# Ranavirus Disease

## Agent

There are several different types of ranavirus. Some are more host-specific than others (*i.e.* some infect only one type or species of animal, while others can infect multiple species or types of animal). Different species of amphibian differ in their susceptibility to ranavirus infection and/or ranavirus disease. Just one type of ranavirus is known to be present in Great Britain, and this is thought to have been introduced from North America in the 1980s.

## Species affected

All species of amphibian in Great Britain are considered to be susceptible to ranavirus infection, but the common frog (*Rana temporaria*) and the common toad (*Bufo bufo*) are most frequently reported with the disease. Tadpoles, metamorphs and adult animals are susceptible. In Great Britain, adult amphibians appear to be most commonly affected. Ranaviruses that infect amphibians often can also infect fish and reptiles.

## Signs of disease

Ranavirus disease outbreaks can vary from numerous dead amphibians visible in, and surrounding, water bodies to individual sick animals seen. Affected adult amphibians may have reddening of the skin, skin ulceration, bloody mucus in the mouth and might pass blood from the rectum; often there is internal bleeding (which is detected on post-mortem examination). Often, large numbers of dead animals are found with no evidence of disease, but these animals invariably have died of internal bleeding. Individual sick animals usually are lethargic and have skin ulceration or loss of digits (fingers and toes), which sometimes progresses to loss of entire feet (Figure 1).

**Figure 1. Common frog (*R. temporaria*) with ranavirus disease showing skin ulceration and loss of digits. (Photo credit: Zoological Society of London.)**

Diseased larval amphibians often have swollen bodies and signs of internal bleeding, such as red patches in the tail or body. Death in susceptible amphibians can occur within a few days following infection or may take several weeks.

Many of the signs of ranavirus disease are typical of a disease syndrome which is commonly called “red leg”. Ranaviruses are not the only possible cause of “red leg” in amphibians and other possible causes, such as bacterial infection or normal variation in skin colouration, should be borne in mind.

Whilst ranavirus disease can occur at any time of year when amphibians are active, most outbreaks occur during the warmer summer months.

Although suspected in other species (such as the common toad), the negative effect of ranavirus infection at a population level has only been demonstrated in common frogs. Ranavirus disease has been shown to cause marked declines, and in some cases local extinctions, of common frog populations at infected sites since the 1990s.

## Disease transmission

Ranaviruses are highly infectious and are capable of surviving for extended periods of time in the environment, even in dried material. Ranavirus can persist in the aquatic environment outside a host for more than two months. Transmission between individuals occurs by indirect and direct routes, and includes exposure to contaminated water or soil, contact with infected individuals, and ingestion of infected tissue.

The spread of ranaviruses into an area will most probably happen by the movement of infected animals, contaminated water or water plants, or via contaminated equipment, such as boots and fishing nets.

## Distribution and origin

Ranavirus disease is known to occur in many parts of the world, including North America, Australia and Europe. In Great Britain, we initially discovered the disease in southern and south east England in the early 1990s. Since then, scientists at the Zoological Society of London and Froglife have continued to investigate the emergence and spread of amphibian ranavirus disease in Great Britain and a recent map of its distribution is shown in Figure 2.

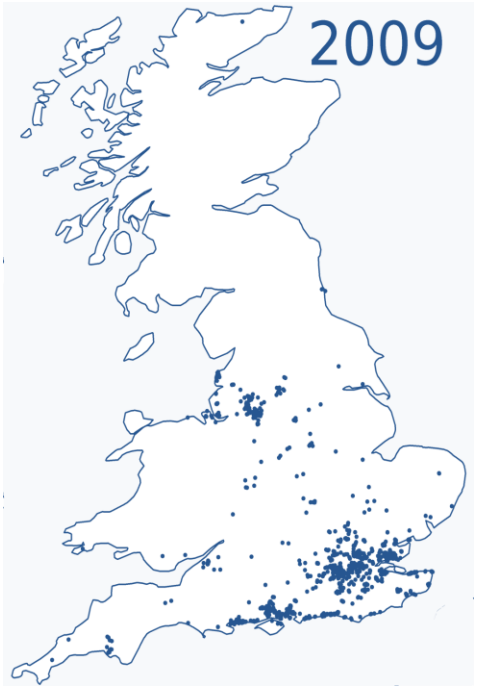


**Figure 2. Map of confirmed ranavirus incidents in Great Britain in 2009 (Credit: Zoological Society of London).**

## Risk to human health

No known risk to human health.

## Risk to domestic animal health

Ranaviruses that infect amphibians often can also infect fish and reptiles. The strain of ranavirus that is known to infect amphibians in Great Britain is also known to cause lethal disease in pet tortoises (*Testudo* spp.). It is possible that the virus can cause disease in a variety of fish species, although this has not yet been confirmed in the wild.

## Diagnosis

While there are several characteristic features of ranavirus disease in amphibians, none of them are specific to ranavirus. Additionally, amphibians may die of ranavirus infection without any observable signs of disease. This means that the diagnosis of ranavirus disease can only be made following post-mortem examination with additional specialist laboratory testing.

If you wish to report finding a dead amphibian, or signs of disease in amphibians, please visit www.gardenwildlifehealth.org. Alternatively, if you have further queries or have no internet access, please call the **Garden Wildlife Health** vets on **0207 449 6685**.

## Prevention and control

There are no effective measures known for the treatment or control of ranavirus disease. During an outbreak the chances of animals becoming infected should be reduced by removing dead amphibians as soon as possible; the

preferred method of disposal being burial as this prevents other animals coming into contact with infected carcasses.

The chances of introducing ranavirus disease to a new site can be minimised by avoiding the introduction of potentially-infected material (spawn, tadpoles, amphibians, water or water plants) to new sites and by cleaning and disinfecting boots and equipment that might be used in different ponds or other water bodies.

## Further reading

European Association of Zoo and Wildlife Veterinarians (EAZWV) Transmissible disease fact sheet: ranavirus infection in amphibians. www.eaza.net/activities/tdfactsheets/050%20Ranavirus%20Infection%20In%20Amphibians.doc.pdf.

Speare, R. (2003) Summary of formidable infectious diseases of amphibians. www.jcu.edu.au/school/phtm/PHTM/frogs/formidable.htm.

World Organisation for Animal Health (OIE) Disease card: infection with ranavirus. http://www.oie.int/fileadmin/Home/eng/Internationa_Standard_Setting/docs/pdf/Ranavirus_card_final.pdf.

World Organisation for Animal Health (OIE) Diagnostic manual for aquatic animal diseases. http://www.oie.int/doc/ged/D9568.PDF.

World Organisation for Animal Health (OIE) reference laboratories and collaborating centres for diseases of amphibians, crustaceans, fish and molluscs: http://www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/3_LIST_OF_LABS.pdf.

## Scientific publications


Hyatt, A.D., Gould, A.R., Zupanovic, Z., Cunningham, A.A., Hengstberger, S., Whittington, R.J. and Coupar, B.E.H. (2000) Characterisation of piscine and amphibian iridoviruses. *Archives of Virology* **145**: 301-331. pmid:10752555.

Daszak, P, Cunningham, A. A. and Hyatt, A. D. (2003) Infectious disease and amphibian population declines, *Diversity and Distributions* **9(2)**: 141–150. doi: 10.1046/j.1472-4642.2003.00016.x.

Pearman, P.B. and Garner, T.W.J. (2005) Susceptibility of Italian Agile Frog populations to an emerging Ranavirus parallels population genetic diversity. *Ecology Letters* **8:** 401-408. doi:10.1111/j.1461-0248.2005.00735.x.

Duffus, A.L.J., Pauli, B.D., Wozney, K., Brunetti, C.R. and Berrill, M. (2008) Frog virus 3-like infections in aquatic amphibian communities. *Journal of Wildlife Diseases* **44**: 109-120. pmid:18263826.

St-Amour, V., Wong, W.M., Garner, T.W.J. and Lesbarrères, D. (2008) Anthropogenic influence on the prevalence of two amphibian pathogens. *Emerging Infectious Diseases* **14:** 1175-1176. doi:10.3201/eid1407.070602.

Teacher, A.G.F., Garner, T.W.J. and Nichols, R.A. (2009) Evidence for directional selection at a novel Major Histocompatability Class 1 marker in wild common frogs (*Rana temporaria*) exposed to a viral pathogen. *PLoS ONE* **4**: E4616. doi:10.1371/journal.pone.00046160.

Teacher, A.G.F., Garner, T.W.J. and Nichols, R.A. (2009) Population genetic patterns suggest a behavioural change in wild common frogs (*Rana temporaria*) following disease outbreaks (Ranavirus). *Molecular Ecology* **18**: 3163-3172. doi:10.1111/j.1365-294X.2009.04263.x.

Duffus, A.L.J. and Cunningham, A.A. (2010) Major disease threats to European amphibians, The *Herpetological Journal* **20(3)**: 117-127.

Robert, J. (2010) Emerging ranaviral infectious diseases and amphibian decline. *Diversity* **2(3)**: 314–330. doi:10.3390/d2030314.

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. doi:10.1111/j.1469-1795.2010.00373.x.