. 102:187–194.

ESRI (Environmental Systems Resource Institute). 2012. ArcMap 10.2. ESRI, Redlands, California.

Garland, S., A. Baker, A. D. Phillott, and L. F. Skerratt. 2010. BSA reduces inhibition in a TaqMan® assay for the detection of *Batrachochytrium dendrobatidis*. Dis. Aquat. Org. 92:113–116.

Goldberg, T. L. 2007. Chytrid fungus in frogs from an equatorial African montane forest in western Uganda. J. Wildl. Dis. 43:521.

Gower, D. J., T. Doherty-Bone, S. P. Loader, M. Wilkinson, M. T. Kouete, B. Tapley, F. Orton, O. Z. Daniel, F. Wynne, E. Flach, H. Müller, M. Menegon, I. Stephen, R .K. Browne, M. C. Fisher, A. A. Cunningham, and T. W. J. Garner. 2013. *Batrachochytrium dendrobatidis* infection and lethal chytridiomycosis in caecilian amphibians (Gymnophiona). Ecohealth 10:173–183.

———, and M. Wilkinson. 2005. Conservation biology of caecilian amphibians. Conserv. Biol. 19:45–55.

Hyatt, A. D., D. G. Boyle, V. Olsen, D. B. Boyle, L. Berger, D. Obendorf, A. Dalton, K. Kriger, M. Hero, H. Hines, R. Phillott, R. Campbell, G. Marantelli, F. Gleason, and A. Colling. 2007. Diagnostic assays and sampling protocols for the detection of *Batrachochytrium dendrobatidis*. Dis. Aquat. Org. 73:175–192.

IUCN (International Union for the Conservation of Nature). 2013. IUCN Red List of Threatened Species. Version 2013.2. Electronic database accessible at http://www.iucnredlist.org/. Accessed 15 December 2013.

Kolby, J. E. 2014a. Ecology: Stop Madagascar's toad invasion now. Nature 509:563–563.

———. 2014b. Presence of the amphibian chytrid fungus *Batrachochytrium dendrobatidis* in native amphibians exported from Madagascar. PLoS One 9:e89660.

Kriger, K. M., and J. -M. Hero. 2007. Large-scale seasonal variation in the prevalence and severity of chytridiomycosis. J. Zool. 271:352–359.

Lips, K. R., J. Diffendorfer, J. R. Mendelson, and M. W. Sears. 2008. Riding the wave: reconciling the roles of disease and climate change in amphibian declines. PLoS Biol. 6:e72.

Longo, A. V., and P. A. Burrowes. 2010. Persistence with chytridiomycosis does not assure survival of direct-developing frogs. Ecohealth 7:185–195.

Maddock, S. T., J. J. Day, R. A. Nussbaum, M. Wilkinson, and D. J. Gower. 2014. Evolutionary origins and genetic variation of the Seychelles treefrog, *Tachycnemis seychellensis* (Dumeril and Bibron, 1841) (Amphibia: Anura: Hyperoliidae). Mol. Phylogenet. Evol. 74:191–201.

Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. da Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature 403:853–858.

Nussbaum, R. A. 1984. Amphibians of the Seychelles. *In* D. R. Stoddart (ed.), Biogeography and Ecology of the Seychelles Islands, pp. 379–415. W. Junk, The Hague.

———, and S. H. Wu. 2007. Morphological assessments and phylogenetic relationships of the Seychellean frogs of the family Sooglossidae (Amphibia: Anura). Zool. Stud. 46:322–335.

Olson, D. H., D. M. Aanensen, K. L. Ronnenberg, C. I. Powell, S. F. Walker, J. Bielby, T. W. Garner, G. Weaver, *Bd* Mapping Group, and M. C. Fisher. 2013. Mapping the global emergence of *Batrachochytrium dendrobatidis*, the amphibian chytrid fungus. PLoS One 8:e56802.

———, and K. L. Ronnenberg. 2014. Global *Bd* Mapping Project: 2014 Update. FrogLog 22:17–21.

Pounds, J. A., M. R. Bustamante, L. A. Coloma, J. A. Consuegra, M. P. Fogden, P. N. Foster, E. La Marca, K. L. Masters, A. Merino-Viteri, R. Puschendorf, S. R. Ron, G. A. Sanchez-Azofeifa, C. J. Still, and B. E. Young. 2006. Widespread amphibian extinctions from epidemic disease driven by global warming. Nature 439:161–167.

Poynton, J. C. 1999. Distribution of amphibians in sub-Saharan Africa, Madagascar, and Seychelles. *In* W. E. Duellman (ed.), Patterns of Distribution of Amphibians: A Global Perspective, pp. 483–539. The Johns Hopkins University Press, Baltimore, Maryland.

Retallick, R. W., H. McCallum, and R. Speare. 2004. Endemic infection of the amphibian chytrid fungus in a frog community post-decline. PLoS Biol 2:e351.

Rohr, J. R., and T. R. Raffel. 2010. Linking global climate and temperature variability to widespread amphibian declines putatively caused by disease. PNAS 107:8269–8274.

Skerratt, L. F., L. Berger, H. B. Hines, K. R. McDonald, D. Mendez, and R. Speare. 2008. Survey protocol for detecting chytridiomycosis in all Australian frog populations. Dis. Aquat. Org. 80:85–94.

———, ———, R. Speare, S. Cashins, K. R. McDonald, A. D. Phillott, H. B. Hines, and N. Kenyon. 2007. Spread of chytridiomycosis has caused the rapid global decline and extinction of frogs. Ecohealth 4:125–134.

Smith, F. 2011. The 2011 UK Chytrid Survey Protocol (AKA The Big Swab 2011): Protocol for Surveyors.

Sodhi, N. S., D. Bickford, A. C. Diesmos, T. M. Lee, L. P. Koh, B. W. Brook, C. H. Sekercioglu, and C. J. Bradshaw. 2008. Measuring the meltdown: drivers of global amphibian extinction and decline. PLoS One 3:e1636.

Taylor, M. L., N. Bunbury, L. Chong-Seng, N. Doak, S. Kundu, R. A. Griffiths, and J. J. Groombridge. 2012. Evidence for evolutionary distinctiveness of a newly discovered population of sooglossid frogs on Praslin Island, Seychelles. Conserv. Genet. 13:557–566.

Todd, B. D. 2007. Parasites Lost? An overlooked hypothesis for the evolution of alternative reproductive strategies in amphibians. Am. Nat. 170:793–799.

Vences, M., J. Kosuch, M.-O. Rödel, S. Lötters, A. Channing, F. Glaw, and W. Böhme. 2004. Phylogeography of *Ptychadena mascareniensis* suggests transoceanic dispersal in a widespread African-Malagasy frog lineage. J. Biogeogr. 31:593–601.

Wake, D. B., and V. T. Vredenburg. 2008. Are we in the midst of the sixth mass extinction? A view from the world of amphibians. PNAS 105:11466–11473.

Wilkinson, M., D. San Mauro, E. Sherratt, and D. J. Gower. 2011. A nine-family classification of caecilians (Amphibia: Gymnophiona). Zootaxa 2874:41–46.