



Viral encephalopathy and retinopathy (VER)

Also known as viral nervous necrosis (VNN)

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

Figure 1 Darkened colouration in seven-band grouper (*Hyporthodus septemfasciatus*) with VER



Note: Dark groupers are diseased, light fish are normal. Change in colouration is an important indicator for VER (species differ in what colour change occurs; diseased barramundi become lighter).

Source: B Munday

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:

- 50% to 100% cumulative mortality over a period of 48 hours to several weeks
- higher mortalities in larvae and juvenile fish (9 to 28 days old), although older fish (greater than 28 days) may also be affected
- anorexia
- abnormal swimming behaviours, including erratic, uncoordinated darting, spiral and/or looping swim pattern, corkscrew swimming
- fish resting belly-up (loss of equilibrium)

- hyperactivity
- sporadic protrusion of the head from the water.

Gross pathological signs are:

- colour change
 - affected fish may become lighter (such as larval barramundi) or darker (such as larval groupers), depending on the species affected and their environment
- blindness
- abrasions
- emaciation
- over-inflated swim bladder (the only significant internal gross pathological sign).

Microscopic pathological signs are:

- vacuolation of central nervous tissues, including retina
- intracytoplasmic inclusions in brain tissues as crystalline arrays or aggregates.

Disease agent

VER or VNN is a disease caused by a *Betanodavirus*, in the family *Nodaviridae*. In Australia, VER was formerly referred to as barramundi picorna-like virus.

Host range

Table 1 Species known to be susceptible to VER

| Common name | Scientific name |
|------------------------------------|----------------------------------|
| Amberjack ^a | <i>Seriola dumerili</i> |
| Atlantic halibut ^a | <i>Hippoglossus hippoglossus</i> |
| Archer fish | <i>Toxotes chatareus</i> |
| Atlantic salmon ^b | <i>Salmo salar</i> |
| Australian bass ^a | <i>Macquaria novemaculeata</i> |
| Banded archerfish ^a | <i>Toxotes jaculatrix</i> |
| Barcoo grunter | <i>Scortum barcoo</i> |
| Barfin flounder ^a | <i>Verasper moseri</i> |
| Barramundi ^a | <i>Lates calcarifer</i> |
| Brown-marbled grouper ^a | <i>Epinephelus fuscoguttatus</i> |
| Chinese catfish ^a | <i>Silurus asotus</i> |
| Cobia ^a | <i>Rachycentron canadum</i> |
| Convict surgeonfish | <i>Acanthurus triostegus</i> |
| Coral trout | <i>Plectropomus leopardus</i> |
| Crimson snapper ^a | <i>Lutjanus erythropterus</i> |
| Common sole ^a | <i>Solea solea</i> |
| Dusky grouper | <i>Epinephelus marginatus</i> |

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| Common name | Scientific name |
|---|-------------------------------------|
| Eastern freshwater cod ^a | <i>Maccullochella ikei</i> |
| Estuarine rockcod ^a | <i>Epinephelus tauvina</i> |
| Estuary catfish | <i>Cnidoglanis macrocephalus</i> |
| European eel ^a | <i>Anguilla anguilla</i> |
| European seabass ^a | <i>Dicentrarchus labrax</i> |
| Flounders ^a | <i>Paralichthyidae</i> |
| Giant grouper ^a | <i>Epinephelus lanceolatus</i> |
| Gilt-head sea bream ^a | <i>Sparus aurata</i> |
| Golden grey mullet ^a | <i>Chelon auratus</i> |
| Golden perch | <i>Macquaria ambigua</i> |
| Grouper and estuary cod ^a | <i>Epinephelus</i> spp. |
| Haddock ^a | <i>Melanogrammus aeglefinus</i> |
| Humpback grouper ^a | <i>Cromileptes altivelis</i> |
| Japanese flounder ^a | <i>Paralichthys olivaceus</i> |
| Japanese parrotfish ^a | <i>Oplegnathus fasciatus</i> |
| Japanese seabass ^a | <i>Lateolabrax japonicus</i> |
| Japanese tilefish | <i>Branchiostegus japonicus</i> |
| Longtooth grouper ^a | <i>Epinephelus bruneus</i> |
| Luderick | <i>Girella tricuspidata</i> |
| Macquarie perch | <i>Macquaria australasica</i> |
| Malabar grouper ^a | <i>Epinephelus malabaricus</i> |
| Mangrove jack ^a | <i>Lutjanus argentimaculatus</i> |
| Milkfish | <i>Chanos chanos</i> |
| Mulletts ^a | <i>Mugilidae</i> , all species |
| Mulloway | <i>Argyrosomus japonicus</i> |
| Murray cod | <i>Maccullochella peelii peelii</i> |
| Narrowstripe cardinalfish | <i>Pristiapogon exostigma</i> |
| Nile tilapia | <i>Oreochromis niloticus</i> |
| Orange-spotted grouper ^a | <i>Epinephelus coioides</i> |
| Permit ^a | <i>Trachinotus falcatus</i> |
| Red drum ^a | <i>Sciaenops ocellatus</i> |
| Red mullet | <i>Mullus barbatus</i> |
| Red-spotted grouper ^a or Hong Kong grouper | <i>Epinephelus akaara</i> |
| Russian sturgeon ^a | <i>Acipenser gueldenstaedtii</i> |
| Samson fish | <i>Seriola hippos</i> |
| Senegalese sole ^a | <i>Solea senegalensis</i> |
| Seven-band grouper ^a | <i>Hyporthodus septemfasciatus</i> |
| Shi drum ^a | <i>Umbrina cirrosa</i> |

Viral encephalopathy and retinopathy (VER)

| Common name | Scientific name |
|-----------------------------------|--|
| Silver perch | <i>Bidyanus bidyanus</i> |
| Silver trevally ^a | <i>Pseudocaranx dentex</i> |
| Six bar grouper | <i>Epinephelus sexfasciatus</i> |
| Sleepy cod | <i>Oxyeleotris lineolata</i> |
| Snubnose dart ^a | <i>Trachinotus blochii</i> |
| Spotted coral grouper | <i>Plectropomus maculatus</i> |
| Spotted knifejaw ^a | <i>Oplegnathus punctatus</i> |
| Spotted wolffish | <i>Anarhichas minor</i> |
| Striped trumpeter ^a | <i>Latris lineata</i> |
| Thread-sail filefish ^a | <i>Stephanolepis cirrhifer</i> |
| Tiger grouper hybrid | <i>Epinephelus fuscoguttatus</i> × <i>E. lanceolatus</i> |
| Tiger puffer ^a | <i>Takifugu rubripes</i> |
| Tilapias | various genera and species |
| Turbot ^a | <i>Scophthalmus maximus</i> |
| White grouper ^a | <i>Epinephelus aeneus</i> |
| White seabass ^a | <i>Atractoscion nobilis</i> |
| Winter flounder ^a | <i>Pseudopleuronectes americanus</i> |
| Winter whiting | <i>Sillago maculata</i> |
| Yellowfin bream | <i>Acanthopagrus australis</i> |
| Yellowtail kingfish | <i>Seriola lalandi</i> |

a Naturally susceptible. **b** Experimentally susceptible to disease via intraperitoneal injection. Note: Other species have been shown to be experimentally susceptible.

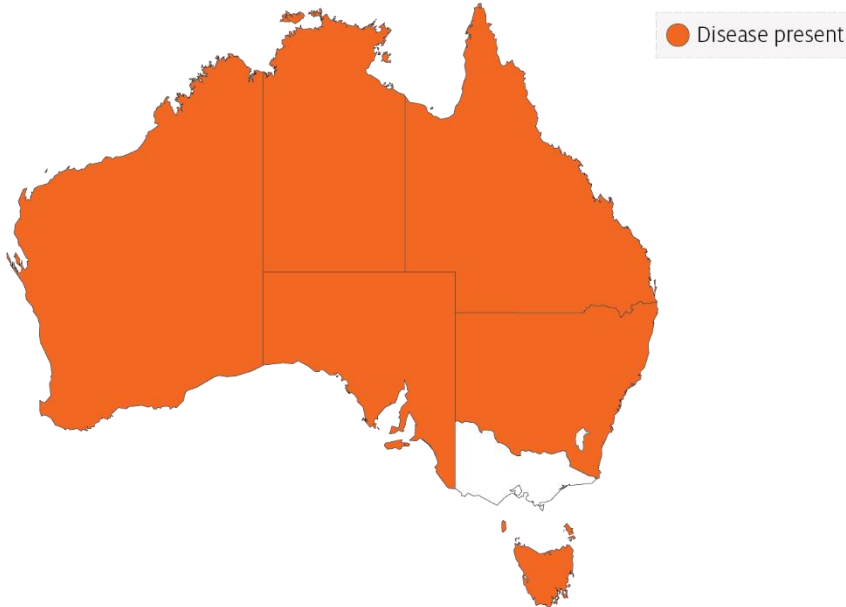
Table 2 Non-fish carriers

| Common name | Scientific name |
|-------------|----------------------------|
| Molluscs | Various genera and species |
| Polychaetes | <i>Nereis</i> spp. |

Presence in Australia

VER has been officially reported from New South Wales, the Northern Territory, Queensland, South Australia, Tasmania and Western Australia. It is primarily reported to affect larvae or fry.

Map 1 Presence of VER, by jurisdiction



Epidemiology

- VER has occurred in at least 70 species of marine fish from 16 families, and has been diagnosed in all inhabited continents.
- Most fish are affected as larvae or juveniles. However, in recent years, mortalities have occurred in older fish up to harvest size, particularly in European seabass, groupers (*Epinephelus* spp.) and Atlantic halibut. Disease incidence in the groupers and seabass has been associated with high water temperatures.
- Susceptibility and mortality are age dependent. Onset of clinical disease in younger fish of some species results in higher mortality.
- Batches of barramundi larvae for aquaculture are now routinely screened for this disease in Australia.
- The incubation period for the disease in barramundi is 4 days, with typical disease onset 9 to 28 days after hatching, rarely occurring in older fish (50 to 60 days old). In silver trevally, disease onset is 1 day after hatching.
- Transmission is believed to occur both horizontally through the water column (via mouth, gills and skin), and vertically (parent to offspring). The rate of transmission may be influenced by stressors, including handling, repeated spawning, high stocking densities, high ambient temperature and virulence of the particular *Betanodavirus* strain. Sand worms of the family *Nereidae*, genus *Nereis*, and bivalves collected in proximity to infected farms have had positive detection of *Betanodavirus*.

- The virus can survive for 1 year in the right environmental conditions (pH 2 to 9 and 15°C) and can persist subclinically in infected live fish. Therefore, fish products and by-products may facilitate the spread of virus to unaffected areas.
- Cumulative mortality at 1 month is typically 50% to 100% in barramundi and 100% in silver trevally. In Australian hatcheries, 100% mortality in less than 3 days in larval fish is typical.

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

Grouper iridoviral disease and Tilapia lake virus (TiLV) disease.

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.

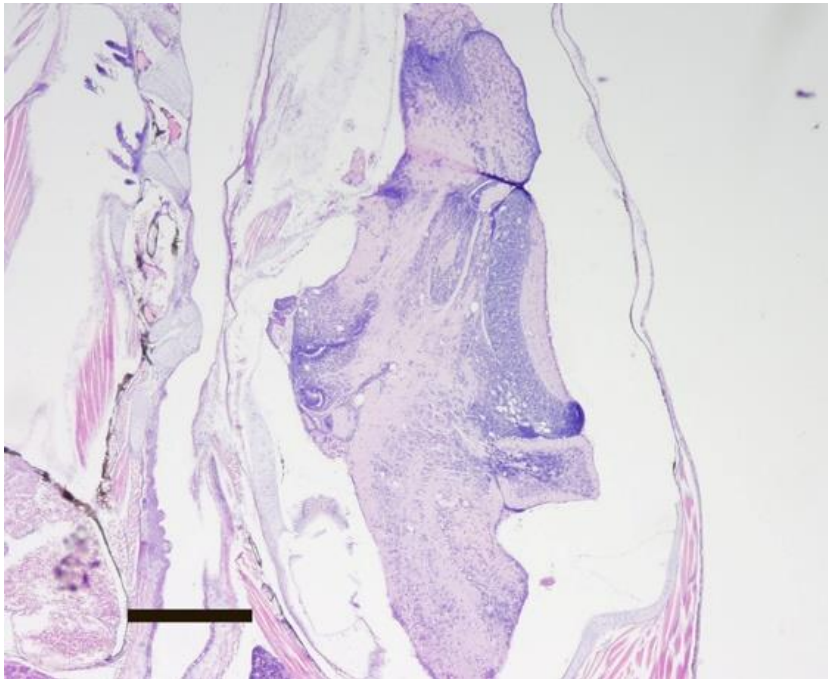
Emergency disease hotline

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.

Microscope images

Figure 2 Transverse histological section through head of larval (20 day old) barramundi (*Lates calcarifer*) with VER



Note: Vacuoles associated with VER infection are readily visible in the brain. Haematoxylin and eosin stain. 20x magnification, scale bar = 300µm

Source: B Jones

Further reading

CEFAS International Database on Aquatic Animal Diseases [Viral Encephalopathy and Retinopathy](#)

Department of Agriculture, Water and the Environment [AQUAVETPLAN disease strategy manual: Viral encephalopathy and retinopathy](#)

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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