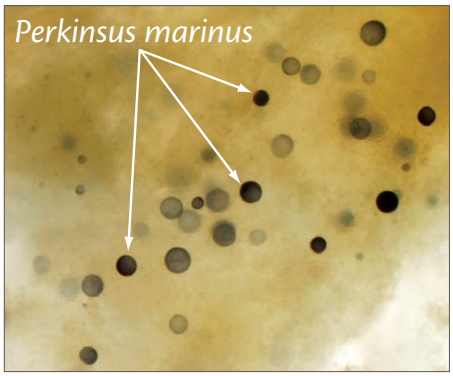
ASIAN OYSTERS:
IMPLICATIONS FOR OYSTER DISEASE

The proposed introduction of the Asian "Suminoe" oyster, Crassostrea ariakensis*, into Chesapeake Bay has been met with concern partly because of its potential implications for oyster disease. Diseases are major causes of mortality for the native Eastern oyster (*Crassostrea virginica*), a reality that underpins arguments for introducing a more disease-resistant oyster species. The Asian oyster is being investigated for its susceptibility to and potential to serve as a transmission vector for a range of oyster diseases. This will help determine whether the Asian oyster might worsen problems of established diseases or serve as an inroad for new ones (Table 1).*

ASIAN OYSTER SUSCEPTIBLE TO KNOWN PATHOGENS

EXISTING DISEASES

The disease commonly know as Dermo is currently the most destructive of all the diseases affecting the Eastern oyster in the mid-Atlantic region. Research has shown that the Asian oyster is relatively resistant to infection from the parasite (*Perkinsus marinus*) that causes Dermo (Figure 1), but heavy infections have been observed in laboratory settings. In its native environment, the Asian oyster has been shown to be susceptible to other *Perkinsus* species, however the effects are not well understood.



Infection of oyster muscle tissue with Dermo disease.

The potential for accidental introduction of a new *Perkinsus* species with the Asian oyster is a concern, but is controlled by international quarantine protocol.

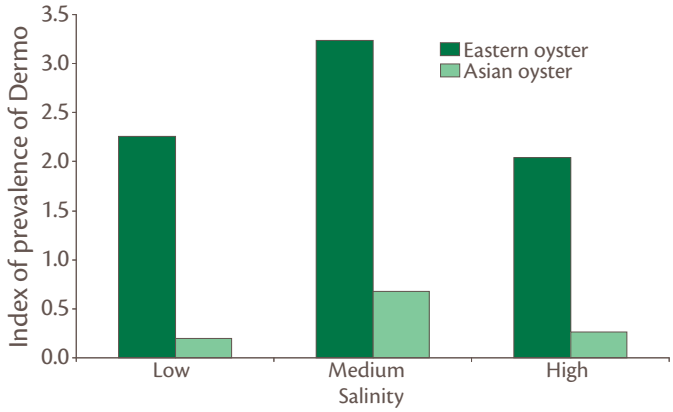


Figure 1: Prevalence of Dermo, caused by Perkinsus marinus*, in Eastern and Asian oysters in three salinity regimes. Data: Calvo et al, 2001.*

Eastern oysters are also susceptible to the disease known as MSX, which is caused by a protistan parasite called *Haplosporidium nelsoni*. In recent years, Eastern oyster populations have started developing a resistance to this disease. The Asian oyster is relatively resistant to MSX as well.

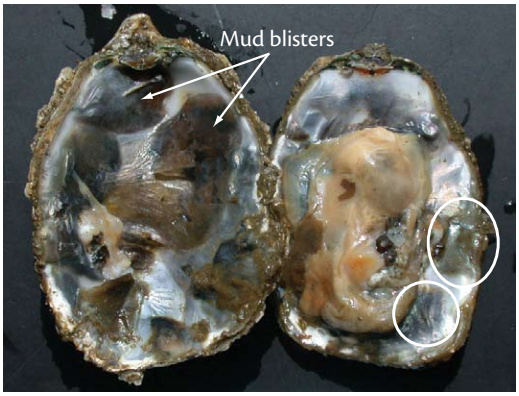
Infestation by common shell-boring polychaete worms (*Polydora* sp.) is a problem in Asian oysters. These pests have been found to easily penetrate the interior of thin Asian oyster shells.

** referred to as the Asian oyster throughout this newsletter*

Table 1: Comparison of diseases that affect Eastern and Asian oysters.

Disease/condition	Pathogen	Point of interest
Dermo	*P. marinus*	Asian oyster relatively resistant
MSX	*H. nelsoni*	Asian oyster resistant Eastern oyster somewhat resistant
Bonamiasis	*Bonamia* sp.	High mortality in Asian oyster
Virus infection	Herpesvirus	Risk of introduction
Polychaete infestation	*Polydora* sp.	Shell fragility, reduced marketability in Asian oyster

The "mud blisters" produced by the oyster in response reduce half-shell marketability and can impact oyster condition and defense against predators (Figure 2). Compromised shells could exacerbate an already heightened Asian oyster susceptibility to predators.



The shell on the left is almost completely covered in blisters of varying age. Note the calcareous nodules indicating the presence of worms (circles).

Figure 2: Photo of an Asian oyster heavily infested with Polydora *worms. Oysters lay down shell material to contain the worms, thus producing mud blisters.*

POTENTIAL NEW DISEASES

Surveys of Asian oyster populations in their native range have revealed another pathogen: a herpesvirus originating from Korea and Japan. This molluscan herpesvirus is similar to those that have caused high mortality of larval and juvenile shellfish in hatcheries in other countries. If this herpesvirus can be transmitted vertically from parents to offspring through oyster gametes, a possibility not yet disproven, a genuine risk of accidental introduction may exist. The potential effects of herpesvirus infection on mid-Atlantic species remains a key question.

EMERGING NEW DISEASE AFFECTS ASIAN OYSTER

In 2003, Asian oysters in controlled field trials in Bogue Sound, North Carolina, were found to be infected with a *Bonamia* species, a parasite of oyster blood cells, causing very high oyster mortality rates. The disease caused by this parasite, bonamiasis, primarily affects Asian oysters under 50 mm in size, though serious infections can still be observed in larger oysters (Figure 3). It is a disease of warmer summer months, when water temperatures are greater than 20–25° C, and of coastal waters with salinities above 25. The Eastern oyster is not known to be susceptible to *Bonamia*, but the crested oyster, *Ostrea equestris*, which is native to the South Atlantic, Gulf of Mexico, and West Indies is susceptible to *Bonamia*.

This disease has decimated oyster populations in Australia, New Zealand, and Europe, but was unknown in the mid-Atlantic and southeastern United States until recently. This *Bonamia* species now ranges from Cape Hatteras, North Carolina, to southern Florida. A northward expansion of the parasite's range with warming ocean temperatures must be addressed. *Bonamia* may eventually limit Asian oyster survival and culture in waters from the mid-Atlantic to southern Florida.

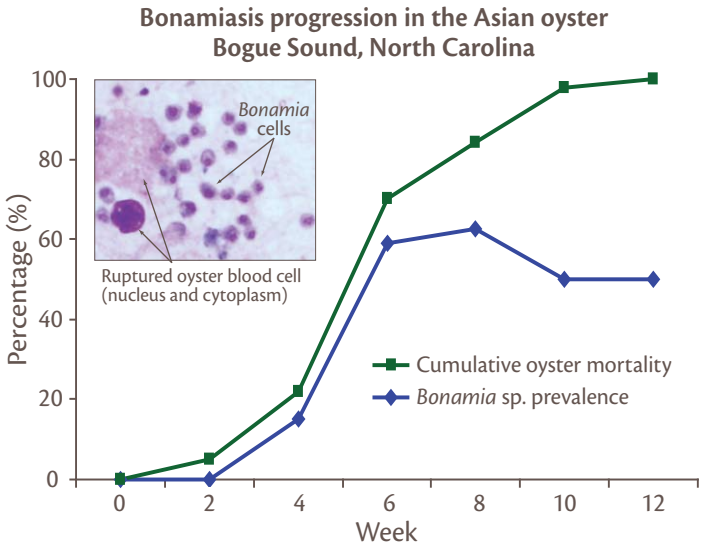


Figure 3: Oyster mortality and Bonamia *prevalence (i.e. the percentage of oysters with* Bonamia *cells) over time, July–October 2005. Data: Carnegie et al., submitted.*

COULD THE ASIAN OYSTER INCREASE DISEASE LEVELS?

> "A non-native species could potentially influence ... disease in native species by acting as a source and increasing transmission of pathogens, or by acting as a sink and decreasing pathogen supply and transmission. It is possible for a species to act as a source or sink if it becomes infected, whether or not that species suffers significant mortality from the pathogens..." (Chesapeake Bay Program's Scientific and Technical Advisory Committee, 2004)

Concern remains that the Asian oyster may be a reservoir for an exotic pathogen that otherwise would not gain a local foothold. Questions also remain regarding the function of the Asian oyster — pathogen source or sink — with respect to local pathogens (Figure 4). The Asian oyster may be irrelevant to MSX disease transmission, and while it acquires Dermo disease, there is little suggestion that Asian oysters will be significant sources of Dermo, particularly when measured against the vast numbers of more susceptible Eastern oysters. Virulence of *P. marinus* in Asian oysters may change over time, however, so the nature of future interactions of *P. marinus* with Asian oysters is impossible to predict. Any expectation that the Asian oyster will serve as a significant sink for *P. marinus* cells is probably unrealistic. The Asian oyster is more likely to act as a source for *Bonamia*, given the vast number of parasite cells that are generated by dying Asian oysters, and the susceptibility of at least one oyster species, *O. equestris*, to this parasite.

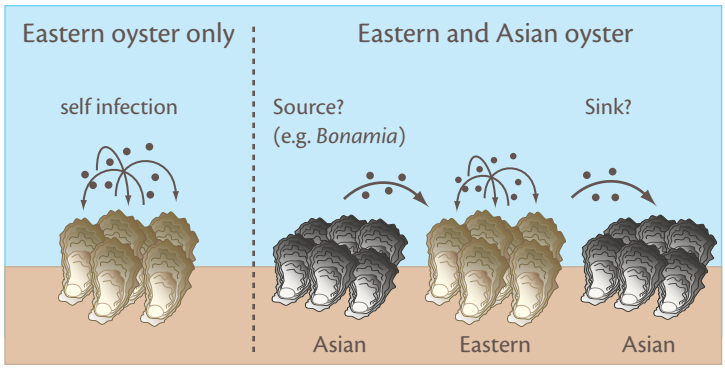


Figure 4: Questions still remain about the potential of the Asian oyster to act as a source or a sink for Dermo, bonamiasis and unknown or new diseases.

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