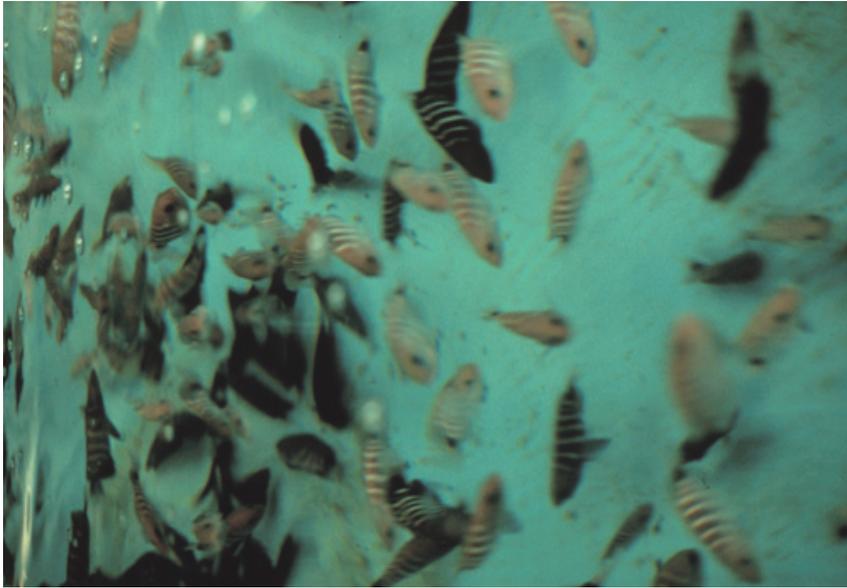


## Viral encephalopathy and retinopathy (Also known as viral nervous necrosis)

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Viral encephalopathy and retinopathy in seven-band grouper (*Epinephelus septemfasciatus*); dark fish are affected, light fish are normal. A change in colouration is an important indicator of disease. Species differ in how they are affected (e.g. barramundi show lighter colouration when affected).

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Source: B Munday

### Signs of disease

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

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

- 50–100% cumulative mortality over a period of 48 hours to several weeks
- higher mortalities in larvae and juvenile fish (9–28 days old) although older fish (>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—larval barramundi become lighter, but groupers become darker
- blindness
- abrasions
- emaciation
- overinflated 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**

Viral encephalopathy and retinopathy (VER) or Viral Nervous Necrosis (VNN) is a disease caused by a *Betanodavirus*, which is in the family *Nodaviridae*. VER was formerly referred to as barramundi picorna-like virus in Australia.

**Host range**

Species known to be susceptible to VER virus are listed below.

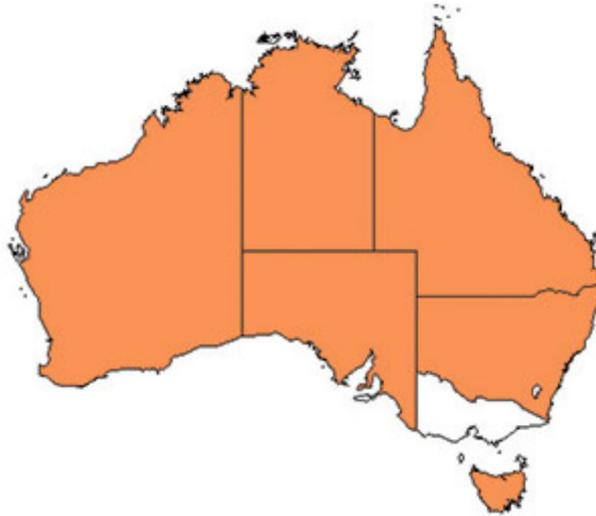
Common name	Scientific name
Atlantic halibut a	<i>Hippoglossus hippoglossus</i>
Atlantic salmon	<i>Salmo salar</i>
Australian bass a	<i>Macquaria novemaculeata</i>
Barcoo grunter	<i>Scortum barcoo</i>
Barfin flounder a	<i>Verasper moseri</i>
Barramundi a	<i>Lates calcarifer</i>
Brown-marbled grouper a	<i>Epinephelus fuscoguttatus</i>
Chinese catfish a	<i>Silurus asotus</i>
Cobia a	<i>Rachycentron canadum</i>
Convict surgeonfish	<i>Acanthurus triostegus</i>
Common sole a	<i>Solea solea</i>
Dusky grouper	<i>Epinephelus marginatus</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>
Gilt-head sea bream a	<i>Sparus aurata</i>
Golden grey mullet a	<i>Liza auratus</i>
Golden perch	<i>Macquaria ambigua</i>
Greater amberjack a	<i>Seriola dumerili</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 tilefish	<i>Branchiostegus japonicus</i>
Japanese parrotfish a	<i>Oplegnathus fasciatus</i>
Japanese seabass a	<i>Lateolabrax japonicus</i>

Common name	Scientific name
Longtooth grouper <b>a</b>	<i>Epinephelus bruneus</i>
Macquarie perch	<i>Macquaria australasica</i>
Malabar grouper <b>a</b>	<i>Epinephelus malabaricus</i>
Mangrove Jack	<i>Lutjanus argentimaculatus</i>
Milkfish	<i>Chanos chanos</i>
Mullet <b>a</b>	<i>Mugil cephalus</i>
Murray cod	<i>Maccullochella peelii peelii</i>
Narrowstripe cardinalfish	<i>Apogon exostigma</i>
Orange-spotted grouper <b>a</b>	<i>Epinephelus coioides</i>
Red drum <b>a</b>	<i>Sciaenops ocellatus</i>
Red mullet	<i>Mullus barbatus</i>
Red snapper	<i>Lutjanus erythropterus</i>
Red-spotted grouper <b>a</b> or	
Hong Kong grouper	<i>Epinephelus akaara</i>
Russian sturgeon <b>a</b>	<i>Acipenser gueldenstaedtii</i>
Samson fish	<i>Seriola hippos</i>
Senegalese sole <b>a</b>	<i>Solea senegalensis</i>
Seven-band grouper <b>a</b>	<i>Epinephelus septemfasciatus</i>
Shi drum <b>a</b>	<i>Umbrina cirrosa</i>
Sleepy cod	<i>Oxyeotris lineolatus</i>
Silver perch	<i>Bidyanus bidyanus</i>
Silver trevally <b>a</b>	<i>Pseudocaranx dentex</i>
Snubnose dart <b>a</b>	<i>Trachinotus blochii</i>
Spotted coral grouper	<i>Plectropomus maculatus</i>
Spotted knifejaw <b>a</b>	<i>Oplegnathus punctatus</i>
Spotted wolffish	<i>Anarhichas minor</i>
Striped trumpeter <b>a</b>	<i>Latris lineata</i>
Thread-sail filefish <b>a</b>	<i>Stephanolepis cirrhifer</i>
Tiger puffer <b>a</b>	<i>Takifugu rubripes</i>
Tilapi <b>a</b>	<i>Oreochromis niloticus</i>
Turbot <b>a</b>	<i>Psetta maxima (also known as Scophthalmus maximus)</i>
White grouper <b>a</b>	<i>Epinephelus aeneus</i>
White seabass <b>a</b>	<i>Atractoscion nobilis</i>
Winter flounder <b>a</b>	<i>Pseudopleuronectes americanus</i>
Yellow-wax pompano <b>a</b>	<i>Trachinotus falcatus</i>

**a** Naturally susceptible (other species have been shown to be experimentally susceptible)

## Presence in Australia

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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.

### Epidemiology

- VER is a disease which has been found in at least 40 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 9–28 days after hatching, rarely occurring in older fish (50–60 days old). In silver trevally, disease onset is 1 day after hatching.
- Transmission is believed to occur horizontally, through the water column (i.e. 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*, collected in proximity to an infected farm have had positive detection of *Betanodavirus*.
- Virus can survive for 1 year in the right environmental conditions (pH 2–9 and 15°C) and can persist subclinically in infected live fish. Therefore, fish products and byproducts may facilitate the spread of virus to unaffected areas.
- Cumulative mortality at 1 month is typically 50–100% in barramundi and 100% in silver trevally. In Australian hatcheries, 100% mortality in <3 days in larvae is typical.

## Differential diagnosis

The list of similar diseases below refers only to the diseases covered by this field guide. Gross pathological signs may be representative of a number of diseases not included in this guide, which therefore should not be used to provide a definitive diagnosis, but rather as a tool to help identify the listed diseases that most closely account for the gross signs.

## Similar diseases

Grouper iridoviral disease

## Sample collection

Due to the uncertainty in differentiating diseases using only gross pathological signs, and because some aquatic animal disease agents might pose a risk to humans, only trained personnel should collect samples. You should phone your state or territory hotline number and report your observations if you are not appropriately trained. If samples have to be collected, the agency taking your call will provide advice on the appropriate course of action. Local or district fisheries or veterinary authorities may also provide advice regarding sampling.

## Emergency disease hotline

The national disease hotline number is 1800 675 888. This number will put you in contact with the appropriate state or territory agency.

## Further reading

Further information can be found at;

Sub-Committee on Animal Health Laboratory Standards (SCAHLs) website at [www.scahls.org.au/procedures/anzsdps2](http://www.scahls.org.au/procedures/anzsdps2)

Centre for Environment, Fisheries and Aquaculture Science (Cefas) International Database on Aquatic Animal Disease (IDAAD) website at [www.cefasc.defra.gov.uk/idaad/disocclist.aspx](http://www.cefasc.defra.gov.uk/idaad/disocclist.aspx).

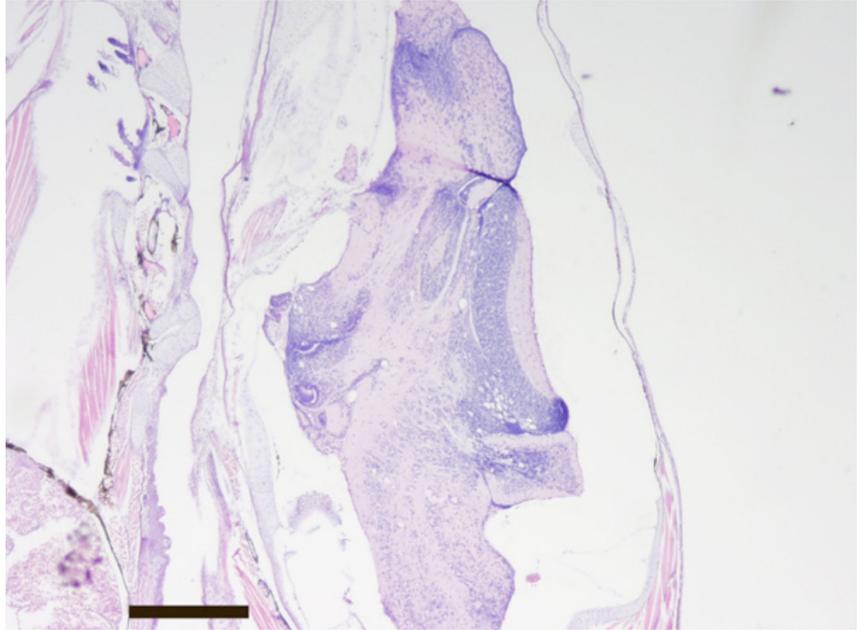
These hyperlinks were correct and functioning at the time of publication.

## Further images

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Barramundi (*Lates calcarifer*) 20 day old juvenile. Transverse section through larval head. Vacuoles associated with VER infection are readily visible in the brain even at 20x magnification. Haematoxylin and Eosin stain. Scale bar = 0.3 mm.

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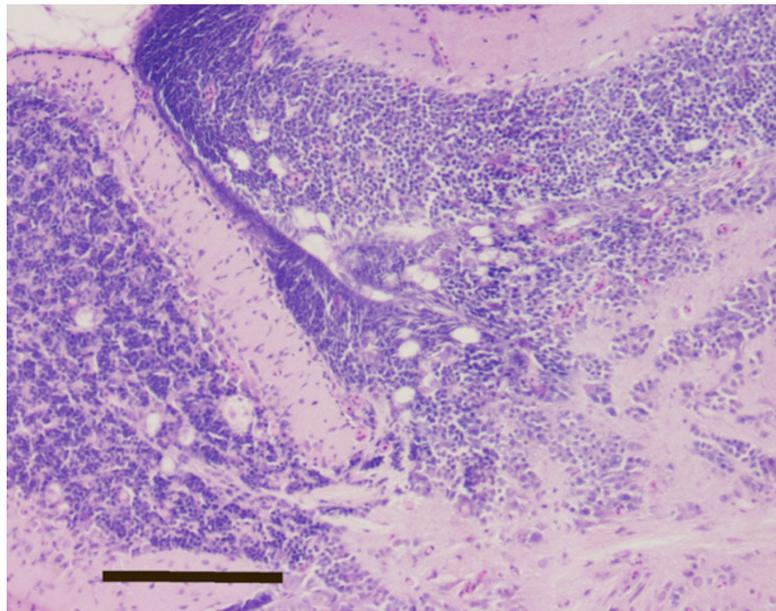


Source: B Jones

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Barramundi (*Lates calcarifer*) 20 day old juvenile. Transverse section through brain. Juncture of optic lobe and mesencephalon. Vacuoles associated with VER infection are readily visible. Haematoxylin and Eosin stain. Scale bar = 0.1 mm.

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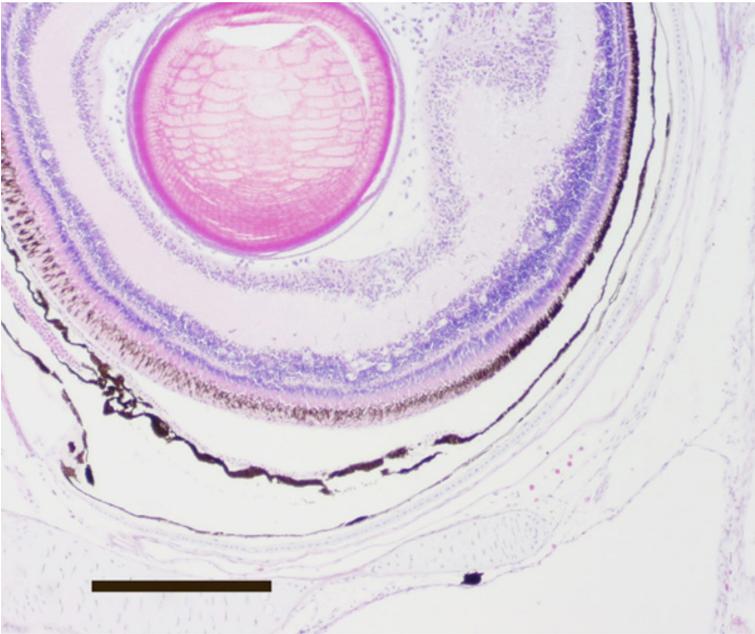


Source: B Jones

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Barramundi (*Lates calcarifer*) 22 day old juvenile. Transverse section through retina. Vacuoles associated with VER infection are visible. Haematoxylin and Eosin stain. Scale bar = 0.2 mm.

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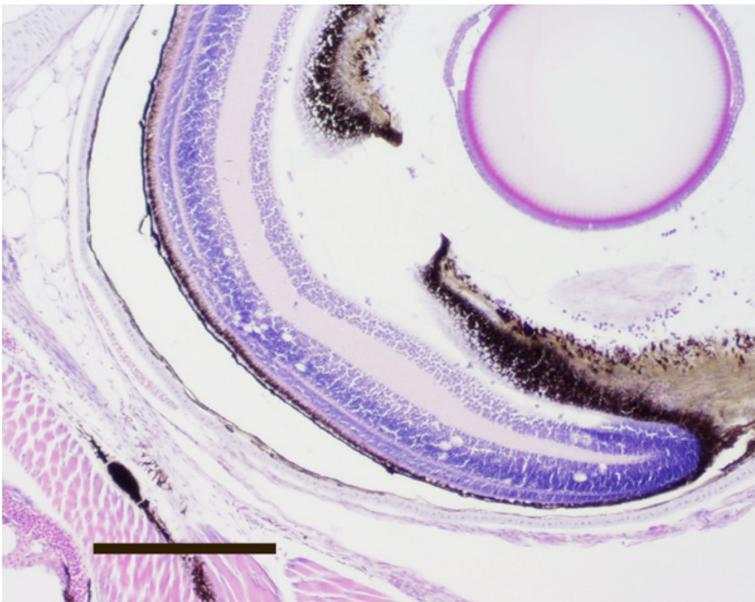
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Source: B Jones

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Barramundi (*Lates calcarifer*) 22 day old juvenile. Transverse section through retina. Vacuoles associated with VER infection are visible. Haematoxylin and Eosin stain. Scale bar = 0.2 mm.

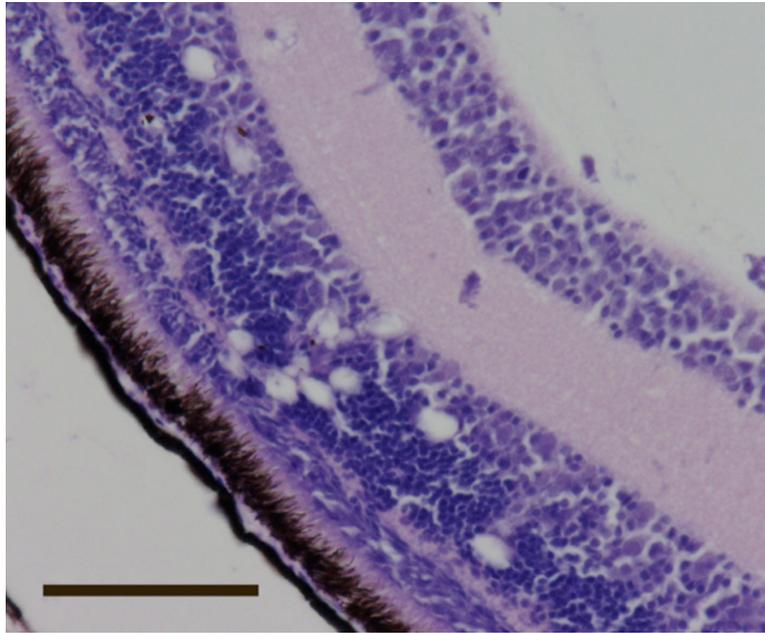
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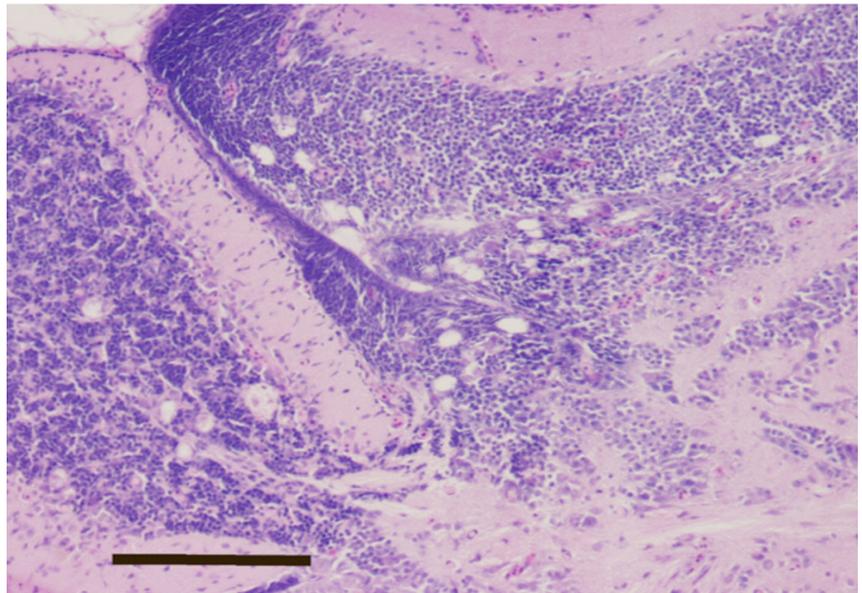
Source: B Jones

Barramundi (*Lates calcarifer*) 20 day old juvenile. Transverse section through retina. Vacuoles associated with VER infection are visible. Haematoxylin and Eosin stain. Scale bar = 0.05 mm.



Source: B Jones

Barramundi (*Lates calcarifer*) 20 day old juvenile. Transverse section through brain. Juncture of optic lobe and mesencephalon. Vacuoles associated with VER infection are readily visible. Haematoxylin and Eosin stain. Scale bar = 0.1 mm.



Source: B Jones