

Epizootic ulcerative syndrome (EUS)



Freshwater and estuarine wetlands supporting susceptible animals

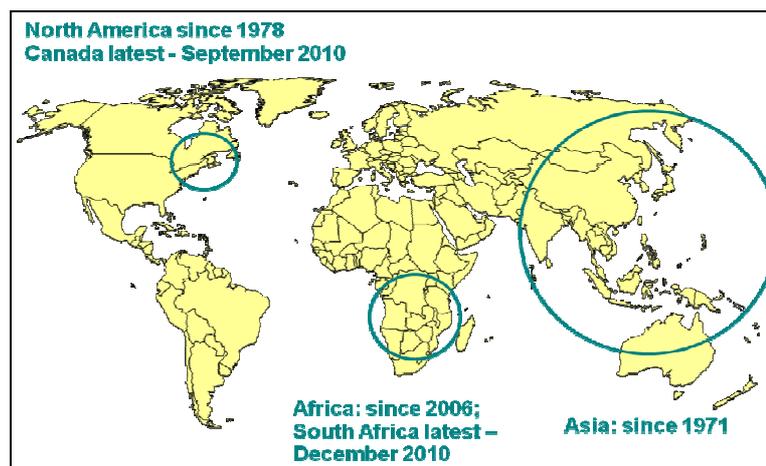
Wildlife ✓
Aquaculture ✓
Human ✗



Synonyms: Epizootic granulomatous aphanomycosis (EGA), mycotic granulomatosis (MG), ulcerative aphanomycosis (UA), ulcerative mycosis (UM), red spot disease (RSD)

KEY FACTS

- What is EUS?** Epizootic ulcerative syndrome (EUS) is an infection caused by an oomycete (or water mould) – a fungus-like microorganism associated with seasonal epidemic conditions affecting wild and farmed freshwater and estuarine fish.
- Causal agent** The lesions in EUS-affected tissues are caused by the oomycete *Aphanomyces invadans* or *A. piscicida*. Parasites and rhabdoviruses have also been associated with specific outbreaks and secondary bacteria invariably infect EUS lesions.
- Species affected** Farmed and wild fish are affected worldwide, with infection confirmed in almost 80 finfish species, e.g. barbs, breams, catfish, gouramy, eel, mullet, pike, tigerfish, tilapias, seabass and snakehead. The range of susceptible species is very broad, thus many more species of fish are likely to be susceptible.
- Some fish species, such as common carp *Cyprinus carpio* and Nile tilapia *Oreochromis niloticus*, have been reported not to develop clinical disease during outbreaks in other species. However, experimental studies demonstrate susceptibility so their potential role in spreading the disease is currently unclear.
- Geographic distribution** EUS is a notifiable OIE-listed disease and now has a worldwide distribution. It was first reported in Japan in 1971, followed by subsequent confirmed reports from Australia (1972), the USA (1978), south and south east Asia (1986), southern Africa (2007) and Canada (2010). EUS now affects 25 countries in four continents: Africa, Asia, Oceania and North America.



Geographic distribution of EUS.

- Environment** Any freshwater or estuarine habitats supporting susceptible species. The causative oomycete grows best at 20–30°C. Water salinity over two parts per thousand (ppt) can stop the spread of the agent.

TRANSMISSION AND SPREAD

Vector(s) No data are available. However, it is possible that fish-eating birds can spread EUS.

How is the disease transmitted to animals? EUS is transmitted horizontally from one fish to another. It is believed that only the zoospores are capable of attaching to damaged skin of fish and germinating into hyphae. If the zoospores cannot find susceptible species or encounter unfavourable conditions, they can encyst in the water or pond environment waiting for conditions that favour the activation of the spores.

Conditions which favour EUS occurrence include periods of lower temperatures (low for tropical climes, *e.g.* 18–22°C) and after heavy rainfall. Sporulation of *A. invadans* occurs under these conditions, whilst low temperatures have been shown to delay the inflammatory response of fish to oomycete infection.

A diverse group of biotic (*e.g.* parasites, bacteria, viruses) and abiotic (*e.g.* acid water) agents/factors are likely involved in initiating skin lesions in freshwater and estuarine fish species which are subsequently colonised by *A. invadans/piscicida*. A specific determinant is unlikely to be associated with EUS outbreaks; most probably, environmental determinants vary from outbreak to outbreak depending on the agent initiating the non-specific lesions, the aquatic environment at the site and the population at risk. EUS outbreaks in wild estuarine populations (*e.g.* Australia and the Philippines) have been reported to be associated with acidified run-off water from acid sulphate soil areas.

For EUS to occur, a combination of factors must ultimately lead to exposure of the skin, attachment to it by *A. invadans/piscicida*, and subsequent invasion by the fungus.

Successful invasion and establishment of EUS in fish requires tissue (epithelial) damage, a susceptible fish species and environmental conditions which favour sporulation of the oomycete.

How does the disease spread between groups of animals? The disease occurs only among finfish. The spread from wild to cultured populations or *vice versa* can occur *via* several routes. Freshwater or estuarine fish migrations are thought to provide a potential pathway for pathogen movement. In addition, movements of fish (cross border and domestic) for aquaculture and the ornamental fish trade are proven pathways. In some countries outbreaks occur in wild fish first and then spread to fish ponds. Flooding also causes the spread of EUS (*e.g.* as in Bangladesh and Pakistan). Once an outbreak occurs in rivers/canals, the disease can spread downstream as well as upstream where susceptible fish species exist.

How is the disease transmitted to humans? The agent causing EUS does not pose any human health implications. However, it is recommended not to eat EUS-infected fish unless it is properly and thoroughly cooked.

IDENTIFICATION AND RESPONSE

Field signs EUS outbreaks have been associated with mass mortality of various species of freshwater or estuarine fish in the wild (*e.g.* in rice-fields, estuaries, lakes and rivers) and in farms often during periods of low temperatures (low for tropical climes, *e.g.* 18–22°C), but outbreaks have been observed across a broad temperature range (10–15 to 33°C).

The following abnormal behaviour may be seen: fish swimming near the surface, sinking to the bottom, loss of balance, flashing, cork-screwing or air gulping (for non air-breathers). Other behavioural signs include loss of appetite and darkening of skin. Infected fish may float near the surface of the water yet become hyperactive with a jerky pattern of movement.

Small to large red spots and open dermal ulcerative lesions may be seen.



African catfish *Clarias gariepinus* infected with EUS (FAO).



Straightfin barb *Barbus paludinosus* (FAO).

Recommended action if suspected

EUS is a notifiable disease and suspected cases must be reported immediately to local (nearest fisheries or veterinary authority) and national authorities and the OIE. Guidance concerning collection of samples should be sought.

Take note of simple observations such as:

- abnormal fish behaviour
- date and time of observed outbreaks
- total estimate of mortalities
- species of fish affected and estimate of mortalities per species
- pattern of mortality (small number of fish dying every day, large number of fish dying at one time, etc.)
- any unusual events.

Diagnosis

Presumptive diagnosis of EUS can be based on clinical signs and, in the laboratory, the observation of hyphae in squashed preparations of the muscle underlying gross lesions. EUS can be confirmed (1) when histological sections show the presence of typical lesions in affected tissues or organs; (2) by PCR identification; or (3) by isolation of *A. invadans/piscicida* from infected fish and confirmed by either bioassay, PCR or DNA sequence analysis.

► **Photos at the end of this factsheet.**

PREVENTION AND CONTROL IN WETLANDS

Environment	Control of EUS in natural water bodies is not possible.
Aquaculture	<p>Actions should be directed firstly at prevention of the disease as subsequent control can be very difficult. No protective vaccine or effective drug/chemical treatment are available. The most important biosecurity measure to prevent the introduction onto farms is sourcing fish from safe, uninfected sources only.</p> <p>A number of simple biosecurity measures can minimise or prevent the spread of EUS. These include:</p> <ul style="list-style-type: none">▪ All possible carriers or vectors such as freshly dead fish, birds or terrestrial animals as well as contaminated fishing gear and fish transport containers should be prevented from entering water bodies or fish ponds.▪ In outbreaks occurring in small, closed water bodies, liming of water and improvement of water quality, together with removal of infected fish.▪ Increasing salinity in holding waters may also prevent outbreaks of EUS in aquaculture ponds.▪ During dry and cold seasons (in tropical climes), close observation of wild fish should be made to determine the presence of EUS-diseased fish in neighbouring tanks or canals, in which case, exchange of water should be avoided.▪ EUS-infected fish should not be thrown back to the open waters and should be disposed of properly by burying them in the ground or by incineration.▪ Additional practical aquaculture biosecurity measures include:<ul style="list-style-type: none">- Good farm hygiene (<i>e.g.</i> handwashing between tanks, separation of nets/tanks/stocks, regular and correct disinfection procedures, <i>etc.</i>)- Good husbandry practices- Good water quality management- Proper handling of fish to avoid stress- Regular monitoring of health status- Good record keeping (gross and environmental observations and stocking records including movement records of fish in and out of aquaculture facilities, <i>etc.</i>).▪ Early reporting or notification to concerned authorities of a disease outbreak or suspicion of any abnormal appearance, behaviour or other observations in fish stocks.
Wildlife	The risk of EUS spread can be reduced by ensuring that water or wild fish do not come into contact with fish culture ponds. Contact between fish-eating birds and aquaculture facilities should be minimised to reduce the risk of disease spread from an infected to an uninfected area.
Humans	Do not eat EUS-infected fish unless it is properly and thoroughly cooked.

IMPORTANCE

Effects on wildlife	EUS is one of the most serious aquatic diseases affecting finfish. Indirect long-term effects may include threats to the environment and aquatic biodiversity through, for example, declining fish biomass and irreversible ecological disruption.
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Effects on aquaculture and fisheries

High losses to fish farmers and fishermen through mortalities, market rejection and public health concerns due to the presence of ugly lesions and reduced productivity of all susceptible fish species.

Effects on humans

The agent causing EUS does not have direct human health implications although it is recommended not to eat EUS-infected fish unless it is properly and thoroughly cooked.

► Effects on aquaculture and fisheries and Economic importance

Economic importance

EUS has the potential to financially ruin those who run fish farms and others who rely on fishing for income. In addition, and perhaps more importantly, EUS outbreaks threaten food security for subsistence fishers and fish farmers and subsequently people's physical health, as fish are an important source of animal protein for people in the affected countries.

FURTHER INFORMATION

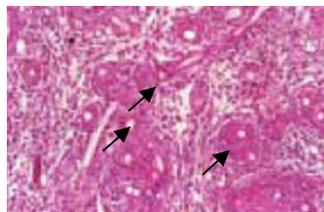
Useful publications and websites

- ☐ World Organisation for Animal Health (OIE). **Chapter 2.3.02: Epizootic ulcerative syndrome.** Manual of diagnostic tests and vaccines for terrestrial animals. www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/2.3.02_EUS.pdf [Accessed March 2012].
- ☐ Food and Agriculture Organization (FAO). **What you need to know about epizootic ulcerative syndrome (EUS) - An extension brochure.** ftp.fao.org/FI/DOCUMENT/aquaculture/aq2008_09/root/i0777e.pdf [Accessed March 2012].
- ☐ Food and Agriculture Organization (FAO). Fisheries technical paper 402/2: **Asia diagnostic guide to aquatic animal diseases.** www.fao.org/docrep/005/y1679e/y1679e00.HTM [Accessed March 2012].
- ☐ Food and Agriculture Organization (FAO). **Report of the International Emergency Disease Investigation Task Force on a serious finfish disease in southern Africa.** 18-26th May 2007. www.fao.org/docrep/012/i0778e/i0778e00.htm [Accessed March 2012].
- ☐ Oidtmann, B. (2012). **Review of biological factors relevant to import risk assessments for epizootic ulcerative syndrome (*Aphanomyces invadans*).** *Transboundary and Emerging Diseases*, 59 (1): 26–39.

Contacts

- ✉ **OIE reference laboratories and collaborating centres for diseases of amphibians, crustaceans, fish and molluscs.** www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/3_LIST_OF_LABS.pdf

Additional photos



Typical severe mycotic granulomas (black arrows) from muscle section of EUS infected fish (FAO).



Typical *Aphanomyces* sporangium (Japanese isolate, FAO).