

***Batrachochytrium dendrobatidis*** 简体中文

**System:** Undefined

正體中文

Kingdom	Phylum	Class	Order	Family
Fungi	Chytridiomycota	Chytridiomycetes	Chytridiales	

**Common name** chytrid frog fungi (English), Chytrid-Pilz (German), chytridiomycosis (English), frog chytrid fungus (English)

**Synonym**

**Similar species**

**Summary**

*Batrachochytrium dendrobatidis* is a non-hyphal parasitic chytrid fungus that has been associated with population declines in endemic amphibian species in upland montane rain forests in Australia and Panama. It causes cutaneous mycosis (fungal infection of the skin), or more specifically chytridiomycosis, in wild and captive amphibians. First described in 1998, the fungus is the only chytrid known to parasitise vertebrates. *B. dendrobatidis* can remain viable in the environment (especially aquatic environments) for weeks on its own, and may persist in latent infections.



[view this species on IUCN Red List](#)

## Species Description

**Fungal Morphology:** *Batrachochytrium dendrobatidis* is a zoosporic chytrid fungus that causes chytridiomycosis (a fungal infection of the skin) in amphibians and grows solely within keratinised cells. Diagnosis is by identification of characteristic intracellular flask-shaped sporangia (spore containing bodies) and septate thalli. The fungus grows in the superficial keratinised layers of the epidermis (known as the stratum corneum and stratum granulosum). The normal thickness of the stratum corneum is between 2µm to 5µm, but a heavy infection by the chytrid parasite may cause it to thicken to up to 60 µm. The fungus also infects the mouthparts of tadpoles (which are keratinised) but does not infect the epidermis of tadpoles (which lacks keratin). The fungus produces inoperculate, smooth-walled zoosporangia (zoospore containing bodies), which are spherical to subspherical in shape. Each zoosporangium (10µm to 40µm in diameter) produces a single discharge tube, which penetrates (and protrudes out of) the skin. Eventually the plug that blocks the release of immature zoospores is shed and the mature zoospores are released. The zoospores (0.7µm to 6µm in diameter) are elongate to ovoid in shape. Each possesses a single posterior flagellum, rendering it motile in water (Mazzoni et al. 2003; Daszak et al. 1999; Berger, et al. 1998; Berger et al. 1998, Berger, Speare and Hyatt, 2000, in Daszak et al. 1999; Speare et al. 2001; Weldon et al. 2003).  
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To view a scanning electron micrograph of infected skin of a wild frog (*Litoria lesueuri*) please see: \r\n[Daszak et al. 1999. Emerging Infectious Diseases and Amphibian Population Declines.](#)\r\n

To view histological sections of infected skin of *Bufo haematiticus* and *Atelopus varius* (showing the sporangia and discharge tubes of the fungus) please see: [Daszak et al. 1999. Emerging Infectious Diseases and Amphibian Population Declines.](#)\r\n

To view a histological section of severely infected skin of a wild frog (*Litoria caerulea*) please see:\r\n[Berger et al. 1998. Chytridiomycosis causes amphibian mortality.](#)

\r\nClick here to see information about [Symptoms of the disease caused by \*Batrachochytrium dendrobatidis\*.](#)

**Pathogenesis of chytridiomycosis:** Authors of a recent study, Voyles et al. (2009) have found that *B. dendrobatidis*, causes such severe electrolyte imbalances that the frog's heart stops. The skin of amphibians maintain proper osmotic balance inside the animal and regulate respiration. The authors found that the skin of infected frogs was less adept at transporting sodium and chloride ions. Sodium and potassium concentrations in the blood of infected frogs dropped, more so as the infection intensified and the animals' hearts began to beat irregularly and ultimately stopped.

## Notes

Salamanders can act as host reservoirs of chytrid infection in frogs, and vice versa (Davidson et al. 2003).

## Lifecycle Stages

*Batrachochytrium dendrobatidis* has two life stages: a spherical reproductive sessile zoosporangium and a motile zoospore. The motile zoospore directs itself and attaches to the keratinised outer layers of its host. It then absorbs its tail and buries itself below the surface of the skin. It matures into a zoosporangia with rhizoids within about four days and produces and releases up to 300 zoospores into the external environment (via a discharge tube). The cycle is initiated again once a suitable substrate (in the same or a different host) is found. The presence of the fungus in the keratinised mouthparts of frog tadpoles (without actually killing them) supports the role of larvae as reservoirs for the pathogen. (The larvae of amphibian species may survive for as long as 3 years before metamorphosing.) Syntopic salamanders and frogs may also act as reciprocal pathogen reservoirs for chytrid infections. It has been suggested that *B. dendrobatidis* may not be an obligate amphibian parasite, possibly living in other non-amphibian hosts or even sapropytically (off dead tissue) (Michigan Frog Survey, 2003; Speare *et al.* 2001; Daszak *et al.* 1999; Davidson *et al.* 2003).<sup>1</sup>

As of yet, no resting structures (either asexual or sexual) have been identified for *B. dendrobatidis*. The fact that sexual reproduction in chytrid fungi has been associated with the production of resistant, thick-walled resting spores has lead to the hypothesis that the production of airborne spores explains the widespread distribution of *B. dendrobatidis* in relatively pristine areas. However recent research has found evidence that shows that the population structure of *B. dendrobatidis* is largely clonal, supporting the hypothesis that the fungus lacks a sexual stage (as is the case for many chytrid fungi). This suggests that dispersal by human (or perhaps other long distance travellers, such as birds), rather than natural causes, are more likely to be the cause of the pathogen's entry into pristine areas (Morehouse *et al.* 2003; Berger *et al.* 1999, Daszak *et al.* 1999, in Morehouse *et al.* 2003).<sup>1</sup>"

## Habitat Description

Chytridiomycosis has now been reported from 38 amphibian species in 12 families, including ranid and hylid frogs, bufonid toads, and plethodontid salamanders. Although chytridiomycosis is found in a range of species and habitats (including African frogs in lowland regions in Africa) it has caused population declines of amphibians species confined to montane rain forests (Weldon *et al.* 2004; Daszak *et al.* 1999). The fungus prefers lower temperatures which may explain the high prevalence of the fungus in high elevations in the tropics. In culture conditions optimum growth occurred at 23°C, with slower growth occurring at 28°C and (reversible) cessation of growth occurring at 29°C (Longcore, Pessier, Nichols, 1999, in Daszak *et al.* 1999).

## Reproduction

*Batrachochytrium dendrobatidis* is diploid and primarily reproduces asexually (and clonally) by producing aquatic uniflagellated zoospores in a zoosporangium (Johnson and Speare, 2003).

## Nutrition

Its occurrence solely in keratinised tissues suggests that it uses amphibian keratin as a nutrient.

*Batrachochytrium dendrobatidis* will grow for at least one generation on cleaned epidermal keratin or on amphibians that have died of the infection. The fungus may also be cultured *in vitro* on tryptone agar without the addition of keratin or its derivatives (Daszak *et al.* 1999; Longcore, Pessier and Nichols, 1999, Pessier *et al.* 1999, in Daszak *et al.* 1999).

## General Impacts

*Batrachochytrium dendrobatidis* has been found to affect at least 93 amphibian species from the orders Anura (frogs and toads) and Caudata (salamanders) in all the continents except Asia. It is thought to be one of the main causes of the global decline in frog populations since the 1960s, and the dramatic population crashes from the 1970s onwards (Parris and Beaudoin, 2004). The chytrid fungus kills frogs within 10 to 18 days (Michigan Frog Survey, 2003), although it is not known how. It may be physical, affecting respiration by altering the frog's skin, or the fungus may give off a toxin (Michigan Frog Survey, 2003). Tadpoles are not affected, although the fungus may infect the keratinised mouthparts (Berger *et al.* 1999).

For a summary on the impacts of *B. dendrobatidis* please follow this link [impacts](#).

Key findings of the [The Global Amphibian Assessment](#) has revealed that one-third (32%) of the world's amphibian species are threatened, representing 1,896 species. Threats include viral diseases, habitat loss, drought, pollution, and hunting for food. The biggest single threat appears to be *B. dendrobatidis*.

A [search](#) on the database using \"diseases\" as a keyword in \"all\" habitat types, biogeographic realm and countries results in a list of 547 species impacted by diseases (IUCN, Conservation International, and NatureServe. 2006).

## Management Info

Preventative measures: Knowledge of the infectiveness and spread of *Batrachochytrium dendrobatidis* is relevant to all control strategies, particularly in the development of preventative measures. The infective unit of the fungus is the zoospore. Infection by the fungus (and thus spread of the disease) requires water because the zoospore does not tolerate dehydration. *B. dendrobatidis* remains viable for up to 3 weeks in tap water, up to 4 weeks in deionised water and even longer in lake water. Infection by an extremely small inoculum (100 zoospores) is sufficient to cause a fatal infection (Berger *et al.* in Speare *et al.* 2001; Johnson and Speare, 2003; Berger, Speare and Hyatt, 2000, in Daszak *et al.* 1999).

Please see [main preventative management strategies](#) for a summary under the following headings: improving diagnostics and knowledge of epidemiology, developing trade and quarantine regulations, raising awareness and control options.

[The Amphibian Conservation Action Plan \(ACAP\)](#) is designed to provide guidance for implementing amphibian conservation and research initiatives at all scales from global down to local. Chapter 4 outlines action steps relating to the detection and control of chytridiomycosis.

**Principal source:** Berger *et al.* 1999. Chytrid fungi and amphibian declines: Overview, Implications and Future Directions.

[Berger \*et al.\* 1998. Chytridiomycosis Causes Amphibian Mortality Associated With Population Declines in the Rain Forests of Australia and Central America.](#)

[Daszak \*et al.\* 1999. Emerging Infectious Diseases and Amphibian Population Declines](#)

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## ALIEN RANGE

[85] AUSTRALIA  
[4] COSTA RICA  
[2] GERMANY  
[1] ITALY  
[3] MEXICO

[2] CANADA  
[4] ECUADOR  
[1] GHANA  
[2] KENYA  
[5] NEW ZEALAND

[3] PANAMA  
 [1] SPAIN  
 [14] UNITED STATES  
 [1] VENEZUELA

[9] SOUTH AFRICA  
 [1] SWAZILAND  
 [2] URUGUAY  
 [1] WEST AFRICA

**Red List assessed species 512: EX = 8; CR = 196; EN = 126; VU = 63; NT = 29; DD = 36; LC = 54;**

<a href="#">Adelotus brevis</a> <b>NT</b>	<a href="#">Agalychnis annae</a> <b>EN</b>
<a href="#">Agalychnis moreletii</a> <b>CR</b>	<a href="#">Allobates olfersioides</a> <b>VU</b>
<a href="#">Alytes cisternasii</a> <b>NT</b>	<a href="#">Anaxyrus canorus</a> <b>EN</b>
<a href="#">Aplastodiscus callipygius</a> <b>LC</b>	<a href="#">Aplastodiscus flumineus</a> <b>DD</b>
<a href="#">Aromobates alboguttatus</a> <b>EN</b>	<a href="#">Aromobates leopardalis</a> <b>CR</b>
<a href="#">Aromobates nocturnus</a> <b>CR</b>	<a href="#">Atelopus andinus</a> <b>CR</b>
<a href="#">Atelopus angelito</a> <b>CR</b>	<a href="#">Atelopus arsyecue</a> <b>CR</b>
<a href="#">Atelopus arthuri</a> <b>CR</b>	<a href="#">Atelopus balios</a> <b>CR</b>
<a href="#">Atelopus bomolochos</a> <b>CR</b>	<a href="#">Atelopus boulengeri</a> <b>CR</b>
<a href="#">Atelopus caraauta</a> <b>CR</b>	<a href="#">Atelopus carbonerensis</a> <b>CR</b>
<a href="#">Atelopus carrikeri</a> <b>CR</b>	<a href="#">Atelopus certus</a> <b>EN</b>
<a href="#">Atelopus chiriquiensis</a> <b>CR</b>	<a href="#">Atelopus chocoensis</a> <b>CR</b>
<a href="#">Atelopus chrysocorallus</a> <b>CR</b>	<a href="#">Atelopus coynei</a> <b>CR</b>
<a href="#">Atelopus cruciger</a> <b>CR</b>	<a href="#">Atelopus dimorphus</a> <b>EN</b>
<a href="#">Atelopus ebenoides</a> <b>CR</b>	<a href="#">Atelopus elegans</a> <b>CR</b>
<a href="#">Atelopus epikeisthos</a> <b>CR</b>	<a href="#">Atelopus erythrops</a> <b>CR</b>
<a href="#">Atelopus eusebianus</a> <b>CR</b>	<a href="#">Atelopus exiguus</a> <b>CR</b>
<a href="#">Atelopus famelicus</a> <b>CR</b>	<a href="#">Atelopus farci</a> <b>CR</b>
<a href="#">Atelopus flavescens</a> <b>VU</b>	<a href="#">Atelopus franciscus</a> <b>VU</b>
<a href="#">Atelopus galactogaster</a> <b>CR</b>	<a href="#">Atelopus glyphus</a> <b>CR</b>
<a href="#">Atelopus guanujo</a> <b>CR</b>	<a href="#">Atelopus guitarraensis</a> <b>CR</b>
<a href="#">Atelopus halihelos</a> <b>CR</b>	<a href="#">Atelopus ignescens</a> <b>EX</b>
<a href="#">Atelopus laetissimus</a> <b>CR</b>	<a href="#">Atelopus limosus</a> <b>EN</b>
<a href="#">Atelopus longibrachius</a> <b>EN</b>	<a href="#">Atelopus longirostris</a> <b>EX</b>
<a href="#">Atelopus lozanoi</a> <b>CR</b>	<a href="#">Atelopus lynchi</a> <b>CR</b>
<a href="#">Atelopus mandingues</a> <b>CR</b>	<a href="#">Atelopus mindoensis</a> <b>CR</b>
<a href="#">Atelopus minutulus</a> <b>CR</b>	<a href="#">Atelopus mittermeieri</a> <b>EN</b>
<a href="#">Atelopus monohernandezii</a> <b>CR</b>	<a href="#">Atelopus mucubajensis</a> <b>CR</b>
<a href="#">Atelopus muisca</a> <b>CR</b>	<a href="#">Atelopus nahumae</a> <b>CR</b>
<a href="#">Atelopus nanay</a> <b>CR</b>	<a href="#">Atelopus nepiozomus</a> <b>CR</b>
<a href="#">Atelopus nicefori</a> <b>CR</b>	<a href="#">Atelopus onorei</a> <b>CR</b>
<a href="#">Atelopus oxapampae</a> <b>EN</b>	<a href="#">Atelopus oxyrhynchus</a> <b>CR</b>
<a href="#">Atelopus pachydermus</a> <b>CR</b>	<a href="#">Atelopus palmatus</a> <b>DD</b>
<a href="#">Atelopus patazensis</a> <b>CR</b>	<a href="#">Atelopus pedimarmoratus</a> <b>CR</b>
<a href="#">Atelopus peruensis</a> <b>CR</b>	<a href="#">Atelopus petersi</a> <b>CR</b>
<a href="#">Atelopus petriruizi</a> <b>CR</b>	<a href="#">Atelopus pictiventris</a> <b>CR</b>
<a href="#">Atelopus pinangoi</a> <b>CR</b>	<a href="#">Atelopus planispina</a> <b>CR</b>
<a href="#">Atelopus pulcher</a> <b>CR</b>	<a href="#">Atelopus quimbaya</a> <b>CR</b>
<a href="#">Atelopus reticulatus</a> <b>CR</b>	<a href="#">Atelopus sanjosei</a> <b>DD</b>
<a href="#">Atelopus seminiferus</a> <b>CR</b>	<a href="#">Atelopus senex</a> <b>CR</b>
<a href="#">Atelopus sernai</a> <b>CR</b>	<a href="#">Atelopus simulatus</a> <b>CR</b>
<a href="#">Atelopus siranus</a> <b>DD</b>	<a href="#">Atelopus sonsonensis</a> <b>CR</b>
<a href="#">Atelopus sorianoi</a> <b>CR</b>	<a href="#">Atelopus spumarius</a> <b>VU</b>
<a href="#">Atelopus surrelli</a> <b>VU</b>	<a href="#">Atelopus subornatus</a> <b>CR</b>
<a href="#">Atelopus tamaense</a> <b>CR</b>	<a href="#">Atelopus tricolor</a> <b>VU</b>
<a href="#">Atelopus varius</a> <b>CR</b>	<a href="#">Atelopus walkeri</a> <b>CR</b>
<a href="#">Atelopus zeteki</a> <b>CR</b>	<a href="#">Bokermannohyla circumdata</a> <b>LC</b>
<a href="#">Bokermannohyla claresignata</a> <b>DD</b>	<a href="#">Bokermannohyla hylax</a> <b>LC</b>

<a href="#">Bolitoglossa conanti</a> EN	<a href="#">Bolitoglossa copia</a> DD
<a href="#">Bolitoglossa dofleinii</a> NT	<a href="#">Bolitoglossa magnifica</a> EN
<a href="#">Bolitoglossa pesrubra</a> VU	<a href="#">Bolitoglossa sombra</a> VU
<a href="#">Bolitoglossa sooyorum</a> EN	<a href="#">Bolitoglossa subpalmata</a> EN
<a href="#">Bombina pachypus</a> EN	<a href="#">Bromeliohyla bromeliacia</a> EN
<a href="#">Bromeliohyla dendroscarta</a> CR	<a href="#">Bufo bufo</a> LC
<a href="#">Centrolene audax</a> EN	<a href="#">Centrolene ballux</a> CR
<a href="#">Centrolene buckleyi</a> VU	<a href="#">Centrolene geckoideum</a> VU
<a href="#">Centrolene gemmatum</a> CR	<a href="#">Centrolene heloderma</a> CR
<a href="#">Centrolene lynchii</a> EN	<a href="#">Centrolene medemi</a> DD
<a href="#">Centrolene peristictum</a> VU	<a href="#">Centrolene pipilatum</a> EN
<a href="#">Centrolene scirtetes</a> DD	<a href="#">Charadrahyla altipotens</a> CR
<a href="#">Charadrahyla nephila</a> VU	<a href="#">Charadrahyla trux</a> CR
<a href="#">Chiropterotriton cracens</a> EN	<a href="#">Chiropterotriton multidentatus</a> EN
<a href="#">Craugastor anciano</a> CR	<a href="#">Craugastor andi</a> CR
<a href="#">Craugastor angelicus</a> CR	<a href="#">Craugastor azueroensis</a> EN
<a href="#">Craugastor berkenbuschii</a> NT	<a href="#">Craugastor brocchi</a> VU
<a href="#">Craugastor catalinae</a> CR	<a href="#">Craugastor charadra</a> EN
<a href="#">Craugastor chrysozeti</a> EX	<a href="#">Craugastor cruzi</a> CR
<a href="#">Craugastor daryl</a> EN	<a href="#">Craugastor emcelae</a> CR
<a href="#">Craugastor emleni</a> CR	<a href="#">Craugastor epochthidius</a> CR
<a href="#">Craugastor escoces</a> EX	<a href="#">Craugastor fecundus</a> CR
<a href="#">Craugastor fleischmanni</a> CR	<a href="#">Craugastor greggi</a> CR
<a href="#">Craugastor guerreroensis</a> CR	<a href="#">Craugastor inachus</a> EN
<a href="#">Craugastor laevissimus</a> EN	<a href="#">Craugastor laticeps</a> NT
<a href="#">Craugastor lineatus</a> CR	<a href="#">Craugastor melanostictus</a> LC
<a href="#">Craugastor merendonensis</a> CR	<a href="#">Craugastor mexicanus</a> LC
<a href="#">Craugastor milesi</a> CR	<a href="#">Craugastor obesus</a> EN
<a href="#">Craugastor olanchano</a> CR	<a href="#">Craugastor omoaensis</a> CR
<a href="#">Craugastor pechorum</a> EN	<a href="#">Craugastor phasma</a> DD
<a href="#">Craugastor podicipinus</a> NT	<a href="#">Craugastor polymniae</a> CR
<a href="#">Craugastor punctariolus</a> EN	<a href="#">Craugastor ranooides</a> CR
<a href="#">Craugastor rhyacobatrachus</a> EN	<a href="#">Craugastor rostralis</a> NT
<a href="#">Craugastor rugulosus</a> LC	<a href="#">Craugastor rupinius</a> LC
<a href="#">Craugastor sabrinus</a> EN	<a href="#">Craugastor saltuarius</a> CR
<a href="#">Craugastor sandersoni</a> EN	<a href="#">Craugastor stadelmani</a> CR
<a href="#">Craugastor tabasarae</a> CR	<a href="#">Craugastor taurus</a> CR
<a href="#">Craugastor trachidermus</a> CR	<a href="#">Crinia georgiana</a> LC
<a href="#">Crinia pseudodorsifera</a> LC	<a href="#">Crossodactylus dispar</a> DD
<a href="#">Crossodactylus gaudichaudii</a> LC	<a href="#">Cycloramphus boraceiensis</a> LC
<a href="#">Cycloramphus ohausi</a> DD	<a href="#">Cycloramphus semipalmatus</a> NT
<a href="#">Duellmanohyla chamulae</a> EN	<a href="#">Duellmanohyla ignicolor</a> EN
<a href="#">Duellmanohyla lythrodectes</a> EN	<a href="#">Duellmanohyla salvavida</a> CR
<a href="#">Duellmanohyla schmidtorum</a> VU	<a href="#">Duellmanohyla soraria</a> CR
<a href="#">Duellmanohyla uranochroa</a> CR	<a href="#">Ecnomiohyla echinata</a> CR
<a href="#">Ecnomiohyla rabborum</a> CR	<a href="#">Eleutherodactylus barlagnei</a> EN
<a href="#">Eleutherodactylus cooki</a> VU	<a href="#">Eleutherodactylus gryllus</a> EN
<a href="#">Eleutherodactylus hedricki</a> EN	<a href="#">Eleutherodactylus jasperi</a> CR
<a href="#">Eleutherodactylus karlschmidti</a> CR	<a href="#">Eleutherodactylus longipes</a> VU
<a href="#">Eleutherodactylus orcutti</a> CR	<a href="#">Eleutherodactylus patriciae</a> EN
<a href="#">Eleutherodactylus portoricensis</a> EN	<a href="#">Eleutherodactylus richmondi</a> CR
<a href="#">Eleutherodactylus ruthae</a> EN	<a href="#">Eleutherodactylus schmidti</a> CR
<a href="#">Eleutherodactylus semipalmatus</a> CR	<a href="#">Eleutherodactylus symingtoni</a> CR
<a href="#">Eleutherodactylus turquinensis</a> CR	<a href="#">Eleutherodactylus unicolor</a> VU

<a href="#">Eleutherodactylus wightmanae</a> EN	<a href="#">Epipedobates tricolor</a> EN
<a href="#">Euproctus platycephalus</a> EN	<a href="#">Exerodonta juanitae</a> VU
<a href="#">Exerodonta melanomma</a> VU	<a href="#">Exerodonta pinorum</a> VU
<a href="#">Gastrotheca cornuta</a> EN	<a href="#">Gastrotheca dendronastes</a> VU
<a href="#">Gastrotheca guentheri</a> VU	<a href="#">Gastrotheca litonedis</a> EN
<a href="#">Gastrotheca orophylax</a> EN	<a href="#">Gastrotheca ovifera</a> EN
<a href="#">Gastrotheca piperata</a> LC	<a href="#">Gastrotheca plumbea</a> VU
<a href="#">Gastrotheca pseustes</a> EN	<a href="#">Gastrotheca riobambae</a> EN
<a href="#">Gastrotheca splendens</a> EN	<a href="#">Geocrinia rosea</a> LC
<a href="#">Heleioporus australiacus</a> VU	<a href="#">Heleioporus eyrei</a> LC
<a href="#">Hyalinobatrachium fleischmanni</a> LC	<a href="#">Hyalinobatrachium guairarepanense</a> EN
<a href="#">Hyla bocourti</a> CR	<a href="#">Hylarana chalconota</a> LC
<a href="#">Hylodes dactylocinus</a> DD	<a href="#">Hylodes magalhaesi</a> DD
<a href="#">Hylodes meridionalis</a> LC	<a href="#">Hylodes perplicatus</a> LC
<a href="#">Hylodes phyllodes</a> LC	<a href="#">Hylomantis lemur</a> CR
<a href="#">Hyloscirtus armatus</a> LC	<a href="#">Hyloscirtus bogotensis</a> NT
<a href="#">Hyloscirtus colymba</a> CR	<a href="#">Hyloscirtus lindae</a> VU
<a href="#">Hyloscirtus pantostictus</a> EN	<a href="#">Hyloscirtus platydactylus</a> VU
<a href="#">Hyloscirtus ptychodactylus</a> CR	<a href="#">Hyloscirtus staufferorum</a> EN
<a href="#">Hyloscirtus torrenticola</a> VU	<a href="#">Hyloxalus anthracinus</a> CR
<a href="#">Hyloxalus bocagei</a> LC	<a href="#">Hyloxalus breviquartus</a> DD
<a href="#">Hyloxalus choocoensis</a> DD	<a href="#">Hyloxalus delatorreae</a> CR
<a href="#">Hyloxalus elachyhystus</a> EN	<a href="#">Hyloxalus lehmanni</a> NT
<a href="#">Hyloxalus pulchellus</a> VU	<a href="#">Hyloxalus vertebralis</a> CR
<a href="#">Hypodactylus dolops</a> VU	<a href="#">Hypsiboas cymbalum</a> CR
<a href="#">Incilius cycladen</a> VU	<a href="#">Incilius fastidiosus</a> CR
<a href="#">Incilius holdridgei</a> EX	<a href="#">Incilius melanochlorus</a> LC
<a href="#">Incilius periglenes</a> EX	<a href="#">Incilius peripatetes</a> CR
<a href="#">Incilius porteri</a> DD	<a href="#">Incilius tacanensis</a> EN
<a href="#">Incilius tutelarius</a> EN	<a href="#">Isthmohyla angustilineata</a> CR
<a href="#">Isthmohyla calypsa</a> CR	<a href="#">Isthmohyla debilis</a> CR
<a href="#">Isthmohyla graceae</a> CR	<a href="#">Isthmohyla pictipes</a> EN
<a href="#">Isthmohyla tica</a> CR	<a href="#">Isthmohyla xanthosticta</a> DD
<a href="#">Leiopelma archeyi</a> CR	<a href="#">Leiopelma hamiltoni</a> EN
<a href="#">Leiopelma hochstetteri</a> VU	<a href="#">Leptobrachium hasseltii</a> LC
<a href="#">Leptodactylus fallax</a> CR	<a href="#">Limnodynastes dumerili</a> LC
<a href="#">Lithobates chiricahuensis</a> VU	<a href="#">Lithobates omiltemanus</a> CR
<a href="#">Lithobates sierramadrensis</a> VU	<a href="#">Lithobates subaquavocalis</a> CR
<a href="#">Lithobates tarahumarae</a> VU	<a href="#">Lithobates taylori</a> LC
<a href="#">Lithobates vibicarius</a> CR	<a href="#">Lithobates warszewitschii</a> LC
<a href="#">Lithobates yavapaiensis</a> LC	<a href="#">Litoria adelaideensis</a> LC
<a href="#">Litoria aurea</a> VU	<a href="#">Litoria booroolongensis</a> CR
<a href="#">Litoria caerulea</a> LC	<a href="#">Litoria castanea</a> CR
<a href="#">Litoria chloris</a> LC	<a href="#">Litoria dayi</a> EN
<a href="#">Litoria ewingii</a> LC	<a href="#">Litoria genimaculata</a> LC
<a href="#">Litoria lesueuri</a> LC	<a href="#">Litoria lorica</a> CR
<a href="#">Litoria moorei</a> LC	<a href="#">Litoria myola</a> CR
<a href="#">Litoria nannotis</a> EN	<a href="#">Litoria nudidigita</a> LC
<a href="#">Litoria nyakalensis</a> CR	<a href="#">Litoria pearsoniana</a> NT
<a href="#">Litoria phallochroa</a> LC	<a href="#">Litoria piperata</a> CR
<a href="#">Litoria raniformis</a> EN	<a href="#">Litoria rheocola</a> EN
<a href="#">Litoria spenceri</a> CR	<a href="#">Litoria verreauxii</a> LC
<a href="#">Mannophryne caqueto</a> CR	<a href="#">Mannophryne cordilleriana</a> CR
<a href="#">Mannophryne herminiae</a> NT	<a href="#">Mannophryne lamarcai</a> CR

[Mannophryne neblina](#) CR  
[Mannophryne olmonae](#) CR  
[Megaelosia massarti](#) DD  
[Mesotriton alpestris](#) LC  
[Mixophyes fasciolatus](#) LC  
[Nymphargus griffithsi](#) VU  
[Oedipina](#) EN  
[Osteopilus pulchrilineatus](#) EN  
[Paratelmatobius lutzii](#) DD  
[Pelobates fuscus](#) LC  
[Phrynomedusa appendiculata](#) NT  
[Phylomedusa ecuatoriana](#) EN  
[Physalaemus moreirae](#) DD  
[Plectrohyla ameibothalame](#) DD  
[Plectrohyla avia](#) CR  
[Plectrohyla calthula](#) CR  
[Plectrohyla celata](#) CR  
[Plectrohyla charadricola](#) EN  
[Plectrohyla chrysopleura](#) CR  
[Plectrohyla cyanomma](#) CR  
[Plectrohyla dasypus](#) CR  
[Plectrohyla exquisita](#) CR  
[Plectrohyla guatemalensis](#) CR  
[Plectrohyla hazelae](#) CR  
[Plectrohyla lacertosa](#) EN  
[Plectrohyla mykter](#) EN  
[Plectrohyla pentheri](#) EN  
[Plectrohyla psiloderma](#) EN  
[Plectrohyla quecchi](#) CR  
[Plectrohyla sabrina](#) CR  
[Plectrohyla siopela](#) CR  
[Plectrohyla teuchestes](#) CR  
[Pleurodema marmoratum](#) LC  
[Pristimantis anotis](#) DD  
[Pristimantis calcarulatus](#) VU  
[Pristimantis caryophyllaceus](#) NT  
[Pristimantis crennobates](#) EN  
[Pristimantis crucifer](#) VU  
[Pristimantis diogenes](#) VU  
[Pristimantis fallax](#) EN  
[Pristimantis ginesi](#) EN  
[Pristimantis ignicolor](#) EN  
[Pristimantis jorgevelosai](#) EN  
[Pristimantis lancinii](#) EN  
[Pristimantis lymani](#) LC  
[Pristimantis nigrogriseus](#) VU  
[Pristimantis prolatus](#) EN  
[Pristimantis ruedai](#) VU  
[Pristimantis sanguineus](#) NT  
[Pristimantis scoblepharus](#) EN  
[Pristimantis signifer](#) VU  
[Pristimantis tamsitti](#) NT  
[Pristimantis urichi](#) EN  
[Pristimantis vicarius](#) NT

[Mannophryne oblitterata](#) DD  
[Mannophryne riveroi](#) EN  
[Megastomatohyla pellita](#) CR  
[Mixophyes balbus](#) VU  
[Mixophyes fleayi](#) EN  
[Nymphargus megacheirus](#) EN  
[Oophaga arborea](#) EN  
[Osteopilus vastus](#) EN  
[Paratelmatobius mantiqueira](#) DD  
[Philoria frosti](#) CR  
[Phyllobates bicolor](#) NT  
[Physalaemus barrioi](#) DD  
[Plectrohyla acanthodes](#) CR  
[Plectrohyla arborescens](#) EN  
[Plectrohyla bistrincta](#) LC  
[Plectrohyla calvicollina](#) CR  
[Plectrohyla cembra](#) CR  
[Plectrohyla chryses](#) CR  
[Plectrohyla crassa](#) CR  
[Plectrohyla cyclada](#) EN  
[Plectrohyla ephemera](#) CR  
[Plectrohyla glandulosa](#) EN  
[Plectrohyla hartwegi](#) CR  
[Plectrohyla ixil](#) CR  
[Plectrohyla matudai](#) VU  
[Plectrohyla pachyderma](#) CR  
[Plectrohyla pokomchi](#) CR  
[Plectrohyla pycnochila](#) CR  
[Plectrohyla robertsorum](#) EN  
[Plectrohyla sagorum](#) EN  
[Plectrohyla tecunumani](#) CR  
[Plectrohyla thorectes](#) CR  
[Pristimantis albericoi](#) CR  
[Pristimantis bicolor](#) VU  
[Pristimantis caprifer](#) LC  
[Pristimantis chalceus](#) LC  
[Pristimantis crenunguis](#) EN  
[Pristimantis diaphonus](#) VU  
[Pristimantis duellmani](#) VU  
[Pristimantis fetosus](#) EN  
[Pristimantis gracilis](#) VU  
[Pristimantis incanus](#) EN  
[Pristimantis labiosus](#) LC  
[Pristimantis lichenoides](#) CR  
[Pristimantis molybrignus](#) NT  
[Pristimantis penelopus](#) VU  
[Pristimantis quinquagesimus](#) VU  
[Pristimantis sanctaemartae](#) NT  
[Pristimantis savagei](#) NT  
[Pristimantis scolodiscus](#) EN  
[Pristimantis sulculus](#) EN  
[Pristimantis uranobates](#) LC  
[Pristimantis verecundus](#) VU  
[Pristimantis zophus](#) EN

[Prostherapis dunni](#) **CR**  
[Pseudoeurycea unguidentis](#) **CR**  
[Pseudophryne pengilleyi](#) **EN**  
[Ptychohyla acrochorda](#) **DD**  
[Ptychohyla erythromma](#) **EN**  
[Ptychohyla legleri](#) **EN**  
[Ptychohyla macrotympanum](#) **CR**  
[Ptychohyla salvadorensis](#) **EN**  
[Ptychohyla spinipollex](#) **EN**  
[Rana muscosa](#) **EN**  
[Ranitomeya abdita](#) **CR**  
[Rhaeo haematicus](#) **LC**  
[Rhinella amabilis](#) **CR**  
[Rhinoderma darwinii](#) **VU**  
[Scinax albicans](#) **LC**  
[Silverstoneia nubicola](#) **NT**  
[Strabomantis cheiroplethus](#) **VU**  
[Strabomantis zygodactylus](#) **LC**  
[Taudactylus diurnus](#) **EX**  
[Taudactylus liemi](#) **NT**  
[Taudactylus rheophilus](#) **CR**  
[Telmatothius atacamensis](#) **CR**  
[Telmatothius boliviensis](#) **NT**  
[Telmatothius brevirostris](#) **EN**  
[Telmatothius ceiorum](#) **EN**  
[Telmatothius colanensis](#) **EN**  
[Telmatothius culeus](#) **CR**  
[Telmatothius degener](#) **EN**  
[Telmatothius gigas](#) **CR**  
[Telmatothius hockingi](#) **VU**  
[Telmatothius ignavus](#) **EN**  
[Telmatothius jelskii](#) **NT**  
[Telmatothius latirostris](#) **EN**  
[Telmatothius mayoloi](#) **EN**  
[Telmatothius niger](#) **CR**  
[Telmatothius peruvianus](#) **VU**  
[Telmatothius pinguiculus](#) **DD**  
[Telmatothius platycephalus](#) **EN**  
[Telmatothius scrocchii](#) **EN**  
[Telmatothius simonsi](#) **NT**  
[Telmatothius thompsoni](#) **EN**  
[Telmatothius truebae](#) **EN**  
[Telmatothius verrucosus](#) **VU**  
[Telmatothius yuracare](#) **VU**  
[Thoropa lutzi](#) **EN**  
[Thoropa petropolitana](#) **VU**

[Pseudacris triseriata](#) **LC**  
[Pseudophryne corroboree](#) **CR**  
[Ptychohyla](#) **CR**  
[Ptychohyla dendrophasma](#) **CR**  
[Ptychohyla euthysanota](#) **NT**  
[Ptychohyla leonhardschultzei](#) **EN**  
[Ptychohyla panchoi](#) **EN**  
[Ptychohyla sanctaerucis](#) **CR**  
[Ptychohyla zophodes](#) **DD**  
[Rana sierrae](#) **EN**  
[Rhacophorus marginatus](#) **LC**  
[Rheobatrachus vitellinus](#) **EX**  
[Rhinella chrysophora](#) **EN**  
[Rhinoderma rufum](#) **CR**  
[Scinax heyeri](#) **DD**  
[Smilisca cyanosticta](#) **NT**  
[Strabomantis necerus](#) **VU**  
[Taudactylus acutirostris](#) **CR**  
[Taudactylus eungellensis](#) **CR**  
[Taudactylus pleione](#) **CR**  
[Telmatothius arequipensis](#) **VU**  
[Telmatothius atahualpae](#) **DD**  
[Telmatothius brevipes](#) **EN**  
[Telmatothius carillae](#) **VU**  
[Telmatothius cirrhacelis](#) **CR**  
[Telmatothius contrerasi](#) **DD**  
[Telmatothius dankoi](#) **DD**  
[Telmatothius edaphonastes](#) **EN**  
[Telmatothius hauthali](#) **VU**  
[Telmatothius hypsolocephalus](#) **EN**  
[Telmatothius intermedius](#) **DD**  
[Telmatothius laticeps](#) **EN**  
[Telmatothius marmoratus](#) **VU**  
[Telmatothius necopinus](#) **EN**  
[Telmatothius pefauri](#) **CR**  
[Telmatothius philippii](#) **DD**  
[Telmatothius pisanoi](#) **EN**  
[Telmatothius schreiteri](#) **EN**  
[Telmatothius sibiricus](#) **EN**  
[Telmatothius stephani](#) **EN**  
[Telmatothius timens](#) **DD**  
[Telmatothius vellardi](#) **CR**  
[Telmatothius vilamensis](#) **DD**  
[Telmatothius zapahuirensis](#) **CR**  
[Thoropa miliaris](#) **LC**  
[Thoropa saxatilis](#) **NT**

## BIBLIOGRAPHY

55 references found for ***Batrachochytrium dendrobatidis***

### Management information

Australian Department of the Environment and Heritage, 2004. Chytridiomycosis (Amphibian Chytrid Fungus Disease). Australia's Natural Heritage Trust.

[Berger, Lee, Alex D. Hyatt, Veronica Olsen, Sandra G. Hengstberger Donna Boyle, Gerry Marantelli, Kaye Humphreys, Joyce E. Longcore., 2002. Production of polyclonal antibodies to \*Batrachochytrium dendrobatidis\* and their use in an immunoperoxidase test for chytridiomycosis in amphibians. Diseases of Aquatic Organisms Vol 48 213-220.](#)

**Summary:** Available from: <http://www.jcu.edu.au/school/phtm/PHTM/frogs/papers/berger-2002-polyab.pdf> [Accessed 14 September 2005]  
Berger, L., Hyatt, A.D., Olsen, V., Hengstberger, S.G., Boyle, D., Marantelli, G., Humphreys, K., Longcore, J.E. 2002. Production of Polyclonal Antibodies to *Batrachochytrium dendrobatidis* and Their use in an Immunoperoxidase Test for Chytridiomycosis in Amphibians, *Dis Aquat Organ.* 48 (3): 213 -220. (Abstract)

[Berger, L., Speare, R., and Hyatt., A.D. 1999. Chytrid Fungi and Amphibian Declines: Overview, Implications and Future Directions. Declines and Disappearances of Australian Frogs. 23 - 34.](#)

[Berger, L., Speare, R., and Kent, A. 1999. Diagnosis of chytridiomycosis in amphibians by histologic examination.](#)

**Summary:** This paper outlines techniques for identifying the chytrid fungus.

Available from: <http://www.jcu.edu.au/school/phtm/PHTM/frogs/histo/chhisto.htm> [Accessed 17 December 2004]

[Daszak, P., A. Strieby, A. A. Cunningham, J. E. Longcore, C. C. Brown and D. Porter., 2004. Experimental Evidence That The Bullfrog \(\*Rana catesbeiana\*\) Is A Potential Carrier Of Chytridiomycosis, An Emerging Fungal Disease Of Amphibians. Herpetological Journal, Vol. 14, Pp. 201-207 \(2004\)](#)

**Summary:** Available from: [http://www.conservationmedicine.org/papers/Herp\\_J\\_Bullfrog\\_exptl\\_infection.pdf](http://www.conservationmedicine.org/papers/Herp_J_Bullfrog_exptl_infection.pdf) [Accessed 14 September 2005]  
DeWeerd, Sarah. 2001. Coordinating an International Monitoring Program The Declining Amphibian Populations Task Force. *Conservation in Practice Winter 2001 Vol 2 no. 1*

Garthwaite, R. Department of Conservation. *Batrachochytrium dendrobatidis*, Frog Chytrid Fungus. Department of Conservation: Waikato.

[Gascon, C., Collins, J. P., Moore, R. D., Church, D. R., McKay, J. E. and Mendelson, J. R. III \(eds\). 2007. Amphibian Conservation Action Plan. IUCN/SSC Amphibian Specialist Group. Gland, Switzerland and Cambridge, UK. 64pp.](#)

**Summary:** The Amphibian Conservation Action Plan (ACAP) is designed to provide guidance for implementing amphibian conservation and research initiatives at all scales from global down to local.

Available from: <http://www.amphibians.org/newsletter/ACAP.pdf> [Accessed 9 June 2008]

[Johnson, Megan L & Richard Speare, 2005. Possible modes of dissemination of the amphibian chytrid \*Batrachochytrium dendrobatidis\* in the environment. \*Dis Aquat Org\* Vol. 65: 181-186, 2005](#)

**Summary:** Available from: <http://www.int-res.com/articles/dao2005/65/d065p181.pdf> [Accessed 14 September 2005]

[Johnson, M.L. and Speare, R. 2003. Survival of \*Batrachochytrium dendrobatidis\* in Water: Quarantine and Disease Control Implications. Emerging Infectious Diseases 9 \(8\): 922 - 925.](#)

**Summary:** Available from: <http://www.cdc.gov/ncidod/EID/vol9no8/03-0145.htm> [Accessed 7 Dec 2004]

Johnson, M.L., Berger, L., Philips, L. and Speare, R. 2003. Fungicidal Effects of Chemical Disinfectants, UV Light, Desiccation and Heat on the Amphibian Chytrid *Batrachochytrium dendrobatidis*, *Diseases of Aquatic Organisms* 57 (3): 255 - 260.

Mazzoni, R., Cunningham, A.A., Daszak, P., Apolo, A. Perdomo, P. and Speranza., G. 2003. Emerging Pathogen of Wild Amphibians in Frogs (*Rana catesbeiana*) Farmed for International Trade, *Emerging Infectious Diseases* 9 (8): 995 - 998.

Michigan Frog Survey. 2003. Michigan Frog Survey Update. Michigan Department of Natural Resources Wildlife Division Natural Heritage Program.

Parker, J.M., Mikaelian, I., Hahn, N. and Diggs, H.E. 2002. Clinical Diagnosis and Treatment of Epidermal Chytridiomycosis in African Clawed Frogs (*Xenopus tropicalis*), *Comp Med.* 52 (3): 265 ♦ 268. (Abstract)

Rollins-Smith, L., Reinert, L.K., Miera, V. and Conlon, J.M. 2002. Antimicrobial Peptide Defenses of the Tarahumara Frog, *Rana tarahumarae*, *Biochemical and Biophysical Research Communications* 297 (2): 361 - 367.

Ron, Santiago R., 2005. Predicting the Distribution of the Amphibian Pathogen *Batrachochytrium dendrobatidis* in the New World1. *Biotropica* 37 (2), 209-221.

Speare, R. and Core Working Group of Getting the Jump on Amphibian Disease. 2001. Nomination for Listing of Amphibian Chytridiomycosis as a key Threatening Process Under the Environment Protection and Biodiversity Conservation act 1999. In: Speare, R. and Steering Committee of Getting the Jump on Amphibian Disease. Developing Management Strategies to Control Amphibian Diseases: Decreasing the Risk due to Communicable Diseases. School of Public Health and Tropical Medicine, James Cook University: Townsville. 163 - 187.

[Speare R, Berger L. Global distribution of chytridiomycosis in amphibians.](#)

**Summary:** This document gives details on the global distribution of the chytrid fungus, and was last updated in April 2004.

Available from: <http://www.jcu.edu.au/school/phtm/PHTM/frogs/chglob.htm>. [Accessed 11 November 2000].

USDI (United States Department of the Interior) U.S. Fish and Wildlife Service. 2003. RE: Buck Springs Range Management Allotment Plan Van-Ells, T., Stanton, J., Strieby, A., Daszak, P., Hyatt, A.D. and Brown, C. 2003. Use of Immunohistochemistry to Diagnose Chytridiomycosis in Dyeing Poison Dart Frogs (*Dendrobates tinctorius*), *Journal of Wildlife Diseases* 39 (3): 742 - 745.

### General information

[Bell, Ben D., Scott Carver, Nicola J. Mitchell, Shirley Pledger., 2004. The recent decline of a New Zealand endemic: how and why did populations of Archey's frog \*Leiopelma archeyi\* crash over 1996-2001? Biological Conservation 120 \(2004\) 189-199](#)

**Summary:** Available from: <http://www.jcu.edu.au/school/phtm/PHTM/frogs/papers/bell-2004.pdf> [Accessed 14 September 2005]

[Berger, L. R Speare, HB Hines, G Marantelli, AD Hyatt, KR McDonald, LF Skerratt, V Olsen, JM Clarke, G Gillespie, M Mahony, N Sheppard, C Williams And MJ Tyler., 2004. Effect of season and temperature on mortality in amphibians due to chytridiomycosis. Australian Veterinary Journal Volume 82, No 7, July 2004](#)

**Summary:** Available from: <http://www.ava.com.au/avj/private/0407/04070434.pdf> [Accessed 14 September 2005]

[Berger, L., Speare, R., Daszak, P., Green, D.E., Cunningham, A.A., Goggin, C.L., Slocombe, R., Ragan, M.A., Hyatt, A.D., McDonald, K.R., Hines, H.B., Lips, K.R., Marantelli, G. and Parkes, H. 1998. Chytridiomycosis Causes Amphibian Mortality Associated With Population Declines in the Rain Forests of Australia and Central America. \*Population Biology \(Proc Natl Acad Sci U S A.\)\* 95 \(15\): 9031 ♦ 9036.](#)

**Summary:** Available from: <http://www.pnas.org/cgi/content/full/95/15/9031> [Accessed 7 Dec 2004]



# GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Batrachochytrium dendrobatidis***

Berger, L., Speare, R., Hines, H.B., Marantelli, G., Hyatt, A.D., McDonald., K.R., Skerratt, L.F., Olsen, V., Clarke, J.M., Gillespie, G., Mahony, M., Sheppard, N. Williams, C. and Tyler. M.J. 2004. Effect of Season and Temperature on Mortality in Amphibians due to Chytridiomycosis, Australian Veterinary Journal 82 (7): 434 - 439.

[Bosch, J., Martinez-Solano, I., and Garcia-Paris, M. 2000. Chytridiomycosis in Spain: First European Report of Declines of Wild Amphibians Associated with Chytridiomycosis.](#)

**Summary:** This article gives details about the first case of chytrid fungus in Spain.

Available from: <http://www.jcu.edu.au/school/phitm/PHTM/frogs/spain/SpainChy.htm> [Accessed 17 December 2004]

Carey, C., Cohen, N. and Rollins-Smith, L. 1999. Amphibian declines: an immunological perspective. Developmental and Comparative Immunology. 23 (6): 459-472.

**Summary:** This paper discusses the role of disease in amphibian decline, and the immunological response.

Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2003. Researching Frog Fungus.

Daszak, P., Andrew, A Cunningham and Hyatt, D Alex., 2003. Infectious disease and amphibian population declines. Diversity and Distributions 9, 141-150

[Daszak, P., Berger, L., Cunningham, A.A., Hyatt, A.D., Green, D.E., Speare, R., 1999. Emerging Infectious Diseases and Amphibian Population Declines. Emerg Infect Dis \[serial on the Internet\]. November-December 1999](#)

**Summary:** Available from: <http://www.cdc.gov/ncidod/eid/vol5no6/daszak.htm> [Accessed 7 Dec 2004]

Davidson, E.W., Parris, M., Collins, J.P., Longcore, J.E., Pessier, P.A. and Brunner, J. 2003. Pathogenicity and Transmission of Chytridiomycosis in Tiger Salamanders (*Ambystoma tigrinum*), Copeia 3: 601 - 607.

Fellers, G.M., Green, D.E. and Longcore, J.E. 2001. Oral Chytridiomycosis in the Mountain Yellow-legged Frog (*Rana muscosa*), Copeia 4: 945 - 953.

[Hero, Jean-Marc & Clare Morrison., 2004. Frog declines in Australia Global implications. Herpetological Journal Vol. 14, pp. 175-186 \(2004\)](#)

**Summary:** Available from:

<http://www.griffith.edu.au/school/asc/ppages/academic/jmhero/EndgFrogs/docs/Hero%20&%20Morrison%202004.pdf> [Accessed 14 September 2005]

[IUCN, Conservation International, and NatureServe. 2006. Global Amphibian Assessment. Downloaded on 4 May 2006.](#)

**Summary:** The Global Amphibian Assessment (GAA) is the first-ever comprehensive assessment of the conservation status of the world's 5,918 known species of frogs, toads, salamanders, and caecilians. This website presents results of the assessments, including IUCN Red List threat category, range map, ecology information, and other data for every amphibian species.

Available from: <http://www.globalamphibians.org/> [Accessed 5 November 2006].

[Johnson, Pieter.T.J., 2006. Amphibian diversity: Decimation by disease. Published online before print February 21, 2006, 10.1073/pnas.0600293103](#)

**Summary:** Available from: <http://www.pnas.org/cgi/content/full/103/9/3011> [Accessed 14 August 2006]

[Kingsley D. Environment News, 23 April 2002.](#)

**Summary:** This article gives details about the first reports of chytrid fungus in Archey's frog.

Available from: [http://www.abc.net.au/science/news/enviro/EnviroRePublish\\_537533.htm](http://www.abc.net.au/science/news/enviro/EnviroRePublish_537533.htm) [Accessed 17 December 2004]

[Lips, Karen.R, Forrest Brem, Roberto Brenes, John D. Reeve, Ross A. Alford, Jamie Voyles, Cynthia Carey, Lauren Livo, Allan P. Pessier, and James P. Collins., 2006. Emerging infectious disease and the loss of biodiversity in a Neotropical amphibian community. Published online before print February 15, 2006, 10.1073/pnas.0506889103](#)

**Summary:** Available from: <http://www.pnas.org/cgi/content/full/103/9/3165> [Accessed 14 August 2006] Available from:

<http://www.pnas.org/cgi/content/full/103/9/3165> [Accessed 14 August 2006]

Lips, K.R., Green, D.E. and Papendick, R. 2003. Chytridiomycosis in Wild Frogs from Southern Costa Rica, Journal of Herpetology 37 (1): 215 - 218.

Lips, K.R., Mendelson, J.R. Munoz-Alonso, A., Canseco-Marquez, L. and Mulcahy, D.G. 2004. Amphibian Population Declines in Montane Southern Mexico: Surveys of Historical Localities, Biological Conservation 119 (4): 555 - 564.

Morehouse, E.A., James, T.Y., Ganley, A.R.D., Vilgalys, R., Berger, L., Murphy, P.J. and Longcore, J.E. 2003. Multilocus Sequence Typing Suggests the Chytrid Pathogen of Amphibians is a Recently Emerged Clone, Molecular Ecology 12 (2): 395 - 403.

Muths, E., Corn, P.S., Pessier, A.P. and Green, D.E. 2003. Evidence for Disease-related Amphibian Decline in Colorado, Biological Conservation 110 (3): 357 - 365.

Mutschmann, F., Berger, L., Zwart, P. and Gaedicke, C. 2000. Chytridiomycosis in Amphibians: First Report in Europe, Berl Munch Tierarztl Wochenschr 113 (10): 380 ◆ 383. (Abstract)

[Norman, R. Undated. Chytrid fungus disease in New Zealand. Massey University Institute of Veterinary, Animal and Biomedical Sciences.](#)

**Summary:** Article outlining the first case of chytrid fungus in New Zealand.

Available from: <http://wildlife.massey.ac.nz/research/chytrid/chytrid1.asp> [Accessed 17 December 2004]

Parris, M. J. 2004. Hybrid response to pathogen infection in interspecific crosses between two amphibian species (Anura: Ranidae). Evolutionary Ecology Research 6: 457-471.

**Summary:** *B. dendrobatidis* differentially affects genotypes between two species of hybridizing leopard frogs (*Rana*). Hybrid genotypes are more susceptible to infection, and suffer greater reductions in growth and development from the fungus.

Parris, M.J. and Beaudoin, J.G. 2004. Chytridiomycosis Impacts Predator-prey Interactions in Larval Amphibian Communities, Oecologia (Berlin) 140 (4): 626 - 632.

**Summary:** *B. dendrobatidis* alters the outcome of natural predator-prey dynamics in a larval amphibian-predator system.

Parris, M. J. and D. R. Baud. 2004. Interactive effects of a heavy metal and chytridiomycosis on gray treefrog larvae (*Hyla chrysoscelis*). Copeia 2004: 343-349.

**Summary:** *B. dendrobatidis* impacts on *Hyla* larvae may be somewhat ameliorated in a heavy metal (Cu) aquatic environment. Thus, pathogenic effects may be a result of interactions with other aquatic contaminants.

Parris, M. J. and T. O. Cornelius. 2004. Fungal pathogen causes competitive and developmental stress in larval amphibian communities. *Ecology* 85: 3385-3395.

**Summary:** This paper documents that *B. dendrobatidis* induces competitive effects in the larval environment between a toad (*Bufo*) and treefrog (*Hyla*) species.

Rollins-Smith, L.A., Carey, C., Longcore, J., Doersam, J.K., Boutte, A., Bruzgal, J.E., and Conlon, J.M. 2002. Activity of antimicrobial skin peptides from ranid frogs against *Batrachochytrium dendrobatidis*, the chytrid fungus associated with global amphibian declines. *Developmental and Comparative Immunology*. 26 (5): 471-479.

**Summary:** This paper outlines the role of antimicrobial peptides in deterring chytrid infection.

[Speare R, Berger L. Chytridiomycosis in amphibians in Australia.](#)

**Summary:** Available from: <http://www.jcu.edu.au/school/phtm/PHTM/frogs/chyspec.htm>. [Accessed 9 October 2000].

[USGS \(U.S. Geological Survey\). 2000. Research Project: Review and Classification of Visitor Impacts to Wildlife Research Methods. U.S. Department of the Interior: Patuxent Wildlife Research Center.](#)

**Summary:** Available from: <http://www.pwrc.usgs.gov/research/sis2000/longco07.htm> [Accessed 7 Dec 2004]

Voyles, Jamie., Sam Young, Lee Berger, Craig Campbell, Wyatt F. Voyles, Anuwat Dinudom, David Cook, Rebecca Webb, Ross A. Alford, Lee F. Skerratt, Rick Speare. 2009. Pathogenesis of Chytridiomycosis, a Cause of Catastrophic Amphibian Declines. *Science*, Vol. 326 No. 5952, October 23, 2009.

**Summary:** The pathogen *Batrachochytrium dendrobatidis* (Bd), which causes the skin disease chytridiomycosis, is one of the few highly virulent fungi in vertebrates and has been implicated in worldwide amphibian declines. However, the mechanism by which Bd causes death has not been determined. We show that Bd infection is associated with pathophysiological changes that lead to mortality in green tree frogs (*Litoria caerulea*). In diseased individuals, electrolyte transport across the epidermis was inhibited by >50%, plasma sodium and potassium concentrations were respectively reduced by ~20% and ~50%, and asystolic cardiac arrest resulted in death. Because the skin is critical in maintaining amphibian homeostasis, disruption to cutaneous function may be the mechanism by which Bd produces morbidity and mortality across a wide range of phylogenetically distant amphibian taxa

[Waldman, B., van de Wolfshaar, K.E., Klena, J.D., Andjic, V., Bishop, P., and Norman, R. J. de B. 2001. Chytridiomycosis in New Zealand frogs. Surveillance. 28 \(3\): 9-11.](#)

**Summary:** This article gives details about the first case of chytrid fungus in New Zealand, including possible means of introduction and spread.

Available from: [http://ivabs.massey.ac.nz/centres/wildlife/rschrepts/chytrid/chytrid\\_article.pdf](http://ivabs.massey.ac.nz/centres/wildlife/rschrepts/chytrid/chytrid_article.pdf) [Accessed 17 December 2004]

[Weldon C, du Preez LH, Hyatt AD, Muller R, Speare R. 2004. Origin of the amphibian chytrid fungus. Emerg Infect Dis \[serial on the Internet\]. 2004 Dec.](#)

**Summary:** Available from <http://www.cdc.gov/ncidod/EID/vol10no12/03-0804.htm> [Accessed 14 December 2005]

Woodhams, D.C., Alford, R.A. and Marantelli, G. 2003. Emerging Disease of Amphibians Cured by Elevated Body Temperature, Diseases of Aquatic Organisms 55 (1): 65 - 67.

Young, B.E., Lips, K.R., Reaser, J.K., Ibanez, R., Salas, A.W., Rogelio Cedeno, J., Coloma, L.A., Ron, S., La Marca, E., Meyer, J.R., Munoz, A., Bolanos, F., Chaves, G. and Romo, D. 2001. Population declines and priorities for amphibian conservation in Latin America. *Conservation Biology*. 15 (5): 1213-1223.

**Summary:** A discussion of the factors involved in the population declines of amphibians in Latin America.