

7. Disease and Mortality

7.1. Disease

In the last decade amphibian diseases have received a great deal of scientific attention, and public awareness of what might otherwise be an esoteric issue is relatively high. This high profile is due to links to the phenomenon of amphibian global declines (1.4 *Global declines*).

In the UK there are two pathogens of known significance to amphibian conservation:

- *Ranavirus*
- Chytrid fungus

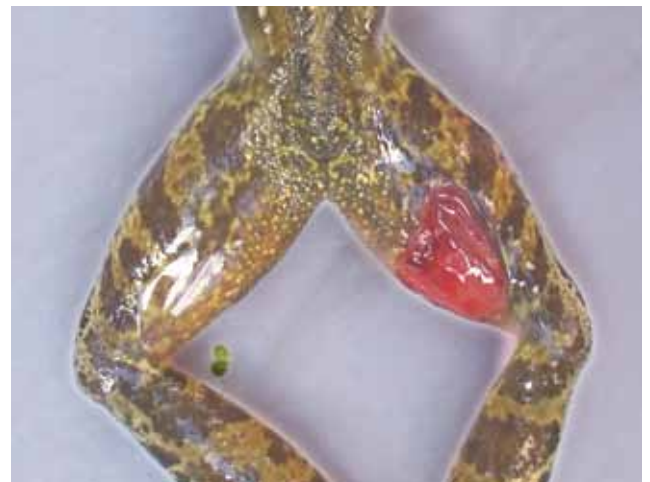
Ranavirus affects mainly common frogs and is found less commonly in other amphibians. It causes two forms of disease in frogs; skin ulcers and internal

bleeding. In the first case ulcers can readily be seen on the skin, especially on the underside of the pelvic region and on the hind limbs and feet, in extreme cases causing loss of digits. Bleeding is sometimes evident from the mouth or cloaca or as a reddening of the underside. The latter symptom led to the name 'red-leg', a term which does not encapsulate the wider range of symptoms associated with *Ranavirus*, which also include lethargy and emaciation. Adult amphibians killed by the virus may also be found dead with no other apparent symptoms.

Ranavirus *Ranavirus* may be a new disease in Britain, possibly spread from North America through the commercial importation of bullfrogs or goldfish (Cunningham *et al.*, 2003). The impacts of *Ranavirus* on frog status nationally are unknown. Individual populations respond differently (Teacher *et al.*, 2010). In some cases mass mortalities are followed by population recovery, in others the disease is recurrent and there can be long-term declines of up to 80% (Teacher *et al.*, 2010).



Symptoms of *Ranavirus*: large ulcer under joint of front leg and emaciation (Amber Teacher)



Symptom of *Ranavirus*: large ulcer on right hand thigh (Amber Teacher)



Symptom of *Ranavirus*: small ulcers under thigh (Amber Teacher)



The reddened underside of this dead frog indicates *Ranavirus*, but red coloration also occurs naturally in female frogs (Jim Foster)

Chytrid Chytridiomycosis is a disease caused by chytrid fungus *Batrachochytrium dendrobatidis*. Chytrid is microscopic and in most cases infection cannot be detected by eye. The fungus lives in amphibian skin that is hardened by keratin (the protein also found in hair, teeth and nails). In frog and toad tadpoles only the mouthparts contain keratin. After metamorphosis the skin becomes more generally keratinised, particularly the undersides and feet, providing chytrid with a greater range of growth substrates.

Symptoms are non-specific i.e. they could also be indicative of other diseases. They include lethargy, reddening of the skin and sometimes ulceration and necrosis of digits (all also symptoms of *Ranavirus*). Chytrid can also cause excessive skin shedding.

Chytrid probably infects amphibians by direct contact between one animal and another and by mobile spores that are released into water. The presence of chytrid disrupts normal skin functions.

Chytrid has been found in all species of native amphibians. A national screening survey carried out in 2008 (Cunningham and Minting, 2008) found chytrid particularly prevalent in natterjack toads and non-native Alpine newts, and often at sites where amphibians had been introduced. Similarly to *Ranavirus*, the impacts of chytrid on amphibians nationally are unknown. Natterjacks appear able to tolerate low fungal loads. However, heavy infection appears to have increased mortality rate in at least one population.

There are no cures to treat wild populations of amphibians infected with either *Ranavirus* or chytrid. The impacts of these diseases on national population status are not yet understood. There are however good reasons to adopt a precautionary approach to the potential spread of amphibian disease:

- *Ranavirus* has had a substantial impact on some infected populations in Britain.
- Chytrid has had devastating impacts on various amphibian species around the world.
- *Ranavirus* has been listed as a notifiable disease by the OIE (World Organisation for Animal Health), making control measures a legal requirement.

Guidelines for amphibian field workers have been produced to minimise the risk of transmission of amphibian disease (ARG UK, 2008). These guidelines are likely to be reviewed as more is learned about amphibian disease. In practice if disease is present at a particular site then amphibian migration between local ponds is likely to transfer disease anyway, making within-site control measures redundant. In general, though, the following precautions are advised:

- Avoid moving animals or other materials between different pond locations.
- Sterilise survey equipment before moving between sites.

7.2. Other diseases and causes of mortality

Amphibians can be affected by other diseases which may not necessarily be fatal. For example, amphibians may be infected by a protozoan, *Amphibiocystidium*, resulting in lumps on the skin. As with other amphibian diseases, there is no practical cure. Fortunately, *Amphibiocystidium*, infection is not always fatal.

Most diseases are a natural part of the amphibians' environment. Healthy amphibians within genetically diverse populations are more likely to be able to withstand infections than individuals that have disease resistance reduced by environmental stress, or those from genetically impoverished populations. Hence, habitat management may have an important role to play in combating disease, by providing high quality environments that allow gene flow between local populations.

Disease is not the only cause of amphibian mortalities. Dead amphibians, sometimes in large numbers, can also be the result of:

- Winterkill
- Breeding associated mortality
- Predation

7.3. Winterkill

Some amphibians, especially common frogs, spend the winter hibernating in ponds. Usually they can survive beneath the ice of frozen ponds. During prolonged cold spells, however, they may die, possibly due to lack of oxygen or perhaps due to the toxic effects of gases produced by decomposing organic material. Bodies of dead frogs are most often noticed in garden ponds following a thaw after prolonged freezing. Typically, frogs that have died this way are grey and bloated.



Frogs may die under the ice on ponds during prolonged freezing periods (Jim Foster)

In the past garden pond owners have been encouraged to maintain holes in the ice of frozen ponds to allow exchange of gases with the air. This was thought to help maintain oxygen levels in the pond and to avoid any possible build-up of gases that may be harmful to amphibians. The effectiveness of this strategy has not been tested. In fact, oxygen levels may not be depleted under ice as long as sunlight reaches the pond allowing plants or algae to release oxygen into the water (through photosynthesis).

The effectiveness of maintained holes in allowing escape of noxious gases has not been thoroughly evaluated.

To minimise the risk of winterkill, snow should be swept from the pond surface to allow in sunlight. Maintaining a hole in the ice is a precautionary measure that may release noxious gases.

7.4. Breeding associated mortality

Common frogs and common toads breed shortly after emergence from hibernation and, in some cases, after a lengthy migration to water. Breeding activity is physically demanding. Frogs and toads do not feed during the breeding period which is undertaken after months with little or no food. It is perhaps not surprising then that some individuals die during the breeding period. These may be females asphyxiated by mating males or perhaps individuals that have died simply through exhaustion.

7.5. Predation

Many predatory birds and mammals kill and eat all or parts of amphibians. Predators may exploit the seasonal abundance of prey when amphibians are present in breeding ponds. Piles of dead amphibians can sometimes be found around breeding ponds, perhaps remains left at a feeding location, or bodies stored by a predator for later consumption



Footprints around these dead toads are signs of predation by rats (Duncan Sweeting)

7.6. Literature

ARG UK (2008). ARG Advice Note 4. Amphibian disease precautions: a guide for UK fieldworkers. [Amphibian and Reptile Groups of the UK.](#)

Cunningham, A.A. and Minting, P. (undated). National survey of *Batrachochytrium dendrobatidis* infection in UK amphibians, 2008. Final report. Institute of Zoology.

Duffus, A.L.J. and Cunningham, A.A. (2010). Major disease threats to European amphibians. *The Herpetological Journal* 20, 117-127.

Teacher, A.G.F., Cunningham, A.A. and Garner, T.W.J. (2010). Assessing the long-term impact of *Ranavirus* infection in wild common frog populations. *Animal Conservation* 13, 514-522.