Aqua Info
AQUACULTURE NOTES

AIN 29.2025

Oyster Diseases: MSX, Dermo, SSO, Malpeque Disease

The American oyster, also known as the Eastern oyster (*Crassostrea virginica*), may be subject to a variety of diseases. Four diseases reported in Atlantic Canada include MSX (multinucleate sphere unknown), dermo, SSO (seaside organism), and Malpeque disease. These diseases do not pose risks to food safety or human health but may inhibit oyster growth rates and cause oyster mortality.

Generalized Symptoms of Oyster Diseases

Regardless of the disease, oysters show general symptoms of poor health. These symptoms may include some, or all of the following signs: gaping of the shells (Figure 1) or slow to close, pale digestive glands, thin and watery meat appearance, slowed shell growth, and/or mantle recession from the outer shell. However, not all infected oysters will appear sick, particularly when a disease progresses rapidly.

Figure 1. Gaping oyster collected in Bedeque Bay, PEI in September 2024.

Disease Control Strategies

To mitigate the spread of disease, do not transfer oysters from an infected area to a non-infected area. An Introduction and Transfer license must be obtained before moving any bivalve molluscs between areas, to inform risk-assessment and limit spread of diseases. Please additionally consult regional CFIA regulations and permit requirements. When moving between areas, ensure all equipment is clean by removing large debris (shells, mud, algae, etc.), rinse, and disinfect all equipment with a bleach solution (30mL bleach in 2L freshwater; mixed solution considered effective for 24h). Let dry completely before using again. Allowing grow-out areas to remain fallow for one to two years before planting seed stocks may also reduce local infection levels.

MSX

MSX is a disease caused by the parasite *Haplosporidium nelsoni.* MSX mainly affects American oysters, while Pacific oysters (*Crassostrea gigas*) may be infected at low levels (<5%) with no associated mortality. MSX can infect oysters of all ages, but mortalities are typically observed in those more than two years old. Mass oyster mortality events (up to 95% within two years) were first reported on the North American east coast in Delaware Bay in 1957. Warming winter temperatures induced by climate change are thought to have facilitated the northward proliferation of MSX along the American eastern seaboard. MSX was first documented in Canada in 2002 in Cape Breton, Nova Scotia (NS). Annual provincial and federal monitoring programs were conducted with no further detections until 2024 in Prince Edward Island (PEI) and New Brunswick (NB).

Parasite Transmission

Despite many laboratory attempts, the transmission of *H. nelsoni* from an infected oyster to a non-infected oyster has never been

successful. It is therefore thought that an intermediate host (such as plankton or benthic invertebrate) is required to transmit the parasite, however, this host has not yet been identified. The complete life cycle is currently unknown, but two life stages are well documented (Figure 2): small parasite bodies and spores that are seen in oyster tissue using a microscope. These findings aid in the diagnosis of the disease. Infections are acquired through gill and mantle tissue, then spread rapidly throughout the oyster. Spores may be released through feces, however, their fate in the environment is unknown at this time.

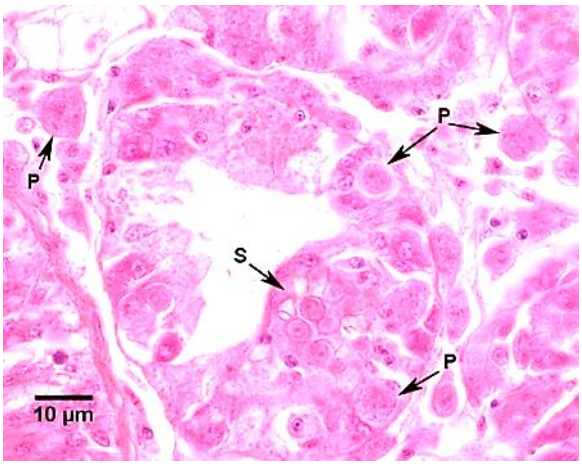

Figure 2. Histological section through the digestive gland of *C. virginica* infected with *H. nelsoni*, showing parasite bodies (P) and mature spores (S). Source: Haplosporidium nelsoni (MSX) of Oysters

Environmental Conditions

Haplosporidium nelsoni is pathogenic in waters with salinities above 15ppt. At water temperatures between 5 and 20°C, infections are acquired, and the parasite proliferates. The infection period begins in the spring and continues through the summer. Peak mortalities of susceptible oysters occur in the fall, when water temperatures return below 20°C. Surviving oysters, or newly set spat first exposed to MSX in the fall, may maintain infection throughout the winter, causing a mortality event the following spring and summer. Winter temperatures may affect the viability of the parasite with colder winters reducing the number of parasites that survive.

Mitigation Strategies

Low salinity immersion may decrease MSX infection levels, but time-temperature-salinity combinations are not fully understood. Studies have found that infections may be eliminated in two to three weeks by immersing oysters in salinities below 10ppt. Oysters should be returned to high salinity waters late in the season to avoid the major early-summer infection period. Water depth may also affect disease progression. One study showed that oysters on-bottom in less than 0.5m water depth have decreased parasite susceptibility compared to those on-bottom in more than 1m water depth. The study suggested piling shells and constructing artificial reefs as a strategy, rather than spreading thin layers of oysters on the bottom. Another study suggested that suspended culture of oysters may reduce the lethal impact of MSX, compared to oysters grown on the bottom. This may be due to increased growth rates and reduced exposure time to MSX, as well as differences in environmental conditions. However, additional studies are needed to confirm this theory and provide information on why this may be true.

Dermo

Dermo is a chronic wasting disease caused by the parasite *Perkinsus marinus.* Dermo mainly affects American oysters that are more than one year old. Clams (*Mya arenaria, Macoma balthica, Macoma mitchelli, Mercenaria mercenaria*) may carry the parasite but there is no evidence that they become infected because the parasite does not multiply inside the host or cause mortality. Dermo-associated oyster mortalities were first documented on the North American east coast in the Gulf of Mexico and Chesapeake Bay in the 1940s and 1950s. Dermo was not a significant cause of concern until a new strain emerged in the 1980s, resulting in more severe mortality events (50 to 75%). Warming temperatures have since facilitated the northward proliferation of the parasite. Dermo was first documented in

Canada in 2024 (NB and mainland NS). As of 2024, dermo has not been detected in PEI.

Parasite Transmission

Unlike MSX, the transmission of dermo is directly from oyster to oyster. Infective stages of *P. marinus* are released from infected oysters via feces, pseudofeces and decaying tissues, then ingested by nearby susceptible oysters. Infective stages begin to damage oysters in the mantle or digestive tract. The parasite goes through several life stages in the oyster tissue (Figure 3). The parasites enter oyster blood cells and multiply, then burst the blood cells and spread throughout the oyster. Death is often the result of the parasites spreading throughout the oyster.

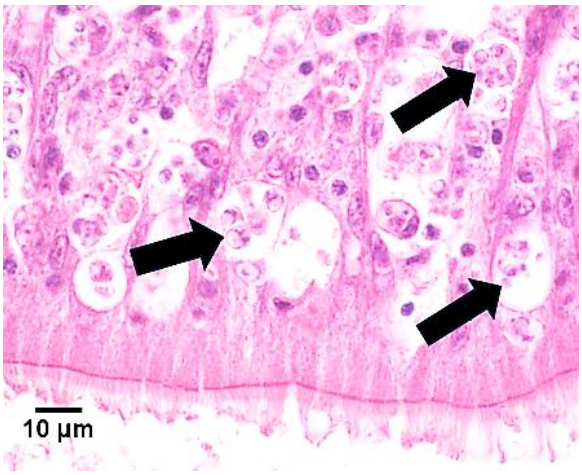

Figure 3. Histological section of *C. virginica* infected with *P. marinus*, showing three different life stages in oyster tissue. Source: Perkinsus marinus ("Dermo" Disease) of Oysters

Environmental Conditions

Perkinsus marinus prefers high salinities and shows low infection intensities below 9ppt, although the parasite can still persist for years at lower salinities. Infections start to be acquired when water temperatures reach 15°C. Between 20 and 25°C, the parasite proliferates and infections intensify. Typically, oysters are killed when water temperatures exceed 25°C. The rate of mortality will be influenced by the strain of the parasite, the condition of the oysters and environmental conditions. Infection prevalence in surviving oysters declines significantly in the winter and may become undetectable until summer. However, low levels of the parasite remain in the oysters, which then proliferates once temperatures increase again. Some oysters may survive summer proliferation of the parasite but may not be able to revive following winter dormancy. Warm winters may result in a higher proportion of over-wintering parasites, and higher infections and mortalities rates.

Mitigation Strategies

Mitigation strategies may include repetitive and well-timed low salinity (<5ppt for 3 weeks) immersion treatments in the spring, before water temperatures reach 15 to 20°C, to prevent infection or maintain non-lethal intensities.

SSO

SSO is a disease caused by the parasite *Haplosporidium costale*. SSO mainly affects American oysters, while Pacific oysters may be infected at low levels with no associated mortality. SSO is restricted to high salinity waters greater than 25ppt therefore the disease may be mitigated by moving infected oysters to lower salinity waters.

Parasite Transmission

SSO is not spread directly from oyster to oyster, therefore an intermediate host may be required for parasite transmission. Infection begins in early summer (May to June) but is not significant until the following spring. Parasite bodies first become detectable in connective tissues of the digestive gland, mantle and gonads in May and June. Spores develop throughout the connective tissues by late June and July, at which point mortalities are observed. In Virginia, SSO-associated mortalities are generally less than 20%, but can sometimes reach up to 40%. Mortality rates are much lower in the northern USA and Atlantic Canada. Starting in 2002, *H. costale* has been detected in Atlantic Canada, however the low prevalences and infection intensities are not currently a cause of concern.

Malpeque Disease

Malpeque disease is named after its first appearance in Malpeque Bay in 1915, following the introduction of juvenile oysters from New England. Cumulative oyster mortality reached over 90% within three years. Between 1915 and 1937, the disease devastated oyster stocks across PEI. Malpeque Bay survivors began showing natural resistance to the disease and recovered to pre-epidemic levels by 1935. Resistant oysters from Malpeque Bay were therefore introduced to the rest of PEI, where recovery was achieved within 10 years. The disease spread to NB and mainland NS starting in the 1950s with losses above 90% within two years. Resistant oysters from Bedeque Bay were transplanted to NB and mainland NS to facilitate the recovery of oyster populations. From the 1960s to 1990s, susceptible oysters from the Bras d'Or Lakes were introduced to Malpeque Bay, with resulting mortalities of 90%, suggesting that the disease remained active. No further outbreaks were reported until 2007 when a suspect case was reported in Cape Breton, NS. The cause of Malpeque disease remains unknown despite several attempts to identify the causative agent. Although the disease remains prevalent, oysters in the Maritime Provinces (outside the Bras d'Or Lakes) are generally considered resistant to the disease.

Identification

In addition to mantle regression and gaping of the shells, Malpeque disease may be identified by oedema (swelling caused by accumulation of liquid) in the mantle and white to yellow abscesses (up to 1cm) in the digestive system and associated connective tissues. Yellow scars may be present on the inner surface of the shell aligned with lesions in the soft tissues (Figure 4). Histological observations may include retardation of gonad development and connective tissue abscess lesions in conjunction with focal infiltration of haemocytes (blood cells), especially in association with intestinal walls (Figure 5). There may additionally be a significant presence of ceroid (brown pigment) within the digestive gland, and abnormal haemocytes characterized by enlarged nuclei and reduced cytoplasm. The combination of gross pathology and histopathology is diagnostic for Malpeque disease. It is distinguished from the other three diseases described because no disease agent is visible using histology.

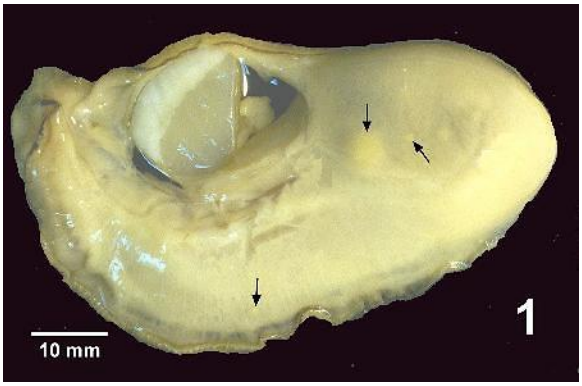

Figure 4. Soft tissues of *C. virginica* removed from shell showing lesions (white nodules, arrows) typical of Malpeque disease. Source: Malpeque Disease of Oysters

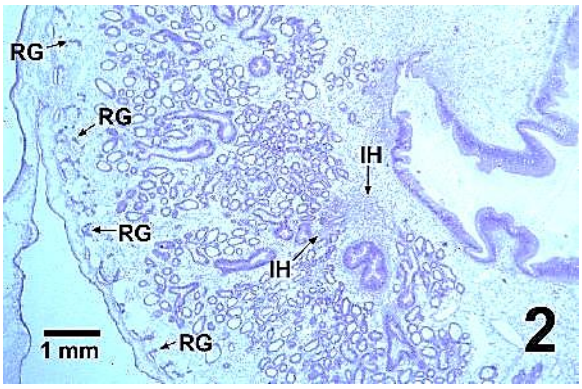

Figure 5. Histological section through the digestive gland and adjacent intestinal tract of *C. virginica* at an early stage of Malpeque disease showing infiltrating haemocytes (IH) and retardation of gonadal development (RG). Source: Malpeque Disease of Oysters

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