



Infection with *Batrachochytrium dendrobatidis* (Bd)

Also known as chytridiomycosis, cutaneous chytridiomycosis and amphibian chytrid fungus

From *Aquatic animal diseases significant to Australia: identification field guide*, 5th edition

Figure 1 Great barred frog (*Mixophyes fasciolatus*) with severe infection with *Batrachochytrium dendrobatidis*



Note: Pieces of shedding skin on the body.

Source: L Berger

Signs of disease

Important: Animals with this disease may show one or more of these signs, but the pathogen may still be present in the absence of any signs.

Disease signs at the farm, tank or pond level are:

- lethargy
- ataxia
- paralysis
- loss of flee response
- loss of righting reflex
- abnormal sitting posture
- tetanic spasms
- nocturnal species emerging during daylight
- burrowing species remaining outside of burrows.

Gross pathological signs are:

- erythema (redness) of the ventral surface
- lesions ranging from no obvious change to sloughing (as small flakes of skin).

Gross changes to the skin may be seen in severe infections. However, these are not specific to the disease.

Microscopic pathological signs are:

- loss of pigmented jaw sheaths and teeth rows in tadpoles' mouthparts
- zoosporangia in the outer epidermal layers that are seen on fresh pieces of shed skin and in histological sections
- hyperkeratosis of the epidermis in areas where zoosporangia occur.

Disease agent

Chytridiomycosis is caused by infection with the parasitic chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), of the class Chytridiomycota, order Rhizophydiales. Recent evidence suggests that *B. dendrobatidis* originated in Southeast Asia and was spread worldwide through international trade of amphibians.

Host range

Most, if not all, amphibians appear to be susceptible to infection with *B. dendrobatidis*. This includes all members of the orders Anura (frogs and toads), Caudata (including salamanders, newts and sirens) and Gymnophiona (caecilians). Amphibian species differ in degree of susceptibility; some are naturally resistant, while others are extremely susceptible with *B. dendrobatidis* infection, greatly increasing extinction risk in some isolated populations. In Australia, *B. dendrobatidis* has been directly implicated in the extinction of at least four native frog species and the decline of many others.

Table 1 Species known to be susceptible to *Batrachochytrium dendrobatidis*

Common name	Scientific name
Caecilians	Order Gymnophiona
Frogs and toads	Order Anura
Bumpy rocket frog	<i>Litoria inermis</i>
Cane toad	<i>Bufo marinus</i>
Great barred frog	<i>Mixophyes fasciolatus</i>
Green tree frog	<i>Litoria caerulea</i>
Magnificent tree frog	<i>Litoria splendida</i>
Ornate burrowing frog	<i>Limnodynastes ornatus</i>
Ornate nursery frog	<i>Cophixalus ornatus</i>
Red tree frog	<i>Litoria rubella</i>
Red-backed toadlet	<i>Pseudophryne coriacea</i>
Sharp-snouted day frog	<i>Taudactylus acutirostris</i>

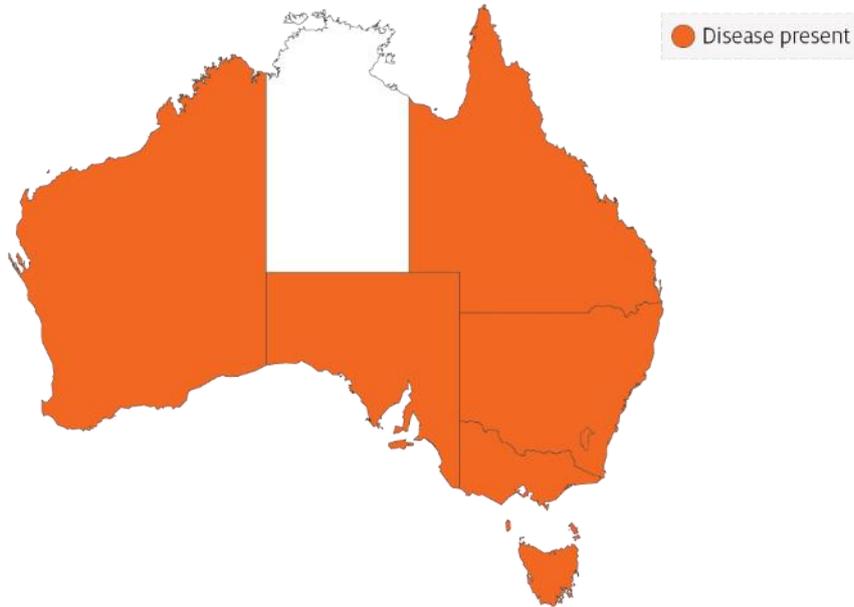
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Common name	Scientific name
Short-footed frog	<i>Cyclorana brevipes</i>
Striped burrowing frog	<i>Cyclorana alboguttata</i>
Salamanders newts and sirens	Order Caudata
Alpine newt	<i>Ichthyosaura alpestris</i>
Blue tailed fire belly newt	<i>Cynops cyanurus</i>
Chiang Mai crocodile newt	<i>Tylototriton uyenoii</i>
Chinese firebelly newt	<i>Cynops orientalis</i>
Clouded salamander	<i>Hynobius nebulosus</i>
Eastern newt	<i>Notophthalmus viridescens</i>
European cave salamander	<i>Speleomantes</i> spp.
Fire salamander	<i>Salamandra salamandra</i>
French cave salamander	<i>Hydromantes strinatii</i>
Italian newt	<i>Lissotriton italicus</i>
Japanese clawed salamander	<i>Onychodactylus japonicas</i>
Japanese fire belly newt	<i>Cynops pyrrhogaster</i>
Lesser siren	<i>Siren intermedia</i>
North African fire salamander	<i>Salamandra algira</i>
Northern crested newt	<i>Triturus cristatus</i>
Northern spectacled salamander	<i>Salamandrina perspicillata</i>
Rough skinned newt	<i>Taricha granulosa</i>
Sardinian brook salamander	<i>Euproctus platycephalus</i>
Siberian salamander	<i>Salamandrella keyserlingii</i>
Smooth newt	<i>Lissotriton vulgaris</i>
Spanish ribbed newt	<i>Pleurodeles waltl</i>
Sword tailed newt	<i>Cynops ensicauda</i>
Vietnamese crocodile newt	<i>Tylototriton vietnamensis</i>
Vietnamese salamander	<i>Paramesotriton deloustali</i>
Wenxian knobby newt	<i>Tylototriton wenxianensis</i>
Yellow spotted newt	<i>Neurergus crocatus</i>
Zeiglers crocodile newt	<i>Tylototriton zieglerei</i>

Presence in Australia

Infection with *B. dendrobatidis* has been officially reported across Australia in Queensland, New South Wales, the Australian Capital Territory, Victoria, South Australia, Tasmania and Western Australia. It does not occur in arid inland areas.

Map 1 Presence of *Batrachochytrium dendrobatidis*, by jurisdiction



Epidemiology

- All age classes, except eggs, are known to be susceptible to infection. Mortality has only rarely been reported in tadpoles.
- *Batrachochytrium dendrobatidis* infects only keratinised tissues (skin of metamorphosed amphibians or the mouthparts of tadpoles). In contrast, *B. salamandrivorans* in salamanders infects only epidermal tissues, causing ulceration.
- Incubation times vary from about 14 to more than 70 days, with mortalities usually occurring within 2 to 3 days of the first clinical signs. Mortalities have approached 100% in some Australian amphibians.
- Horizontal transmission is via waterborne, motile zoospores and is likely to be by direct animal-to-animal contact. Vertical transmission via eggs has not been demonstrated.
- Outbreaks may be associated with seasons (cooler months), altitude (most declines are generally restricted to high-altitude populations) and breeding habitat.
- Temperature affects the survival and growth of *B. dendrobatidis*, maximum growth occurring between 17°C and 25°C. The sporangia die in temperatures of 32°C or higher. The pathogen can persist in very low host densities.
- Large-scale mortality of newly metamorphosed amphibians may indicate infection, as some species appear to be most susceptible at this time.

Differential diagnosis

The list of [similar diseases](#) in the next section refers only to the diseases covered by this field guide. Gross pathological signs may also be representative of diseases not included in this guide. Do not rely on gross signs to provide a definitive diagnosis. Use them as a tool to help identify the listed diseases that most closely account for the observed signs.

Similar diseases

Infection with *Batrachochytrium salamandrivorans*.

Sample collection

Only trained personnel should collect samples. Using only gross pathological signs to differentiate between diseases is not reliable, and some aquatic animal disease agents pose a risk to humans. If you are not appropriately trained, phone your state or territory hotline number and report your observations. If you have to collect samples, the agency taking your call will advise you on the appropriate course of action. Local or district fisheries or veterinary authorities may also advise on sampling.

Emergency disease hotline

See something you think is this disease? Report it. Even if you're not sure.

Call the Emergency Animal Disease Watch Hotline on **1800 675 888**. They will refer you to the right state or territory agency.

Further reading

Department of the Environment and Energy [Infection of amphibians with chytrid fungus resulting in chytridiomycosis \(2016\)](#)

Imperial College London [Global Bd mapping project](#)

World Organisation for Animal Health [Manual of Diagnostic Tests for Aquatic Animals](#)

These hyperlinks were correct at the time of publication.

Contact details

Emergency Animal Disease Watch Hotline 1800 675 888

Email AAH@agriculture.gov.au

Website agriculture.gov.au/pests-diseases-weeds/aquatic

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