# Diseases of molluscs

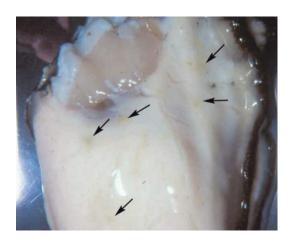
# Parasitic diseases—Infection with Mikrocytos mackini

### Signs of disease

Important: animals with disease may show one or more of the signs below, but disease may still be present in the absence of any signs. Macroscopic lesions are not always present.

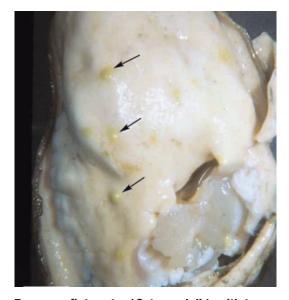
#### Gross signs of disease in an infected animal

- focal green pustules up to 5 mm in diameter within body wall or on surfaces of the labial palps or mantle
- brown scars often on shell adjacent to abscesses or ulcers on the mantle surface
- focal intracellular infection, mainly of vesicular connective tissue cells, resulting in haemocyte infiltration and tissue necrosis
- abscesses composed of granular haemocytes and hyalinocytes, and may contain small (1–3 µm) cells



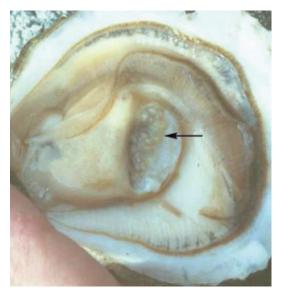
Pacific oyster (*Crassostrea gigas*) removed from shell and showing lesions (arrowed) characteristic of infection with *Mikrocytos mackini* when the microcell is most abundant in the vesicular connective tissue cells immediately surrounding the pustule

Source: S Bower



European flat oyster (*Ostrea edulis*), with top valve removed, showing numerous pustules in the adductor muscle (arrowed) caused by *M. mackini* 

Source: S Bower



Pacific oyster (*Crassostrea gigas*) removed from shell, showing lesions (arrowed) seen during later stages of infection with *Mikrocytos mackini*. Typically, *M. mackini* can no longer be found in oysters at this advanced stage of the disease

Source: S Bower



Sourced from AGDAFF–NACA (2007) Aquatic Animal Diseases Significant to Asia-Pacific: Identification Field Guide. Australian Government Department of Agriculture, Fisheries and Forestry. Canberra.

### Infection with Mikrocytos mackini continued

### Disease agent

*Mikrocytos mackini*, a member of the phylum Haplosporidia, is a parasite of connective tissue that causes lethal infection of the haemocytes of certain oysters.

### **Host range**

Molluscs known to be susceptible to infection with *M. mackini*:

European flat oyster\* (Ostrea edulis)

Olympia oyster\* (Ostrea conchaphila)
Pacific oyster\* (Crassostrea gigas)
American oyster (Crassostrea virginica)

#### Presence in Asia-Pacific

EXOTIC — has not been officially reported in the Asia–Pacific region under the NACA–FAO–OIE quarterly aquatic animal disease reporting program.

# **Epidemiology**

- Severe infections appear to be restricted to oysters over two years old.
- The mortality rate varies at around 40% of older oysters at low tide levels.
- The disease occurs more often in April and May (the Northern Hemisphere spring), after a 3–4 month pre-patent period when temperatures are less than 10°C.
- *Mikrocytos mackini* prefers high salinities.
- The Pacific oyster seems to be more resistant to the disease than the other species challenged experimentally, under laboratory and field conditions.

#### **Differential diagnosis**

The differential diagnostic table and the list of similar diseases appearing at the bottom of each disease page refer only to the diseases covered by this field guide. Gross signs observed might well be representative of a wider range of diseases not included here. Therefore, these diagnostic aids should not be read as a guide to a definitive diagnosis, but rather as a tool to help identify the listed diseases that most closely account for the gross signs.

Outside the known distribution range, electron microscopy or molecular probes (if available) must be used to identify and distinguish the detected organism from microcell species of *Bonamia*.

<sup>\*</sup> naturally susceptible (other species have been shown to be experimentally susceptible)





### Sample collection

Because of uncertainty in differentiating diseases using only gross signs, and because some aquatic animal disease agents might pose a risk to humans, you should not try to collect samples unless you have been trained. Instead, you should phone your national hotline number and report your observations. If samples have to be collected, the agency taking the call will advise you on what you need to do. Local or district fisheries/veterinary authorities could advise you on sampling.

### **Emergency disease hotline**

For your national emergency disease hotline number, see Whom to contact if you suspect a disease.

### **Further reading**

http://www.oie.int/aac/eng/cards/en\_diseasecard.htm

http://www.pac.dfo-mpo.gc.ca/sci/shelldis/pages/mikmacoy\_e.htm

The currently accepted procedures for a conclusive diagnosis of infection with *Mikrocytos mackini* are summarised at http://www.oie.int/eng/normes/fmanual/A\_00041.htm

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

# **Histological images**



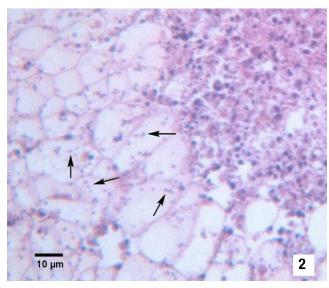
Histological section through a lesion caused by Mikrocytos mackini on the mantle of Pacific oyster (Crassostrea gigas). This intracellular protozoan (not visible at this magnification) usually occurs in the intact vesicular connective tissue cells immediately surrounding the periphery of the lesion (arrows). Haematoxylin and eosin stain

Source: S Bower



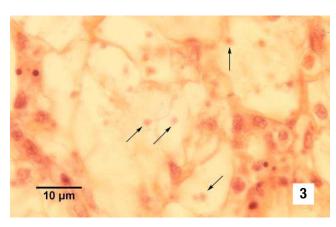


# **Histological images**



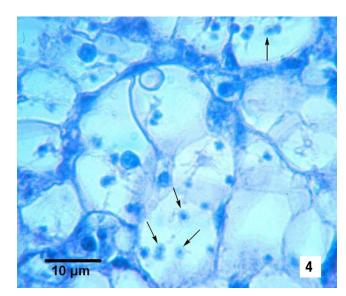
Many *M. mackini* (arrows) within vesicular connective tissue cells adjacent to a lesion characterised by an accumulation of haemocytes and necrotic cells. Haematoxylin and eosin stain

Source: S Bower



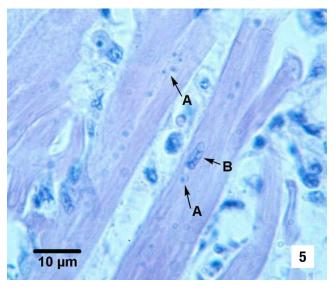
Oil immersion magnification (100 x objective) of M. mackini (arrows) within the cytoplasm of vesicular connective tissue cells of Pacific oyster. Haematoxylin and eosin stain

Source: S Bower



As for Fig 3 but from a different specimen. Because of the small size of this parasite, it is very difficult to visualise and photograph in histological preparations. Haematoxylin and eosin stain

Source: S Bower



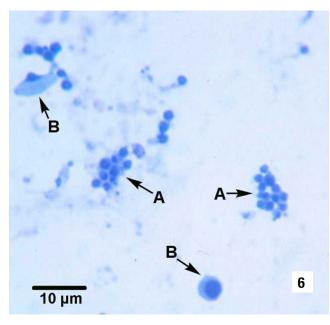
*M. mackini* (A) within fibres of the adductor muscle of Pacific oyster. One *M. mackini* is located close to the nucleus (B) of a muscle cell. Haematoxylin and eosin stain

Source: S Bower



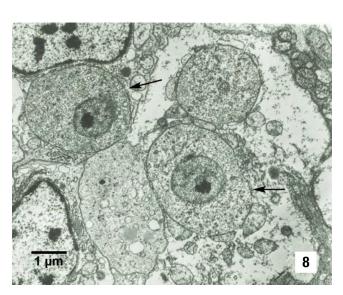
Sourced from AGDAFF–NACA (2007) Aquatic Animal Diseases Significant to Asia-Pacific: Identification Field Guide. Australian Government Department of Agriculture, Fisheries and Forestry. Canberra.

### **Histological images**



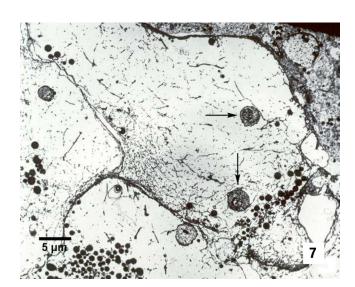
Clusters of *M. mackini* (A), isolated and partially purified from a heavily infected Pacific oyster, among host cell debris (B). Hemacolor® stain

Source: S Bower



*M. mackini* (arrows) each containing a nucleus with a pronounced nucleolus and lacking mitochondria. Uranyl acetate and lead citrate stain

Source: S Bower



Electron micrograph of a Pacific oyster vesicular connective tissue cell containing *M. mackini* (arrows). Uranyl acetate and lead citrate stain

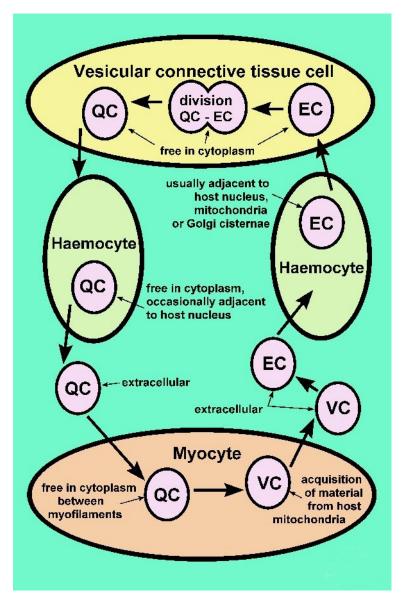
Source: S Bower



Sourced from AGDAFF–NACA (2007) Aquatic Animal Diseases Significant to Asia-Pacific: Identification Field Guide. Australian Government Department of Agriculture, Fisheries and Forestry. Canberra.



### **Histological images**



Proposed developmental cycle of M. mackini indicating host cell type and host organelle affiliation for the three recognised morphological forms: quiescent cell (QC), vesicular cell (VC) and edosomal cell (EC)

Source: S Bower



