

Controlling mudworm in oysters

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Commercial production of oysters in Australia began with the farming of the Sydney rock oyster (*Saccostrea glomerata*) in New South Wales and southern Queensland around 1870. Initially, oyster beds (5–20 m deep) were dredged and intertidal beds were harvested by hand, while a range of catching and growing substrata such as sticks, slabs of rock, and shell were placed on intertidal mudflats to exploit natural recruitment. As dredge beds were depleted, rock oysters from New Zealand, which belong to the same species as Sydney rock oysters, were imported. These imports of oysters into 12 oyster growing estuaries in NSW and southern Queensland from 1889 to 1898 caused, in all instances, immediate outbreaks of mudworm. Silt accumulation on oyster beds assisted the proliferation of mudworm. This pandemic permanently destroyed natural sub-tidal oyster reefs, and forced the oyster industry to adopt intertidal farming systems to cope with mudworm. Consequently, the industry progressively adopted stick and tray culture on intertidal racks in the early 1900s. To a large extent, this farming system protects oysters from mudworm. Dredge bed culture (a most effective way of oyster farming) has disappeared from all but a few areas in NSW, because of siltation and the mudworm.

Mudworm

The mudworm, *Polydora websteri*, is thought to be the most damaging of four spionid polychaete worms which infest and kill large numbers of oysters grown on or near the bottom in NSW or southern Queensland. Apart from the Sydney rock oyster, mudworm also infests most commercial molluscs, including Pacific oysters (*Crassostrea gigas*), blue mussels (*Mytilus galloprovincialis*), flat oysters (*Ostrea angasi*), pearl oysters (*Pinctada imbricata*), scallops (*Pecten fumatus*) and abalone (*Haliotis rubra*). In Tasmania, the mudworm, *Boccardia knoxi*, is found in subtidally cultured Pacific oysters, whereas *P. websteri* and *P. hoplura*

occur in intertidal oysters. The Pacific oysters that grow in some bays in South Australia have a problem with mudworm in particular years. This is surprising, as these bays are very oceanic, the water is very clear, and there is no mud or silt on the bottom. The species of concern in South Australia are *P. websteri*, *P. hoplura*, and *B. chilensis*.

Sydney rock oysters have been observed to become infested with *P. websteri* when mudworm larvae enter via the in-flowing food current and settle inside the oyster near the lip of the shell.

In North America, *P. websteri* larvae have been observed infesting eastern oysters (*Crassostrea virginica*), by boring through the shell exterior. It seems likely, therefore, that *P. websteri* uses varied routes of attack under different circumstances.

P. websteri larvae grow to become adult-segmented mudworms up to 25 mm long, 1 mm wide and red in colour. When mudworm larvae are filtered out with food, the worm builds a tube as it grows, which eventually extends to the outside of the oyster's shell, and through which it begins feeding. Muddy wastes, which result from the worm's feeding, are laid down in the tube between the shell and the mantle. The mud irritates the oyster, which responds by covering the worm's tube with a thin layer of shell to form a blister. The mudworm lives and reproduces within this blister, and lays down more compacted mud. The worm must maintain a tube across the lip of the oyster to be able to feed. In the case of shell-boring larvae, the worm maintains an opening through the shell. In heavily infested oysters in late summer, adult worms crawl between the shell and mantle and form U-shaped channels, with both open ends leading to the outside.

A healthy, rapidly growing oyster may be able to cover the worm and its mud blister and completely recover from the attack. If the oyster is slow-growing or already weakened by infestation, and if muddy conditions persist with warm summer temperatures that favour the growth of the worm, a large blister will result, and further infestation of oysters is likely. Mudworm-infested oysters become



Mudworm results in poor oyster condition and presence of unsightly and foul-smelling mud blisters, which easily rupture when the oysters are opened.



Figure 1. Sydney rock oysters infested with mudworm. Photograph: Ray Alley and John Matthews.

more susceptible to other stresses, such as high temperatures, low salinities and storage out of water. Oyster mortality due to mudworm is often very high, but economic losses also arise from infested oysters becoming unsaleable.

Preventative measures

Grow oysters in intertidal culture, and use the measures shown below as required.

1. Raising growing height

To prevent mudworm, oysters are grown above the mid-tide level. If oysters get infested, growing height should be raised further. Although this will reduce feeding time for oysters, it will also reduce the chance of continued infestation.

2. Washing oysters

Some oyster farmers wash mud from oysters on their leases using boom-sprays on punts to lower the risk of infestation. This treatment may be applied every 2–3 weeks during muddy periods in summer.

3. Maintenance of good tidal regime

The entrance to estuaries must be kept open, to maintain a good tidal range and good flushing of

estuaries. Some areas within estuaries may be more vulnerable to mudworm than others, such as areas with low flow conditions and high turbidity.

Control measures

Note that any control measures used on non-healthy oysters may result in mortalities. It is advised that farmers conduct small-scale trials before treating a crop of oysters with any of the measures listed below.

1. Drying oysters

Sydney rock oysters can be left out of water in the shade for 7–10 days to kill mudworm, without harming oysters.

2. Bathing oysters

a) Freshwater

Leaving Sydney rock oysters in freshwater for 2 days will kill the mudworm, *P. websteri*. The same treatment, applied to Pacific oysters for 12 hours, will kill the mudworm, *P. hopleura*, without harming oysters.

b) Brine

Immersing oysters in a saturated salt solution for 10–15 minutes followed by 15 minutes of drying in



Figure 2. Pacific oysters infested with mudworm. Photograph: Ray Alley and John Matthews.

the air, or a dip for 1 minute followed by air drying for at least 2 hours, is effective in killing the mudworm, *P. websteri*, in eastern oysters.

c) Iodine

Some farmers have successfully used an iodine bath to kill mudworm. Sydney rock oysters are left out to dry for 4–5 days, followed by a 2–3 hour bath in an iodine-based disinfectant solution (at 0.1 g of active iodine per litre of seawater), prior to returning oysters to the lease. It is claimed that this treatment is more successful in treating bad outbreaks of mudworm than drying alone.

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