NOTABLE OYSTER DISEASES

“Dermo” (Perkinsiosis) of the American (Eastern) Oyster (Crassostrea virginica)

“Dermo” (or, more formally, perkinsiosis) is caused by a parasite (now named Perkinsus marinus, but previously known both as Dermocystidium marinum and as Labyrinthomyxa marina) that infects almost all tissues of the oyster. It is transmitted by direct contact in water but is limited by its inability to tolerate low salinities and low temperatures.

The disease occurs during the warmest months of the year and is more severe in highly concentrated populations of oysters. The disease has had a serious impact on oyster culture on the Gulf and Atlantic coasts for at least 45 years, first being described in association with serious mortalities in the Gulf of Mexico in the 1940s but probably present as early as the 1930s.

Geographic Range and Species Infected

The disease occurs on the Atlantic coast of the United States from Delaware Bay south and on the Gulf Coast. However, it does not occur in all oyster-growing areas within this general geographic range. It has been reported in American oysters cultured in Hawaii, but it is not known if the disease is still present there. The severe effects of this disease in Chesapeake Bay and along most of the Gulf Coast are especially well known. There is a resurgence of the disease in Chesapeake Bay associated with drought.

The American oyster is the only species known to be infected by this parasite, although there are reports of similar parasites infecting other molluscs elsewhere in the world.

Mortality Rate, Environmental Factors, and Seasonality

The severity of the disease increases periodically in infected areas. Mortalities can reach 100% and have been reported to be 30%-50% in the first year, with cumulative mortalities of 75% and higher in the second year in oysters introduced to an infected area. The disease does not cause serious mortalities below salinities of 12-15 ppt (parts per thousand) but can persist in overwintering oysters in salinities below 5 ppt.

“Dermo” is a warm-temperature disease; outbreaks and mortalities occur in the summer months (June through October in the Chesapeake). Epizootic disease occurs typically in warming temperatures in the 18°C-30°C range.

The disease increases dramatically in infected areas that receive heavy plantings of oysters. It has been shown to be transmitted over at least 50 ft in the water, and it is
possible that it is transmissible over much greater distances. The disease can be spread from one oyster to another by Boonea impressa, a gastropod parasite of the oyster. Boonea can increase the infection intensity of oysters already infected with Perkinsus as well as initiate new infections in the oysters on which it feeds.

**Diagnosis**

The parasites are not visible to the naked eye. As they do with other terminal conditions, oysters infected with dermo will show a weakened shell closure and gape. Decrease in growth is reported to occur several months before the onset of mortalities. Heavy infections of the parasites can be visualized under the microscope with the aid of Lugol's iodine stain (see reference by Ray 1966) as shown in Figure 1. The parasites can be enlarged to facilitate microscopic visualization by culturing the oyster tissues in a specialized microbiological culture medium. This technique and histological confirmation of the disease require professional assistance.

*Figure 1. Perkinsus marinus* parasites, magnified 400 times, in a sample of oyster tissue after five days in a microbiological growth medium (fluid thioglycollate) and stained with iodine. This method can be used to help identify infected oysters.
Prevention and Management

Disease-free Areas

American oysters infected with the disease should not be imported into disease-free areas. Historical records of the disease, in conjunction with the microbiological and histological methods mentioned above, make it possible to be reasonably certain of the presence or absence of the disease in a given population of American oysters.

Although the disease is geographically widespread, there appear to be areas of disease-free American oysters on the Atlantic coast. Conditions on the west coast of North America are not favorable for cultivation of the American oyster, and there is no evidence that the disease affects any of the oysters cultured there. Nevertheless, any proposed movement of American oysters to disease-free areas should include a thorough examination to ascertain the dermo-free status of the oysters.

Areas Known to Have the Disease

Eradiation is not considered possible due to the widespread nature of the disease and the lack of knowledge regarding other species that might carry the disease. Management methods consist of reducing the density of oysters and harvesting or moving oysters to low-salinity areas before the warm months.

References


MSX Disease of the American (Eastern) Oyster (Crassostrea virginica)

MSX disease is caused by a parasite known as Haplosporidium nelsoni (formerly known as Minchinia nelsoni) and originally referred to as multinucleate sphere unknown (MSX). The disease is also known as haplosporidiosis of American oysters and Delaware Bay disease. The parasite invades virtually all tissues of the oyster, but apparently it requires another host species (as yet unknown) in order to complete its life cycle.

The disease was first recognized in Delaware Bay in 1957. It rapidly destroyed the Delaware Bay industry, with mortalities of oysters reaching 90%-95% by 1960 (see Figure 2). The percentage of infected oysters and mortality due to the disease have fluctuated over the years. Seed from partially resistant Delaware Bay stock introduced into infected areas are still subject to serious mortalities, reported to be in the 30% range after one year. Evidence shows that this resistance to the disease has occurred in some stocks of oysters subjected to continuing infection over the years (see Figure 3). The parasite causes serious mortalities in Chesapeake Bay as well. Since about 1980, a recurrence of the disease has been observed in both Chesapeake Bay and Delaware Bay, associated with a drought.

Geographic Range and Species Infected
MSX disease has been reported from Maine to Florida, but the most serious mortalities occur in Delaware Bay and Chesapeake Bay. The American oyster is the only oyster known to be infected, but similar parasites infect a variety of other bivalve molluscs.

Mortality Rate, Environmental Factors, and Seasonality
The early infections in Delaware Bay resulted in mortalities approaching 100% over three years. Oyster stocks introduced to Delaware Bay that have not been subjected to MSX disease show similarly high mortality rates. On seed beds in Delaware Bay, annual mortalities of stocks exposed (and thus partially resistant) to the disease were estimated to be in the 4%-9% range, before the drought that began in 1980. About 30% of these seed were estimated to have died within one year when transplanted to infected high-salinity growout beds. Mortalities have been higher in recent years, exceeding 50% even among the resident Delaware Bay stocks.
Salinity and temperature are known to affect the severity of MSX disease. In general, the disease is rarely acquired below about 10 ppt (parts per thousand); salinities of about 15 ppt are required for the parasite to appear in substantial numbers in host tissues, and serious mortalities occur only above about 20 ppt. There is some indication that the disease may be limited by a salinity greater than 30 ppt.

Oysters become infected during the warm months (late May through October), with peak mortalities in late summer and early fall and again in the following summer. The disease reappears or increases in severity in drought years. The parasite appears to be sensitive to high temperatures; in oysters with some resistance, the disease is reported to go into remission or disappear when temperatures exceed about 20°C.

**Diagnosis**

A definitive diagnosis requires professional pathological assessment or microscopic examination of oyster tissues. The following signs characterize the disease, but other
Figure 3. Evidence that oysters from Delaware Bay develop some resistance to *Haplosporidium nelsoni* (the cause of MSX disease) after continuous exposure to the parasite. The highest mortality occurred in the oysters that had not been exposed to MSX. The reduced mortality rates are shown for the first-, third-, and fifth-generation offspring (F₁, F₃, and F₅, respectively) of the original stocks. The graph shows that the greatest differences in mortality rate for the offspring are in their first three years of being exposed to MSX. (Graph courtesy of S. E. Ford, from Ford and Haskin 1987)

diseases may cause similar signs: thin, watery oysters with pale digestive glands; mantle recession and heavy fouling along the interior margins of the left-hand valve in oysters with advanced infections; and, in some cases, raised yellow-brown deposits on the interior valve surfaces in older surviving oysters.

**Prevention and Management**

**Disease-free Areas**

As in the case of other infectious oyster diseases that cause serious mortalities, MSX-infected oysters should not be introduced into areas where the disease has not been
reported. Historical and pathological evaluation of American oyster stocks should be made to locate disease-free stocks of animals if this species is needed for importation to other areas.

Since the American oyster does not thrive under conditions on the continental west coast of North America, and since MSX disease does not appear to infect the presently cultivated species on that coast, there appears to be little risk from this disease on the west coast today.

**Areas Known to Have the Disease**

Eradication is not a feasible approach because of the widespread occurrence of the disease and the possible existence of other unknown hosts involved in the life cycle of MSX. In infected areas, it is clear that the disease can be controlled by holding the oysters in low-salinity areas or, where possible, by taking advantage of the sensitivity of the parasite to temperature and salinity. Oysters should be held for as short a time as possible in high-salinity areas where they may be transferred for growing.

For large-scale control of the disease, an MSX-resistant strain of oysters (as developed by researchers at the Rutgers Oyster Research Laboratory in Bivalve, New Jersey) offers the best hope.

**References**


Seaside Haplosporidiosis of American (Eastern) Oysters
(Crassostrea Virginica)

Seaside haplosporidiosis is caused by a parasite known as Haplosporidium costale (formerly Minchinia costalis). After its discovery in 1959 it was described as a seaside organism (SSO) due to its occurrence in the more saline waters on the seaside coast of Virginia and Maryland, in contrast to Haplosporidium nelsoni (causing MSX disease), which is found in more inland waters such as Chesapeake Bay. The disease caused three years of serious mortalities from 1959 to 1961, but it has not been so severe and recurrent a problem as MSX disease. However, annual mortality rates can reach 50% in seaside bays of Virginia.

The parasite infects all tissues of the oysters except the epithelium and is capable of causing substantial synchronous mortalities when the parasites form spores.

Geographic Range and Species Infected
Only the American oyster is infected. The disease has been reported in some populations from the Virginia coast north to Maine. Serious mortalities from the disease are reported only in high-salinity bays on the seaside coast from Virginia to Delaware.

Mortality Rate, Environmental Factors, and Seasonality
The disease is detectable only by pathological examination from March through June of each year and is associated with mortalities in May and June. Infections acquired in the spring of one year may not cause death until the following spring, when the mortality rate can reach 50%. Oysters may also be infected with MSX disease, which often kills the oyster before it can succumb to Haplosporidium costale. Thus, the apparent rate of mortality due to H. costale is lower than it would be if the MSX organism were not present.

The fact that this disease occurs on seaside coasts rather than in the more inland embayments apparently results from its requirement for high salinities to infect and cause disease in the host.
Diagnosis

A definitive diagnosis is based on a histological examination of tissues and identification of the parasite; professional assistance is required for the identification of the parasites’ life stages. Sick and gaping oysters are thin and may be discolored.

Prevention and Management

Transplantation of oysters to less saline areas retards or eliminates the disease. In the Chesapeake Bay region, this may be effective for seaside haplosporidiosis, but oysters may then become infected with the more serious MSX disease.

References


Velar Virus Disease of Pacific Oysters

Oyster velar virus disease (OVVD) is known only as a hatchery disease and is commonly referred to as “blisters” by hatchery workers. The virus causing the disease belongs to a group known as the iridoviruses. It infects the epithelium of the velum of the larva and can cause serious mortalities in hatchery operations. The virus is most likely carried in the adult oyster and may even cause some form of disease in the adult, but this has not been documented.

Geographic Range and Species Infected

Washington is the only state that has reported the presence of OVVD. However, considering the historical commerce of this oyster around the Pacific Rim, it is likely that the disease is much more widespread than is now known.

Larvae of the Pacific oyster, Crassostrea gigas, are the only species and life stage known to be infected by the disease. Although the disease has been confirmed only in hatchery-reared larvae, it probably occurs in some wild stocks as well. Similar viruses have been observed in adult Pacific and Portuguese oysters in France, but their relationship to OVVD has not been determined.