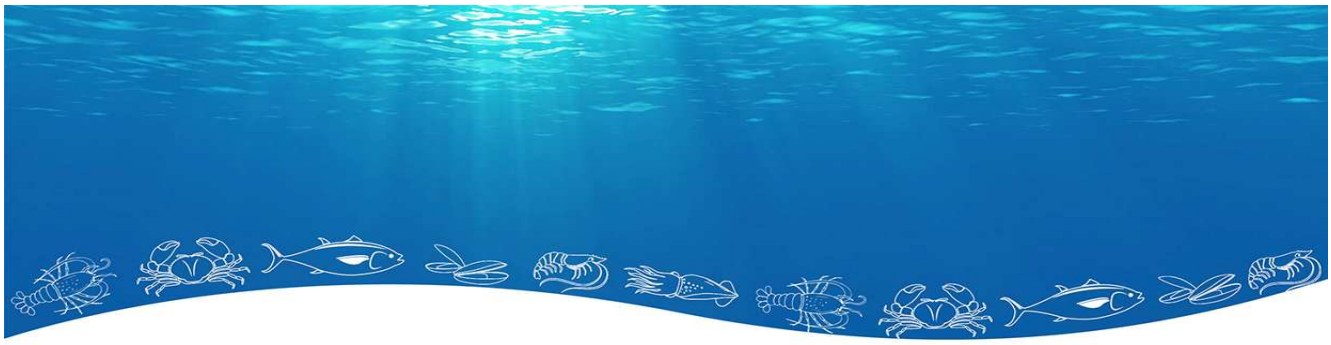

BIOSECURITY PLAN FOR THE EAST COAST OTTER TRAWL FISHERY

Version 1.0

March 2018

QUEENSLAND SEAFOOD INDUSTRY BIOSECURITY PLAN

EAST COAST OTTER TRAWL FISHERY

Australian Government
Department of Agriculture and Water Resources

This project is supported by the Queensland Seafood Industry Association, through funding from the Australian Government through the Department of Agriculture and Water Resources.

Prepared by: DigsFish Services Pty Ltd

Prepared with: Queensland Seafood Industry Association

and

Biosecurity Queensland

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Overview

The detection of the exotic White Spot Disease in crustaceans in the Logan River and Moreton Bay in the summer of 2016/17 required an emergency biosecurity response from the Queensland State Government in order to attempt to eradicate, manage, control and prevent spread of the internationally significant White Spot Syndrome Virus (WSSV) into other regions of Queensland and Australia. This response included eradication attempts on prawn farms that were affected by the disease, and establishment of a movement control area encompassing the entire Moreton Bay region (Figure 1), from which movement of uncooked crustaceans and other WSSV hosts, carriers or unsanitised fishing equipment was prohibited. The biosecurity requirements of the White Spot Disease movement control zone highlighted how severely biosecurity related issues can impact seafood businesses in Queensland.

One of the broader outcomes of the White Spot Disease response was an undertaking funded by the Federal Government to develop a Biosecurity Plan for the Queensland Seafood Industry. The aim of this plan is to enhance the ability of Queensland's wild harvest seafood industry to prepare for, identify, mitigate the impact of and respond to future biosecurity incidents by:

- Alerting the industry about its role and responsibilities during biosecurity incidents;
- Reviewing and implementing best practice biosecurity measures within the wild harvest seafood industry; and
- Communicating with and educating stakeholders about the characteristics, prevention and management of important aquatic pests and diseases.

The educational resources developed as part of this Biosecurity Plan together form an information toolkit. In Queensland every person has a general biosecurity obligation under the Biosecurity Act and there are large penalties for non-compliance. The main aim of developing this toolkit is to improve industry biosecurity capacity to assist commercial fishers and processors to develop the necessary skills to become more aware of their general biosecurity obligations and responsibilities under the Queensland Biosecurity Act 2014, and to know what to do if they suspect the presence of a major aquatic pest or disease. The development of the toolkit includes the various resources in a total of 23 fishery-specific Biosecurity Plans, which are also published online as well as in hard copy.

The disease identification sheets in this Biosecurity Plan provide information relating to diseases that may affect the East Coast Otter Trawl Fishery, hence it only contains information on those diseases that may effect this fishery. For information on diseases that may affect other fisheries, see the relevant biosecurity plan for that fishery.

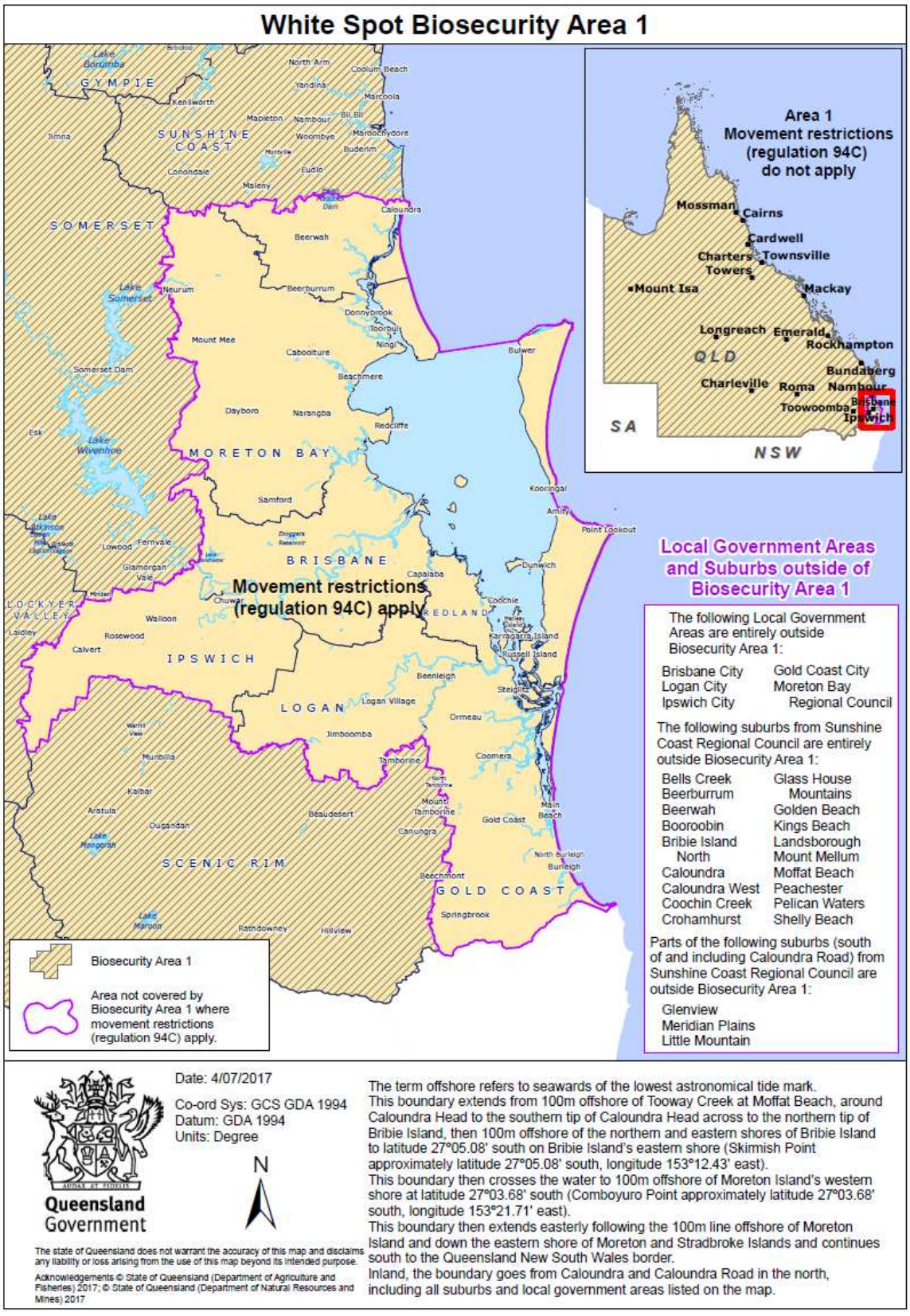


Figure 1. Movement control zone for White Spot Disease in Moreton Bay, SE QLD.

What is biosecurity ?

- Biosecurity is about prevention of the introduction and spread of diseases.
- Prevention is the ideal goal first and foremost. Unfortunately, biosecurity breaches do occur and new diseases can emerge or be introduced via various pathways.
- If a significant new or exotic disease agent is found in a new area, there are several options available to biosecurity authorities under the Queensland Biosecurity Act 2014 to attempt to manage the situation and try to minimise damage to industries and the environment.
- These options include eradication, containment and asset based protection (Figure 2).

Eradication

- If a new disease emerges or an exotic disease is introduced into a new area, the first step is to try to eradicate it to return to freedom from that disease.
- Eradication efforts may involve destruction of infected fish, shellfish or other animals that are potential hosts or carriers of an unwanted disease agent, and/or decontamination of affected fish farms, boats, processing facilities or equipment in contact with infected hosts in an attempt to eliminate or reduce the amount of viable disease agents that occur in the environment.
- The aim of eradication is to remove the disease agent from the environment altogether, or reduce the numbers of hosts or disease agents to the point where the disease can no longer effectively be transmitted to infect new hosts and 'fizzles out".
- Commercial fishers and processors will be adversely affected by eradication efforts in the short-term.
- However, the long-term benefits of returning to business as usual are much greater than the "short-term pain" involved with eradication.

Containment and Zoning

- Containment is an important part of eradication efforts and/or longer term disease management because diseases can be spread a long way very quickly by humans, much faster than they can be spread by natural movements of infected animals.
- Containment of a disease is usually undertaken by restricting the movements of animals, people and equipment from areas where the disease occurs. This is because disease agents can survive in for long periods in infected animals (whether they are diseased or not), as well as for shorter periods on the surfaces of clothing and equipment in contact with infected animals or water containing infected animals.
- Zoning arrangements are usually implemented in the affected geographic area in order to facilitate containment (Figure 1).

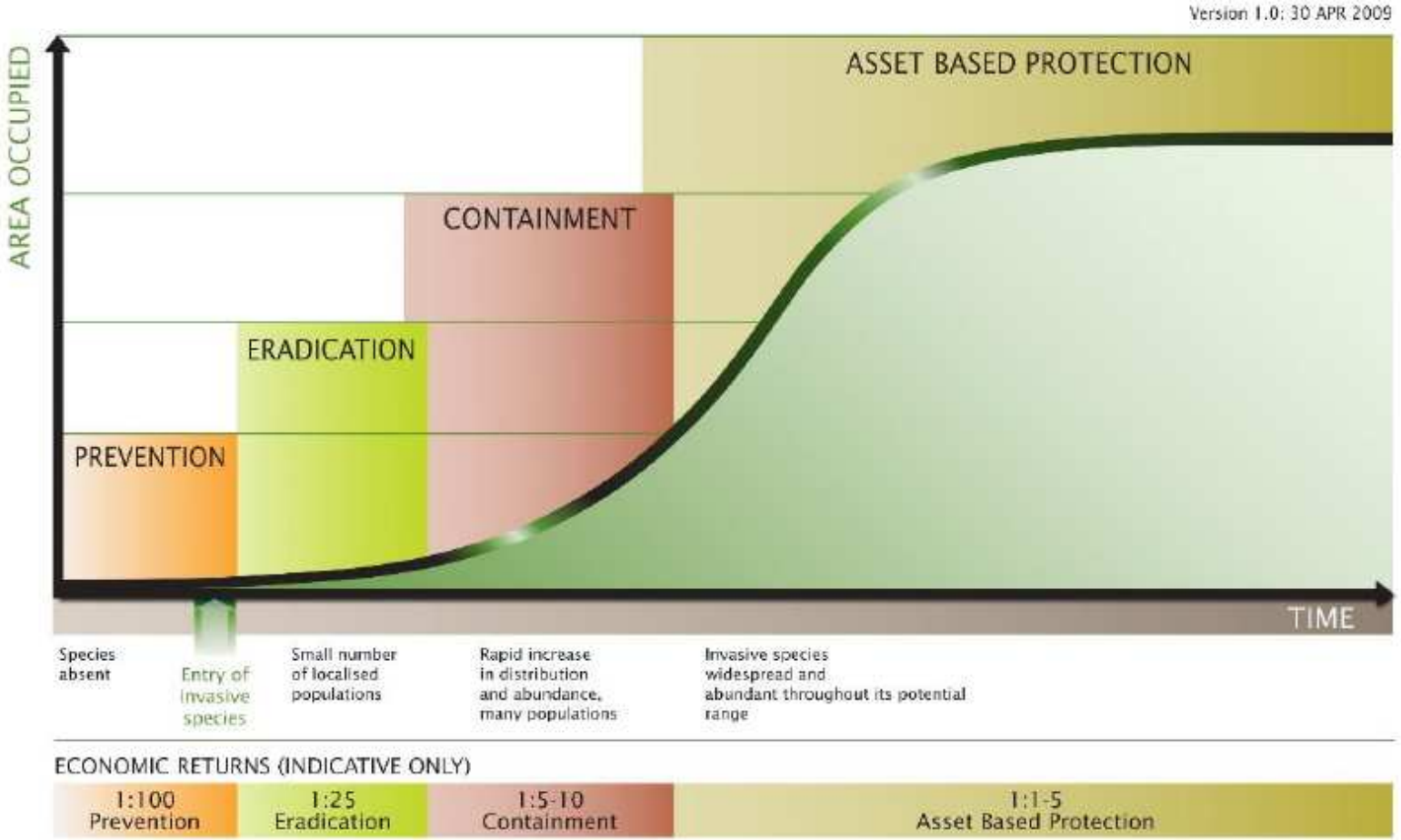


Figure 2. Biosecurity is firstly about prevention (most cost effective), but eradication and containment/zoning are also extremely important to try to limit spread of a disease once it is introduced. Diagram from Victorian Government (2010).

Different products present different biosecurity risks

The risk of translocating (moving) diseases from one place to another are not equal amongst different commodities. The relative risks are ranked as follows:

Risk profile	Product/process
Highest	Live animals
	Dead (uncooked)
	Frozen (uncooked)
	Contaminated equipment/clothing
Lowest	Cooked product

- Movements of live animals pose the greatest risk of spread of diseases.
- The second greatest risk is movement of dead (uncooked) animals, followed by frozen uncooked products.
- Diseases can also be spread on contaminated clothing, boats, vehicles and equipment.
- The lowest risk of disease spread is via movement of cooked products, as the heat from the process of cooking inactivates virtually all disease agents.

Why do I need to take biosecurity seriously?

- Our biosecurity systems are only as strong as the weakest link in the chain.
- The spread of serious, internationally significant aquatic diseases such as White Spot Disease to new areas can cause massive and permanent disruption and economic losses to fisheries and aquaculture businesses.
- Strict controls on the movement of infected animals and contaminated equipment are required to prevent rapid movement of these diseases to new areas.
- It is important that fishers and farmers abide by these containment /zoning controls. These rules are put in place with the future best interests of our primary industries in mind.
- Every person in Queensland has a general biosecurity obligation under the Queensland Biosecurity Act 2014, and there are large penalties (up to and exceeding $350,000) for non-compliance with these regulations.

Diseases of significance to the East Coast Otter Trawl Fishery

Table 1 lists the notifiable diseases that are of significance to the East Coast Otter Trawl Fishery.

Table 1. The notifiable diseases of concern that affect species captured in the East Coast Otter Trawl Fishery. Red font = exotic disease (not in Australia). Green font = occurs in Australia. *** = already occurs in Queensland.**

East Coast Otter Trawl Fishery – Target Species	Notifiable disease risks (Biosecurity Act 2014)	Other potential disease risks
Prawns (*Penaeus* spp., *Metapenaeus* spp.)	Infectious Myonecrosis (IMN) *Monodon* Slow Growth Syndrome (MSGS) Taura Syndrome (TS) White Spot Disease (WSD)* Yellowhead Virus (YHV1) Acute Hepatopancreatic Necrosis Disease (AHPND) Necrotising hepatopancreatitis (NHP) Infection with *Enterocytozoon hepatopenaei* (EHP)	*Epipenaeon* spp.* Shell disease*
Moreton Bay Bugs (*Thenus orientalis*) Balmain bugs (*Ibacus peronii*)	White Spot Disease (WSD)* Milky Haemolymph Disease of Spiny Lobsters (MHD-SL)	*Haematodinium* spp. * Microsporidians* Shell disease*
Saucer scallops (*Amusium balloti*)	Acute Viral Necrosis of Scallops (AVNV) Iridoviruses of molluscs Infection with *Perkinsus marinus* Infection with *Perkinsus olseni**	Haplosporidians* Vibriosis*

For more information on each of these diseases, including the affected host species, see the disease information sheets on the following pages.

Learn more about diseases of fish and shellfish in your fishery

Another way to learn more about the range of diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** that is available for iOS, android and windows devices at the following locations:

iOS - https://itunes.apple.com/au/app/aquatic-disease-field-guide/id1217061785?mt=8

Android -https://play.google.com/store/apps/details?id=au.gov.agriculture&hl=en

Windows - https://www.microsoft.com/en-au/store/p/aquatic-disease-field-guide/9p3vc2ww8nb2

Infectious Myonecrosis (IMN)

Disease agent: Infectious Myonecrosis Virus, a virus related to the family Totiviridae.

Presence in Australia: Exotic

Presence in Queensland: Exotic

Infectious Myonecrosis is exotic to Australia and has not been recorded in any State.

Signs of Disease:

Crustaceans infected with this virus may exhibit the following signs:

- lethargy and high mortalities during stressful events
- small to large areas of white lesions in the muscle of the abdomen and/or a reddish tail fan

Infectious Myonecrosis (IMN): Left. Pacific white shrimp infected with IMNV showing extensive whitening of the abdominal muscle. Right. Focal areas of opaque white tail muscle due to Infectious Myonecrosis.

Photos: Don Lightner

Host Species affected may include:

Banana prawns Black tiger prawns
Brown tiger prawns

Imported seafood including:
Uncooked prawns
(Pacific white shrimp *Penaeus vannamei*,
Pacific blue shrimp *Penaeus stylirostris*)

At risk fisheries in QLD may include:

East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns) for bait or berley.

Basic decontamination information:

There is no published information on inactivation of this disease agent, though it is considered more difficult to inactivate compared to other known crustacean viruses. Likely treatments will nevertheless include dessication (drying out), and temperatures above 100°C for over 1 minute.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice, or frozen.

Learn more
For more information about IMN and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Monodon Slow Growth Syndrome (MSGS)

Disease agent: Not fully known, but involves detection of Laem-Singh Virus (LSNV) in unusually slow growing prawns.

Presence in Australia: Exotic

Presence in Queensland: Exotic

Monodon Slow Growth Syndrome is exotic to Australia and has not been recorded in any State.

Signs of Disease:

Crustaceans infected with this virus may exhibit the following signs:

- abnormally slow growth and unusually dark colouration of carapace with brittle antennae
- bamboo shaped abdominal segments with unusually bright yellow markings

***Monodon* Slow Growth Syndromes (MSGS):** Left. Black tiger prawn with MSGS showing unusually dark colouration and bamboo shaped, deformed abdominal segments. Middle and Right. Black tiger prawn with MSGS showing darkened hepatopancreas and unusually bright yellow markings on carapace.

Photos: Don Lightner

Host Species affected may include:

Black tiger prawns

Imported seafood including:
Uncooked Black tiger prawns

At risk fisheries in QLD may include:

East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns) for bait or berley.

Basic decontamination information:

There is no published information on inactivation of this disease agent. Likely treatments will nevertheless include dessication (drying out), and temperatures above 100°C for over 1 minute.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice, or frozen.

Learn more
For more information about MSGS and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Taura Syndrome (TS)

Disease agent: Taura Syndrome Virus, a virus of the genus *Aparavirus* within the family Dicistroviridae.

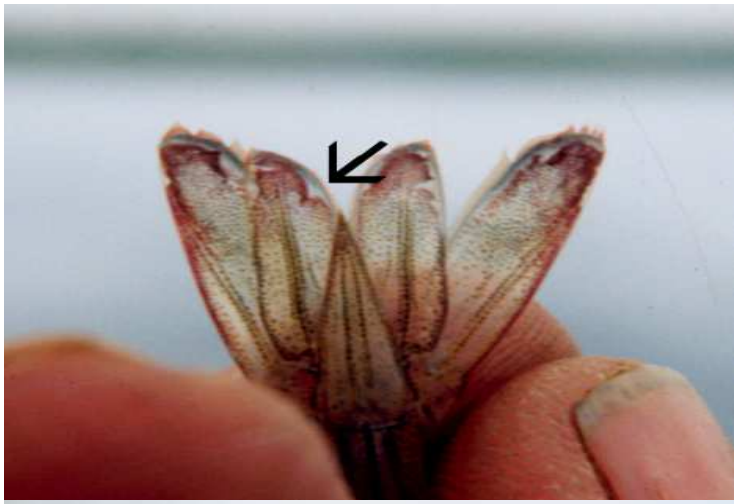
Presence in Australia: Exotic

Presence in Queensland: Exotic

Taura Syndrome is exotic to Australia and has not been recorded in any State.

Signs of Disease:

Crustaceans infected with this virus may exhibit the following signs:



- unusual swimming near the water surface near the edge of water bodies
- reddish tinge to tail or appendages
- soft carapace
- multiple black (melanised) lesions on the carapace in chronic phase
- high mortalities especially during moulting

Taura Syndrome (TS):

Top. Taura Syndrome in Pacific white shrimp. Note distinctive red tail fan of Taura syndrome. Rough edges around tail fin are also common.

Below. Taura Syndrome in Pacific white shrimp note darkening of carapace on side of the body (melanised spots) .

Photos: Don Lightner

Host Species affected may include:

Prawns (all) Mud crabs

Imported seafood including:
Uncooked prawns (all)

At risk fisheries in QLD may include:

Mud Crab Fishery
East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns) for bait or berley.

Basic decontamination information:

There is no published information on inactivation of this disease agent, though it is probably highly tolerant of acids, being able to survive in the faeces of seabirds for at least 48 hours. Likely treatments will nevertheless include dessication (drying out), and temperatures above 100°C for over 1 minute.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice, or frozen.

Learn more
For more information about TS and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

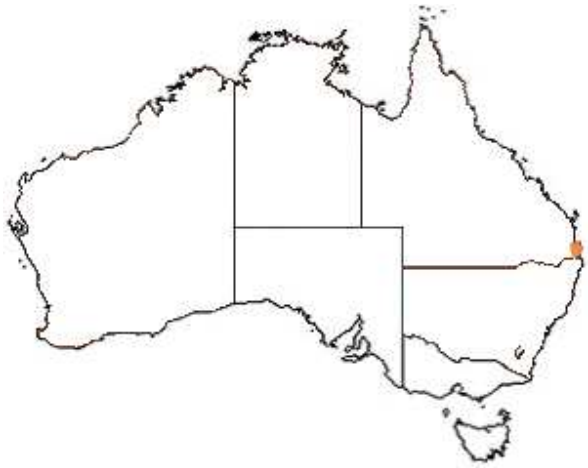
IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

White Spot Disease (WSD)

Disease agent: White Spot Syndrome Virus (WSSV), a virus of the genus *Whispovirus* within the family Nimaviridae.

Presence in Australia: Exotic

Presence in Queensland: South East QLD



White spot disease was confirmed in Moreton Bay in December 2016, and an emergency response to contain and attempt to eradicate the disease is ongoing.

Signs of Disease:

Crustaceans infected with this virus may exhibit the following signs:

- white spots (calcium deposits) in the carapace
- reddish tinge to tail or appendages
- unusual swimming near the water surface
- loose carapace with external fouling
- delayed or no clotting of haemolymph
- high mortalities

White Spot Disease (WSD):

Top. A farmed black tiger prawn from the Logan River, Moreton Bay with WSD.

Below. Note the numerous white calcium deposits on the cuticle of the carapace. These are classical signs of WSD, however prawns infected with the virus may not have any white spots.

Photo: Ben Diggles

Host Species affected may include:

Prawns (all) Crabs (all)
Lobsters (all) Freshwater crayfish
Bait worms (polychaetes)

Imported seafood including:
Uncooked prawns (all)
Uncooked crabs Uncooked lobsters
Uncooked crayfish

Ornamental crustaceans including:
Shrimps Crayfish

At risk fisheries in QLD may include:

Crayfish and Rock Lobster Fishery
Bait Worm Fishery
Blue Swimmer Crab Fishery
Mud Crab Fishery
Spanner Crab Fishery
East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns or crabs) or ornamental crustaceans for bait or berley or release ornamental crustaceans into waterways.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out for 3 hours), temperatures above 70°C for over 5 minutes , 75 mg/L benzalkonium chloride for 10 minutes, 200 mg/L chlorine for 10 minutes, 200 mg/L iodine for 10 minutes, 30% ethanol for 1 minute, UV light > 250 mJ/cm^2 or 5 mg/L/min ozone.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice, or frozen.

Learn more

For more information about WSD and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Yellowhead Disease (YHD)

Disease agent: Yellowhead virus genotype 1 (YHV1), a virus of the genus *Okavirus* within the family Roniviridae.

Presence in Australia: Exotic

Presence in Queensland: Exotic

Yellowhead virus genotype 1 (YHV1)that causes Yellowhead Disease is the most virulent genotype and has never been recorded in Australia. However other related genotypes do occur in Australia, including Gill Associated Virus (YHV2) and 2 others (YHV6, YHV7), but these strains are around a million times less virulent than the YHV1 strain.

Signs of Disease:

Crustaceans infected with this virus may exhibit the following signs:

- yellowish head and lighter coloured body with reddish tinge to appendages
- yellow soft swollen digestive gland (which makes the head appear yellow)
- white, yellow or brown gills
- unusual swimming near the water surface
- high mortalities

Yellowhead Disease (YHD):

Left. Yellowhead disease in giant black tiger prawns from Thailand. Note the yellow heads of infected prawns on the left. The prawns on the right are normal

Photo: Don Lightner

Host Species affected may include:

Prawns (all) Freshwater shrimp

Imported seafood including:
Uncooked prawns (all)

Ornamental crustaceans including:
Freshwater shrimps

At risk fisheries in QLD may include:

East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns) or ornamental crustaceans for bait or berley or release ornamental crustaceans into waterways.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out), temperatures above 60°C for over 15 minutes, 30 mg/L chlorine for 1 hour, or 0.5 mg/L/min ozone.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice, or frozen.

Learn more
For more information about YHV and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Necrotising Hepatopancreatitis (NHP)

Disease agent: Candidatus *Hepatobacter penaei*, a gram negative species of alpha-proteobacteria.

Presence in Australia: Exotic

Presence in Queensland: Exotic

Necrotising Hepatopancreatitis caused by *Hepatobacter penaei* is exotic to Australia and has not been recorded in any State.

Signs of Disease:

Crustaceans infected with this bacteria may exhibit the following signs:

- a pale/white shrunken hepatopancreas with or without black (melanised) streaks
- lethargy
- soft shell with heavy external fouling
- black (melanised) gills
- empty gut

Necrotising Hepatopancreatitis (NHP):

Top. A Pacific white shrimp from the USA with NHP; note darkening at base of swimmerets, giving a fouled, 'dirty' appearance.

Below. The same shrimp showing a marked reduction in the size of the hepatopancreas.

Photos: Don Lightner

Host Species affected may include:

Prawns (all)

Imported seafood including:
Uncooked prawns (all)

At risk fisheries in QLD may include:

East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns) for bait or berley.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out). There is little information available specific for this pathogen relating to its tolerance to high temperatures, but related species of bacteria are inactivated by exposure to 60°C for over 5 minutes, or 3.5% formalin for 20 minutes.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice (but not frozen).

Learn more
For more information about NHP and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Acute Hepatopancreatic Necrosis Disease (AHPND)

Disease agent: *Vibrio parahaemolyticus* (Vp_{AHPND}), a gram negative bacterium in the family Vibrionaceae that has a plasmid gene that produces toxins lethal to prawns.

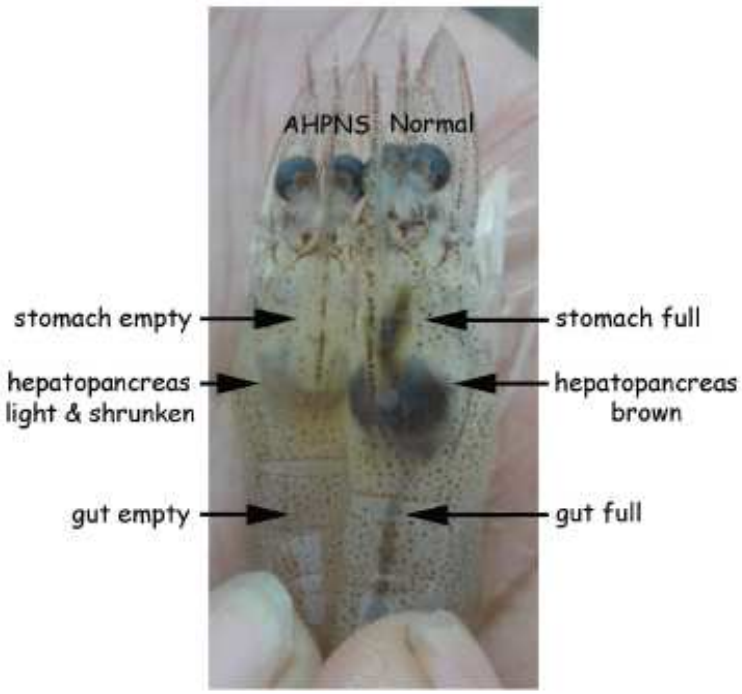
Presence in Australia: Exotic

Presence in Queensland: Exotic

While *Vibrio parahaemolyticus* is known to occur in Australia, specific strains of *V. parahaemolyticus* containing the genes that produce toxins (Vp_{AHPND}) have not been recorded.

Signs of Disease:

Crustaceans infected with this bacteria may exhibit the following signs:



- a pale/white shrunken hepatopancreas
- soft shells
- black (melanised) spots or streaks in the hepatopancreas
- empty gut
- moribund prawns sink to the bottom

Acute Hepatopancreatic Necrosis Disease (AHPND):

The prawn on the left of the picture has AHPND and displays a lighter coloured, shrunken hepatopancreas and an empty gut.. The prawn on the right of the picture is normal.

Photos: Don Lightner / Tim Flegel

Host Species affected may include:

Prawns (all)
Bait worms (polychaetes)

Imported seafood including:
Uncooked prawns (all)

At risk fisheries in QLD may include:

Bait Worm Fishery
East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns) for bait or burley.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out), temperatures above 50°C for over 10 minutes or 60°C for over 1 minute, 250 mg/L chlorine for 30 minutes, 25 mg/L iodine for 2 minutes, 1% Virkon S for 10 minutes, UV light > 5 mJ/cm^2 or 1.9 mg/L/min ozone.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice (but not frozen).

Learn more
For more information about AHPND and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Infection with *Enterocytozoon hepatopenaei* (EHP)

Disease agent: *Enterocytozoon hepatopenaei*, a microsporidian parasite belonging to the family Enterocytozoonidae.

Presence in Australia: Exotic

Presence in Queensland: Exotic

While superficially similar microsporidians have been recorded in a variety of crustaceans from some areas of Australia, *Enterocytozoon hepatopenaei* is exotic to Australia and has not been recorded in any State.

Signs of Disease:

Crustaceans infected with this parasite may exhibit the following signs:

- unusually slow growth, poor food conversion ratios and highly variable sizes at age
- white faeces packed with large numbers of microsporidian spores
- mortalities can occur when EHP occurs in the presence of other pathogens such as AHPND

Infection with *Entrocytozoon hepatopenaei* (EHP):

Left. Pacific white shrimp infected with EHP showing variation in size due to poor growth compared to a normal shrimp (top).

Right. Head of a small EHP infected shrimp showing white empty gut and discoloured hepatopancreas compared to a normal shrimp (on the right).

Photos: Rajendran et al. (2016). *Aquaculture* 454: 272-280.

Host Species affected may include:

Prawns (all)
Bait worms (polychaetes)

Imported seafood including:
Uncooked prawns (all)

At risk fisheries in QLD may include:

Bait Worm Fishery
East Coast Otter Trawl Fishery
River and Inshore Beam Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked prawns) for bait or berley.

Basic decontamination information:

There is no published information on inactivation of this disease agent. Likely treatments will include dessication (drying out), while related species of microsporidians are inactivated by exposure to 100°C for over 3 minutes, 70% ethanol for over 10 minutes, or 25 mg/L chlorine for over 10 minutes.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice (but not frozen).

Learn more
For more information about EHP and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Milky Haemolymph Disease of Spiny Lobsters (MHD-SL)

Disease agent: A gram negative rickettsia-like bacterium.

Presence in Australia: Exotic

Presence in Queensland: Exotic

Milky Haemolymph Disease of Spiny Lobsters is exotic to Australia and has not been recorded in any State.

Signs of Disease:

Crustaceans infected with this bacteria may exhibit the following signs:

- milky, opaque haemolymph that does not clot
- swollen abdomen, lethargy, mortalities

Milky Haemolymph Disease of Spiny Lobsters (MHD-SL): Left. Painted crayfish from Vietnam with Milky Haemolymph Disease showing white, opaque haemolymph drawn into a syringe. Right. Milky appearance of the hepatopancreas of a painted crayfish with Milky Haemolymph Disease. Photos: Don Lightner

Host Species affected may include:

Tropical Lobsters (Crayfish)

Imported seafood including:
Tropical Lobsters

At risk fisheries in QLD may include:

Crayfish and Rock Lobster Industry
East Coast Otter Trawl Fishery

Introduction Pathways to avoid:

Do not use imported seafood (particularly imported uncooked tropical lobster tails) for bait or berley.

Basic decontamination information:

There is no published information on inactivation of this disease agent. Likely treatments will include dessication (drying out). Related species of bacteria are inactivated by exposure to 60°C for over 5 minutes, or 3.5% formalin for 20 minutes.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole crustaceans should be provided alive (if possible) or chilled and on ice (but not frozen).

Learn more

For more information about other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Acute Viral Necrosis of Scallops (AVNV)

Disease agent: Acute Viral Necrosis Virus, a variant of Ostreid Herpesvirus 1 (OsHV-1), a virus in the genus *Ostreavirus* within the family Malacoherpesviridae.

Presence in Australia: Exotic

Presence in Queensland: Exotic

The strain of OsHV-1 virus responsible for AVNV has never been reported from Australia, and is considered exotic.

Signs of Disease:

Molluscs infected with this virus may exhibit the following signs:

- gaping and mantle retraction in adult scallops over 2 years of age
- weak shell closing reflex, mucous accumulation in the mantle cavity
- enlarged digestive gland, gill erosion and adductor muscle ulceration
- high mortalities (>90% within a week) when water temperatures are 18-20°C or above

Infection with AVNV:

Left. Chinese scallops infected with AVNV have retracted mantles and a weakened shell closing reflex.

Photo: www.farm-2-market.com

Host Species affected may include:

Scallops Clams/Arc shells

Imported seafood including:
Chinese scallops Clams/Arc shells

At risk fisheries in QLD may include:

East Coast Otter Trawl Fishery
Rock Oyster Industry

Introduction Pathways to avoid:

Do not translocate scallops or clams of unknown disease status from areas where AVNV is known to occur. Do not use imported seafood (including mollusc products) for bait or berley.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out in the sun for 7 days at 20°C), high temperatures (50°C for 5 minutes), 20g/L sodium hydroxide for 10 minutes, 0.1% available iodine for 5 minutes, 1% Virkon S for 15 minutes, 10% formalin for 30 minutes and 800 mg/L benzalkonium chloride for 10 minutes.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole molluscs should be provided alive (if possible) or chilled and on ice.

Learn more
For more information about other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Infection with Iridoviruses (Gill Necrosis Virus)

Disease agent: Unassigned iridoviruses in the family Iridoviridae.

Presence in Australia: Exotic

Presence in Queensland: Exotic

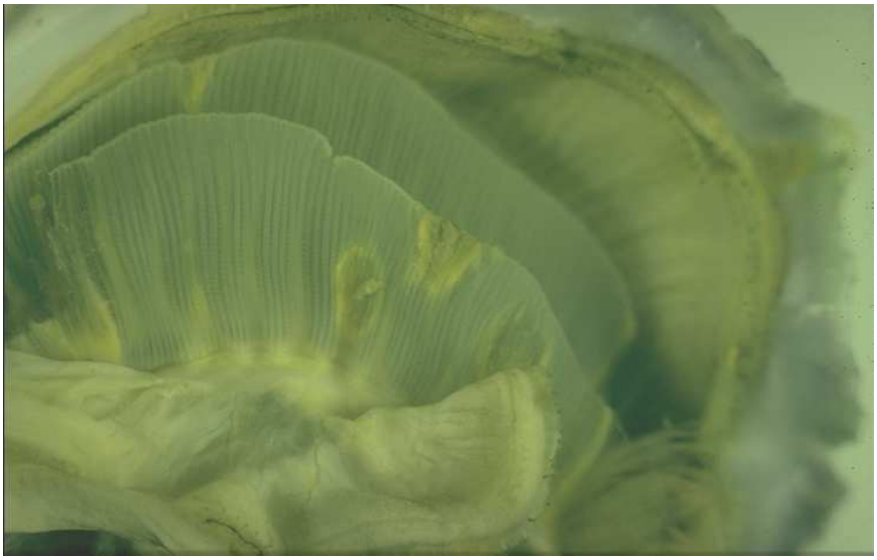
Iridoviral diseases of molluscs are exotic to Australia and have not been recorded in any State.

Signs of Disease:

Molluscs infected with these viruses

may exhibit the following signs:

- yellow or green pustules on the mantle or adductor muscle
- yellow spots on the gills and labial palps that enlarge into ulcers and spread as disease progresses
- the ulcers develop brown centres as the infected tissues die, leaving holes in the gills
- high mortalities



Infection with iridovirus:

Left. A Portugese oyster from Europe infected with iridovirus. Note the multiple ulcers which are visible in the gill tissue.

Photo: D. Alderman

Host Species affected may include:

Flat oysters
Pacific oysters
Sydney rock oysters

Imported seafood including:

European flat oysters
Pacific oysters
Portugese oysters

At risk fisheries in QLD may include:

East Coast Pearl Fishery
Trochus Fishery
Rock Oyster Industry
East Coast Otter Trawl Fishery

Introduction Pathways to avoid:

Do not translocate molluscs of unknown disease status from areas where iridoviruses are known to occur. Do not use imported seafood (including mollusc products) for bait or berley.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out). Iridoviruses of molluscs are also likely to be inactivated by high temperatures, freshwater and common disinfectants including chlorine, ozone, hydrogen peroxide and benzalkonium chloride, however effective doses/durations for these chemicals have not been published.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole molluscs should be provided alive (if possible) or chilled and on ice.

Learn more

For more information about iridoviruses of molluscs and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Infection with *Perkinsus marinus*

Disease agent: *Perkinsus marinus* is a protozoan parasite from Family Perkinsidae, Phylum Perkinsozoa within the Alveolata (dinoflagellates, apicomplexans, and ciliates).

Presence in Australia: Exotic

Presence in Queensland: Exotic

Perkinsus marinus is exotic to Australia and has never been reported from any State. Related species of *Perkinsus* (e.g. *P. olseni*, *P. chesapeaki*) have been recorded in several States. Any new diagnosis of *Perkinsus* spp. requires specific confirmation using molecular techniques.

Signs of Disease:

Molluscs infected with these parasites may exhibit the following signs:

- gaping and weakened shell closure
- stunted growth and poor condition with watery appearance of the flesh and shrunken gonad
- high cumulative mortalities when water temperatures exceed 20°C at salinities > 10 ppt

Infection with *Perkinsus marinus*:

American oysters from the USA. The oyster on the right is in poor condition with thin watery tissues, a typical sign of infection with *Perkinsus marinus*. The specimen on the left is normal.

Photo: E. Burreson.

Host Species affected may include:

Pacific oysters
Milky oysters
Sydney rock oysters
Black-lip rock oysters

Imported seafood including:
Pacific oysters
American oysters
Suminoe oysters
Blue mussels

At risk fisheries in QLD may include:

East Coast Otter Trawl Fishery
Rock Oyster Industry
Trochus Fishery

Introduction Pathways to avoid:

Do not translocate molluscs of unknown disease status from areas where *Perkinsus marinus* infections are known to occur. Do not use imported seafood (including mollusc products) for bait or berley.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out >7 days), temperatures above 60°C for over 1 hour, 300 mg/L chlorine for 30 minutes, freshwater (0 ppt salinity) for 30 minutes, and UV light > 28 mJ/cm^2.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole molluscs should be provided alive (if possible) or chilled and on ice.

Learn more
For more information about *Perkinsus marinus* and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

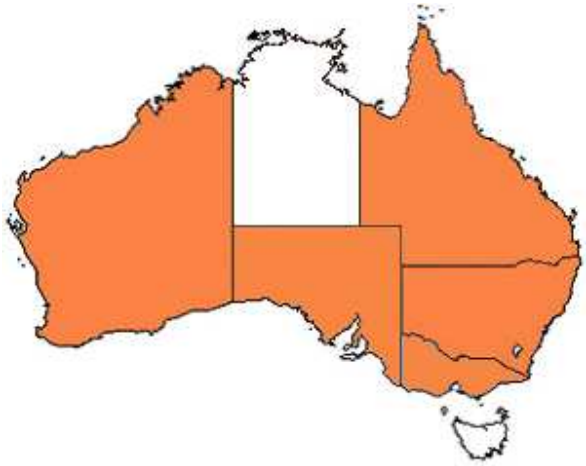
IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Infection with *Perkinsus olseni*

Disease agent: *Perkinsus olseni* is a protozoan parasite from Family Perkinsidae, Phylum Perkinsozoa within the Alveolata (dinoflagellates, apicomplexans, and ciliates).

Presence in Australia: Endemic

Presence in Queensland: Endemic



Perkinsus olseni has been reported from QLD, NSW, VIC, SA and WA in a wide variety of wild and cultured molluscs including abalone, clams and pearl oysters. However other *Perkinsus* species may also be present, and any new diagnosis of *Perkinsus* spp. requires specific confirmation using molecular techniques.

Signs of Disease:

Molluscs infected with these parasites may exhibit the following signs:

- in bivalves: gaping and weakened shell closure with pale nodules evident in internal organs
- in abalone: multiple pustules or creamy brown/yellow abscesses on the foot or mantle
- mortalities when water temperatures exceed 20°C

Infection with *Perkinsus olseni*:

A greenlip abalone from NSW infected with *Perkinsus olseni*. Note the numerous brown/yellow abscesses in the muscle of the foot.

Photo: NSW Dept. of Primary Industries.

Host Species affected may include:

Pacific oysters
Sydney rock oysters
Silver lipped pearl oysters
Black lipped pearl oysters
Abalone
Razor shells
Milky oysters
Scallops
Clams
Cockles
Giant clams

Imported seafood including:

Manila clams
NZ cockles
Scallops
Pearl oysters
Pacific oysters
Blue mussels
Abalone

At risk fisheries in QLD may include:

Rock Oyster Industry
East Coast Pearl Fishery
Trochus Fishery
East Coast Otter Trawl Fishery

Introduction Pathways to avoid:

Do not translocate molluscs of unknown disease status from areas where *Perkinsus olseni* infections are known to occur. Do not use imported seafood (including mollusc products) for bait or berley.

Basic decontamination information:

This disease agent can be inactivated by the following treatments: Dessication (drying out >7 days), temperatures above 60°C for over 1 hour, 300 mg/L chlorine for 30 minutes, freshwater for 6 hours and UV light > 240 mJ/cm^2.

What to do if this disease is suspected:

If you suspect this disease is present please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

How to collect and store samples for diagnosis:

If you are taking samples to help authorities to test for this disease, whole molluscs should be provided alive (if possible) or chilled and on ice.

Learn more

For more information about *Perkinsus olseni* and other diseases of aquatic animals of significance to Australia, download the **Aquatic Disease Field Guide App** available for iOS, android and windows devices at these locations:

IOS	ANDROID	WINDOWS
https://goo.gl/9UJNp9	https://goo.gl/T4Tn1X	https://goo.gl/Y8Vibj

Biosecurity Protocols for Queensland Fisheries

This section provides information on biosecurity obligations and protocols of relevance to fisheries in Queensland.

Your General Biosecurity Obligation. What to do during a disease outbreak in your fishery.

The Queensland Biosecurity Act 2014 came into effect on 1 July 2016. The new Act included introduction of a general biosecurity obligation (GBO), which requires every person to take reasonable and practical steps to prevent or minimise biosecurity risks to the economy, agricultural and tourism industries, and the environment. People do not need to know about all biosecurity risks but they are expected to know about the risks associated with their day-to-day work and hobbies.

To meet their GBO, people in Queensland need to:

- take all reasonable and practical steps to prevent or minimise each biosecurity risk
- minimise the likelihood of the risk causing a biosecurity event, and limit the consequences of such an event, and
- prevent or minimise the adverse effects the risk could have, and refrain from doing anything that might exacerbate those adverse effects.

Under the new act, everyone in Queensland needs to take an active role in managing the biosecurity risks under their control. If a person's activities are likely to pose a biosecurity risk, they are expected to know about the risks posed by what they do, and to ensure they do not spread pests, diseases or contaminants.

A biosecurity risk exists when dealing with any pest, disease or contaminant, or with something that could carry one of these. This includes moving or keeping a pest, disease or contaminant, or animals, plants, soil and equipment that could carry a pest, disease or contaminant. A biosecurity event is caused by a pest, disease or contaminant that is, or is likely to become, a significant problem for human or animal health, social amenity, the economy or the environment of Queensland.

Reporting a suspected notifiable disease

If you suspect one of the diseases listed in this document is present in your fishery or processing facility, please contact the Department of Agriculture and Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) immediately.

Collecting samples for diagnosis

Fishers and processors are often in the best position to provide high quality samples to authorities to help them identify if a significant disease is present in a fishery. However, due to the uncertainty of identifying any particular disease based on visual signs (i.e. the appearance of the infected animal), diagnosis of diseases requires collecting samples and sending them to specialist laboratories for further analysis. Because some diseases of aquatic animals can also pose a risk to human health, people are advised to call the Department of Agriculture and

Fisheries (13 25 23) or the National 24 hr Emergency Animal Disease Hotline (1800 675 888) first to obtain advice. In some cases, the relevant State or Territory agency taking your call will put you in contact with fisheries or veterinary authorities who will be able to provide advice on what is required to ensure the correct samples are taken without endangering the health of the person taking samples.

In general, if you are taking samples to help authorities to test for diseases of concern, whole fish or shellfish should be provided alive (if possible) so that a full range of tests can be applied. If this is not possible the next best samples are usually chilled on ice (but not frozen). Some testing procedures require fixation of samples in special fixatives (e.g. ethanol, formalin) and if these are required, Biosecurity QLD or Department of Agriculture and Fisheries staff may advise of these requirements. For more information, see "Submitting samples to the Biosecurity Sciences Laboratory" on the internet at https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/sample-testing/submitting or email bslclo@daf.qld.gov.au.

Zoning and compartmentalisation - how it could affect your business

If an important disease is introduced or emerges in a new region, zoning arrangements are likely to be implemented in order to try to contain the disease within a certain geographic area. Zoning is a tool used for trade facilitation and as a disease management tool. A zone is defined by geographical separation of different countries or parts of a country (Figures 1, 3). For example, in the case of the White Spot Disease incursion into Moreton Bay, the zone chosen to delimit the disease was a geographic area where infected animals were known to be present or likely to be present, which incorporated the entire Moreton Bay region and its river catchments because the disease can effect hosts in both freshwater and marine areas (Figure 1).

Disease surveillance is then used to determine the extent of the incursion and help facilitate trade in the regions outside the affected zone. Surveillance is also undertaken within the infected zone in order to monitor the extent of disease spread. Under international rules, if a properly designed surveillance program does not detect the disease agent of concern within a zone over a period of 2 years, the zone can be declared free of the disease for the purposes of trade.

A similar concept to zoning is compartmentalisation, however unlike a zone which is defined by geographical separation, a compartment is defined by strict adherence to a clearly defined biosecurity management system within a distinct population of animals held isolated within an infected zone (Figure 3). Individual farms, processing facilities or holding facilities can qualify as compartments if they have effective biosecurity plans in place and 2 years of surveillance that demonstrates freedom from the prescribed disease(s) of concern. Both zoning and compartmentalisation are used for trade facilitation and as disease management tools.

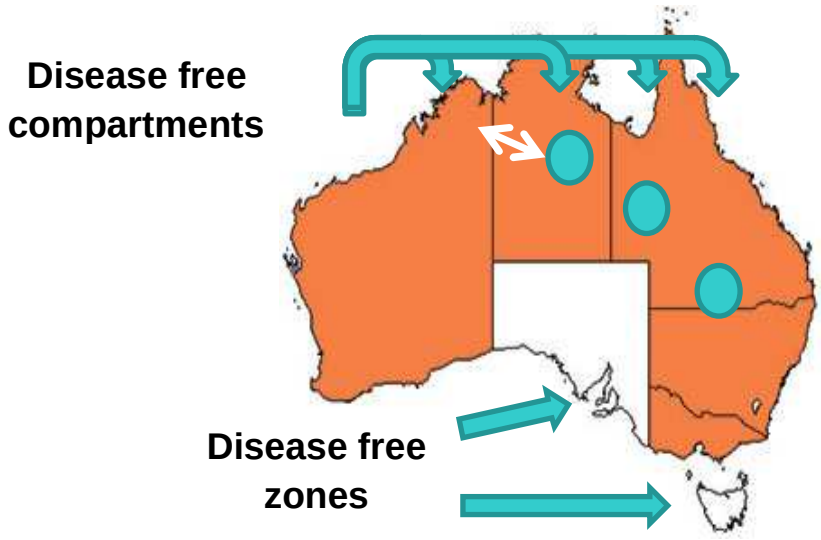


Figure 3. Diagram depicting disease free zones (white areas, SA and TAS) within a country with infected geographical zones (WA, NT, QLD, NSW, VIC) for a hypothetical disease agent. The green circles show disease free compartments that can be established within infected zones. Graphics courtesy of Federal Department of Agriculture and Water Resources.

Decontamination of equipment

To prevent accidental movement of diseases from infected zones or compartments, it is important that fishing, crabbing and trawl equipment is clean and disinfected before leaving movement control areas.

Desiccation (drying out) is an effective method of decontaminating used equipment, and most pathogens are inactivated by drying out for 5 to 7 days (please refer to Table 2 (page 43) or the information sheets for each disease agent for specific details). However, in some circumstances fishers may need to leave a movement control zone and not have the opportunity to completely dry out their boats or equipment. In these cases, sanitising agents need to be used to disinfect boats or equipment to inactivate any disease agents that may be present.

Certain types of sanitising detergents are ideal for disinfecting fishing, crabbing and trawl equipment that may have been in contact with diseased hosts. Detergents such as benzalkonium chloride are often preferred compared to hypochlorite (e.g. chlorine), iodophore (e.g. iodine), or aldehyde (e.g. formalin) based chemicals as they destroy some pathogens at relatively low concentrations, are biodegradable (less toxic to the environment), and are readily available in bulk (see Table 1, page 42). However, the effectiveness of a given chemical will vary depending on the type of disease agent being treated - some disease agents are more sensitive to certain chemicals because the structure of the disease agent is more sensitive to the mode of action of the chemical. The type of sanitising agent and its relevant concentration will therefore vary depending on the identity of the disease of concern (Table 2). For more information, readers are referred to the relevant disease identification sheets in the fishery-specific biosecurity plans, or the Aquavetplan decontamination manual (available at http://www.agriculture.gov.au/animal/aquatic/aquavetplan/decontamination).

Decontamination procedures

1. Use a high-pressure or high-volume hose to remove solids and organic matter from equipment, such as nets, crab pots and boat decks. The water used for washing down or soaking equipment can be either freshwater or seawater.

    a. For land based decontamination this should be done in a nominated wash down area

    b. For vessels at sea simply wash back into the water

2. After cleaning, apply the diluted detergent/sanitising agent to all surfaces for the prescribed time using a broom, sponge or scrubbing brush. Leave the detergent/sanitising agent in contact with the equipment for the prescribed time period. Items such as small nets may be easier to submerge into a bucket or large vat filled with the sanitising agent.

3. After the prescribed contact period has elapsed, rinse thoroughly with clean water. Follow the instructions on the label for directions for proper disposal of chemical sanitising agents.

Mixing your sanitising agent

Various chemical sanitising agents are purchased in concentrated form and need to be diluted prior to use. The manufacturers recommended dilutions may be used for some applications, however many disease agents will require different concentrations to those shown on the label. Usually the concentration of a chemical is expressed as milligrams of active ingredient per litre (mg/L, which is the same as parts per million (ppm)).

If a chemical is provided as 100% active ingredient, the concentration used in mg/L is easily worked out as follows: 1 ml of chemical in 10 litres of water = 100 mg/L

Other common dilutions for a 100% active ingredient chemical are as follows		
10 mg/L = 0.1 ml in 10 L	100 mg/L = 1 ml in 10 L	250 mg/L = 2.5 ml in 10 L
50 mg/L = 0.5 ml in 10 L	200 mg/L = 2 ml in 10 L	500 mg/L = 5 ml in 10 L

Many chemicals are purchased already diluted such that their concentration of active ingredient is less than 100%. These usually need to be further diluted to the final concentration, which can be calculated as follows:

Minimum quantity of product (ml) added to 10 Litres of water:

target mg/L = target ÷ (% active ingredient in product) = ml added

100 mg/L = 100 ÷ (% active ingredient in product) = ml added

Worked examples

Table 1 (page 42) contains the calculations required to dilute a range of commercially available sanitising products to provide a minimum 75 mg/L dose of a detergent (benzalkonium chloride) for use to inactivate White Spot Syndrome Virus (WSSV) on boats and fishing equipment.

Other products containing benzalkonium chloride (BC) can be used provided they are applied as follows:

Minimum quantity of product added to 10 L of water = 75 ÷ (% active BC ingredient in product)

Minimum quantity of product added to 100 L of water = 750 ÷ (% active BC ingredient in product)

Example1: Product X contains 10% benzalkonium chloride.

I want to make up a solution of 10 litres of 75 mg/L benzalkonium chloride.

Target 75 mg/L = 75 ÷ 10 (% active) = 7.5 ml of Product X into 10 L of water

Example 2: Product Y contains 2.5% iodine active ingredient.

I want to make up a solution of 20 litres of 100 mg/L iodine for sanitising a cast net.

Target 100 mg/L = 100 ÷ 2.5 (% active) = 40 ml of Product Y into 10 L of water

for 20 L (instead of 10L) x 2 = 80 ml of Product Y into 20 L of water.

Table 2 (Page 43) summarises the concentrations of various different sanitizing agents used for decontaminating the various disease agents which are listed in the disease information sheets contained in the fishery specific biosecurity plans.

Table 1. Available benzalkonium chloride sanitisers for inactivating White Spot Syndrome Virus *.

Benzalkonium Chloride Product	(%) active	Min. amount* in 10L**	Min. amount* in 100L**	Manufacturer /Importer	Distributors	Approximate Price
Barquat DM-50	50%	1.5 ml	15 ml	Lonza Water Treatment www.lonzawatertreatment.com.au, Ph. 03 9417 2428	ordersaustralia.water@lonza.com	
Redox Quaternary Ammonium Compound	50%	1.5 ml	15 ml	Redox Pty Ltd Ph. 07 3268 1555 www.redox.com, john.Hornby@redox.com	Redox Brisbane 776 Boundary Road Richlands QLD 4077	$900 / 200L
Form Quat	20-30%	2.5 - 3.75 ml	25 - 37.5 ml	Formula Chemicals Ltd www.formulachemicals.com.au Ph 02 98074266	www.generalsanitation.com.au	
Phytoclean	10%	7.5 ml	75 ml	Phytoclean Pty Ltd Ph. 0412 885 556 http://www.phytoclean.com.au/	Fernland Agencies Yandina QLD 4561 Ph:1800672794	$75 / 5L, $200 / 20L, $1450 / 200L
Quat Sanitiser	5%	15 ml	150 ml	Mountain Cleaning www.mountaincleaning.com.au Ph 02 6622 8733		
Septone Spice Septone Forest Pine	3%	25 ml	250 ml	Septone Ph. 1800 177 989 www.septone.com.au	Signet.net.au Blackwoods Cleaningshop.com.au	$20-25 / 5L $75-100 / 25L
Disinfectant, General CMCP298	2%	37.5 ml	375 ml	www.livingstone.com.au Ph. 02 83447300	www.livingstone.com.au	$16 / 5L $37 / 25L

* inactivation of WSSV requires a minimum of 75 mg/L of benzalkonium chloride in water for 10 minutes.

** can use either freshwater or seawater

Table 2. Decontamination summary table

Finfish Diseases	Drying out	Heat	UV mj/cm^2	Ozone mg/L/min	Chlorine (mg/L)	Ethanol	Iodine (mg/L)	Formalin	Benzalkonium chloride (mg/L)	Sodium hydroxide	Virkon S
Channel Catfish Virus	>2 days	>60°C 1 hr	>0.2		540/ 30min		250/ 30min			>6 hr pH >12	
Grouper Iridoviral Disease	>200 d				200/ 2 hrs	70%/ 2hr		200mg/L 2h			1%/ 1min
IPN	✓	>80°C 10min	>250	0.5	50/ 30min		10/ 2.5min	2%/ 5min		20min pH>12	1%/ 10min
ISKNV-like viruses	✓	>50°C 30min	5		200/ 30min					30min pH>11	
Red Sea Bream Iridovirus	✓	>56°C 30min	5		200/ 30min					30min pH>11	
VER	>7 days	>60°C 30min	>200	0.5	100/ 5min		100/ 30min	0.2%/ 6hrs	50/ 10min	>24 h pH>12	
VHS	>10 d	>50°C 10min	>10		50/ 1min	40%/ 2min	100/ 10min		125/ 5min	>2hr pH>12.2	0.1%/15min
Aeromonas salmonicida – atypical	✓	>50°C 2min	>6	0.5	2/ 1min		2.6/ 5min		300/ 2min		0.5%/10min
Bacterial Kidney Disease	✓	>65°C 15min	>20		10/ 1min		25/ 5min			>6 hr pH >12	1%/ 10min
Enteric Septicaemia of Catfish***	✓	>60°C 1 hr	>5		50/ 1min	30%/1min	50/ 1min			>6 hr pH >12	
ERM – Hagerman Strain	✓	>75°C 1min	>5	0.7	250/ 2 hrs		25/ 15sec			>5 hr pH>12	1%/ 10min
EUS***	✓		>210		100/ 5min		100/ 5min				
Furunculosis	✓	>60°C 1 hr	>6	0.5	2/ 1min		2.6/ 5min		300/ 2min	10min pH>12	0.5%/10min
Crustacean Diseases											
Infectious Myonecrosis	✓	100°C >1min									
Monodon slow growth syndrome	✓	100°C >1min									
Taura Syndrome	✓	100°C >1min									
White Spot Disease	>3 hrs	>70°C 5 min	>250	5	200/ 10 min	30%/1min	200/10 min		75/ 10 min	25min pH>12	
Yellowhead Virus (YHV1)	✓	>60°C 15min		0.5	30/ 60 min						
AHPND	✓	>60°C 1min	>5	1.9	250/ 30 min		25/ 2 min				1% 10min
Milky Haemolymph Disease	✓	>60°C 5min						3.5%/20min			
Necrotising hepatopancreatitis	✓	>60°C 5min						3.5%/20min			
Enterocytozoon hepatopenaei	✓	100°C >3min			25/ 10 min	70%/10min					
Mollusc Diseases											
Acute viral necrosis of scallops	>7 days	>50°C 5min					1000/5min	10%/30min	800/ 10 min	20g/L 10min	1% 15min
Iridoviruses	✓										
OsHV-1µVar (POMS)	>7 days	>60°C 10min					1000/5min	10%/30min	800/ 10 min	20g/L 10min	1% 15min
Bonamia ostreae, *Bonamia* spp.*	✓	>60°C 15min									
Marteilia refringens	✓				200/4 hrs						
Marteilioides chungmuensis	✓										
*Mikrocytos mackini**	✓	>60°C 15min									
*Perkinsus marinus***	>7 days	>60°C 1 hr	28		300/30 min						
Perkinsus olseni	>7 days	>60°C 1 hr	240		300/30 min						
QX Disease	✓				200/4 hrs						
Winter Mortality*	✓	>60°C 15min									
Akoya Oyster Disease											
Oyster Oedema Disease											

✓ = likely to be effective, but duration not recorded, * = also 10-50 mg/L (0.001-0.005%) acetic acid (vinegar), ** = also freshwater for 30 min, *** = also >3-4 ppt salt.