



Comparing MSX and Dermo: Diseases of the Eastern oyster *Crassostrea virginica*

Disease	Multinucleate Sphere Unknown (MSX)	Dermo
Parasite	<i>Haplosporidium nelsoni</i> (protozoa)	<i>Perkinsus marinus</i> (protozoa)
No human health concerns.		
Symptoms	Inhibits growth rates and reproductive capacity. Not all infected oysters appear sick. Signs of infection may include gaping shells or slow to close, pale digestive glands, thin and watery meat, no new shell growth or slowed shell growth, and mantle recession from outer shell.	
Infection and Mortality	Can infect oysters of all ages; typically see mortalities in oysters >2 years old. Mortality rates up to 95%.	Typically affects oysters >1 year old. Mortality rates between 50-75%.
Effect of Salinity	Infections occur >15 ppt and may be greatly reduced after 2-3 weeks <10 ppt.	Prefers high salinity. Low infection intensities <9 ppt but can persist for years.
Effect of Water Temperature	Infections are acquired and the parasite proliferates between 5-20°C. Infection period begins in the spring and continues through summer. Peak mortalities of susceptible oysters often occur in the fall, when water temperatures return <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. When winter temperatures are consistently <3°C, development of the disease is limited, but disease will occur once warmer temperatures return.	Infections are acquired at water temperatures >15°C. The parasite proliferates and infections intensify between 20-25°C. The parasite quickly multiplies, spreads, and kills susceptible oysters at water temperatures >25°C. Infection prevalence in surviving oysters declines significantly in winter and may become undetectable until spring/summer. However, low levels of the parasite remain, which proliferates once temperatures increase again. Warm winters may result in a higher proportion of over-wintering parasites, and higher infection and mortality.
Parasite Transmission	Direct transmission of <i>H. nelsoni</i> from oyster to oyster has not been achieved. The current hypothesis is that an intermediate host transmits the parasite.	Infective stages of <i>P. marinus</i> are released via feces, pseudofeces, and decaying infected tissues. The waterborne infective stages are then acquired by nearby oysters during filter-feeding, therefore the parasite is directly transferred from oyster to oyster.