Short Communication

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Are Outbreaks of *Marteilia sydneyi* in Sydney Rock Oysters, *Saccostrea commercialis*, Triggered by a Drop in Environmental pH?

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Abstract

Two outbreaks of *Marteilia sydneyi* in oysters near the mouth of the Brisbane River are described. Before the first outbreak the pH fell slightly, but before the second outbreak it remained unchanged. Changes in salinity and temperature were minor. The results indicate that these epizootics of *M. sydneyi* were not correlated with fluctuations in pH, salinity and temperature of water in close proximity to the oysters.

Introduction

Marteilia sydneyi Perkins and Wolf, 1976 is a paramyxean pathogen of the Sydney rock oyster, *Saccostrea commercialis* (Iredale and Roughley). The pathogen sporulates in the digestive gland of the oyster, spores are shed into the environment via the alimentary canal, and the rest of its life cycle is unknown including the stage infective to the oyster.

Seasonal outbreaks of the parasite occur in Sydney rock oyster farms along the mid-eastern coastline of Australia. These outbreaks usually follow heavy summer rains (Haysom 1978). In 1982, infection in oysters in Ningi Creek, Queensland, coincided with a period of heavy rainfall between 18 and 25 January (Lester 1986). A substantial drop in pH (from neutral or slightly alkaline to below 6) has been recorded after heavy rain in many rivers of New South Wales (NSW) in which *M. sydneyi* is endemic. For example, in 1987 deaths of all gilled organisms in the Tweed River, NSW, were attributed to heavy acidic run-off (pH 3·6) (Easton 1989; Sammut *et al.* 1993); iron pyrite in the soil had oxidized to sulfuric acid during a prolonged dry period. Since this killing, canegrowers in the region have raised their floodgates so that floodwater in their fields is diluted before being released into the river. Since then there have been no reported outbreaks of *M. sydneyi* in the Tweed River, where it was previously endemic (J. Bender, personal communication).

Since many rivers endemic for *M. sydneyi* become acidic at a time when oysters usually become infected, we conducted a field study to see if oysters became infected with the parasite only at times of low pH or if low pH allowed organisms already in the oysters to proliferate and become pathogenic. Salinity and temperature were also monitored.

Materials and Methods

The study site was at the Port of Brisbane Authority, near the mouth of the Brisbane River, Queensland. Oysters were obtained from Port Stephens, NSW, which is south of the southerly limit of *M. sydneyi*. This ensured that the specimens were completely free of *M. sydneyi*. Two bags of oysters were suspended from a pontoon below the intertidal level in the summer of

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1992–93: one in December with 50 oysters; and the other in February with 47 oysters. The December sample was tested for infection 55, 99 and 235 days after immersion in the Brisbane River and the February sample was tested after 47, 68 and 132 days. Diagnosis of *M. sydneyi* was by observing spores in wet smears of digestive gland under a microscope. When ten oysters from a sample tested negative for *M. sydneyi*, it was concluded that an outbreak had not occurred. This conclusion is based on the epidemiology of *M. sydneyi*; the parasite usually infects more than 50% of cultured oysters, and an infection below 20% has never been reported or personally observed. The intensity of infection was ranked as heavy and light when more than 100 sporonts and fewer than 10 sporonts per field of view (×20 objective) were observed, respectively.

Environmental pH, salinity and temperature were recorded every 30 min from late November 1992 to May 1993, with a Datasonde 3 Hydrolab (CHK Industries). Daily rainfall records from January to March for two sites near the study site were obtained from the Australian Bureau of Meteorology.

Results

Of 14 oysters from the December sample dissected after 55 days (early February), three were heavily infected with *Marteilia sydneyi*. Five out of seven oysters were heavily infected when examined 44 days later in mid March. Eighty-three percent of the remaining oysters were dead by August (late winter) and the rest were lightly infected. Ten oysters from the February sample were not infected when examined 47 days later (late March). Twenty-one days later (mid April) five out of ten oysters in the February sample were heavily infected, and by August 85% of the remaining oysters were dead and the rest were lightly infected.

During the test period the ranges of pH and salinity were 7·7 to 8·6 and 30 to 37 g kg^{-1}; there were no severe fluctuations in temperature (Fig. 1).

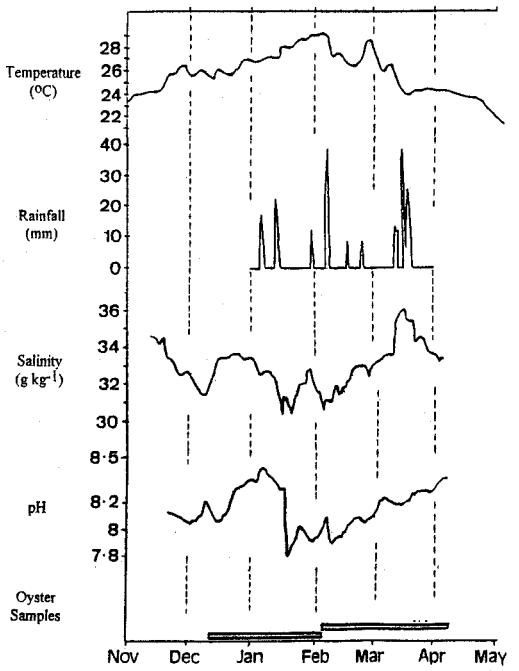

Fig. 1. Temperature, rainfall, salinity and pH data recorded during the test period. The period of time each oyster sample spent in the water until *M. sydneyi* was diagnosed is represented by a horizontal bar.

Discussion

The measured environmental variables did not fluctuate markedly or reach extremes. The stable salinity correlates with a lack of prolonged periods of heavy rainfall. The study

site has a salinity of 34 g kg^{-1} for most of the year but this can fall to 10 g kg^{-1} during summer floods (Davie 1990). The minor fall in pH and salinity, caused by run-off after some rainfall, occurred about three weeks before oysters from the December sample were observed to be heavily infected with *M. sydneyi*. It is possible that oysters became infected at that time and spores had developed after three weeks. Past research on the parasite has found that the disease can be diagnosed by wet smears two weeks after the parasite starts to develop (Lester 1986).

There were no fluctuations in pH from the time the February sample was first immersed in the water until they were found to be infected in April; this suggests that a drop in pH in water contacting the oysters is not necessary for an outbreak of *M. sydneyi* to occur.

The results of this study confirm the beliefs of Wolf (1979) and Balouet (1979) that environmental stresses on oysters such as variations in temperature and salinity have little significance to outbreaks of *Marteilia*.

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