

Chapter 7. Shellfish Health

Overview

- Many factors affect the health of bivalves including: infectious agents, pollutants, oxygen deficiency, salinity and temperature extremes, siltation, fouling organisms, predation, starvation and toxic algae blooms. Infectious agents such as viruses, bacteria and parasites may cause disease outbreaks and high mortalities.
- This section will provide an overview of the most common diseases and parasites for different types of shellfish.

Oysters, *Crassostrea virginica*

- The most important disease of the Eastern oyster is MSX (Multinucleated Sphere X), which is caused by the protozoan parasite *Haplosporidium nelsoni*^{13,14}. The parasite causes outbreaks and mortalities every few years (Fig. 1).
- A higher degree of resistance to *H. nelsoni* is developing in native oyster populations on the east coast of the United States^{15,16}. This rising resistance to *H. nelsoni* is also observed in Connecticut, where each outbreak is associated with less oyster mortality.
- Another parasite of the same genus, *Haplosporidium costale*, SSO (Seaside Organism), occurs as a coinfection with MSX¹⁷. It is less prevalent than *H. nelsoni*.
- A protozoan parasite, *Perkinsus marinus*, the causative agent of Dermo-disease, is present in Connecticut's oysters¹⁸. *P. marinus* occurs with high prevalence (Fig. 2), but low intensities (Fig. 3), which means there are very few parasites within each oyster. Consequently, no significant Dermo-associated mortality is detected in market-size or younger oysters. Intensity of Dermo increases each year as the oyster ages. Dermo-associated mortality can be avoided by harvesting oysters when they reach the market size.
- *Roseovarius* Oyster Disease (ROD), previously known as Juvenile Oyster Disease (JOD), affects hatchery-raised seed of Eastern oysters. The disease is caused by the bacterium *Roseovarius crassostreae*. Affected oyster seed has high mortality, slow growth, shell cracks, extreme cupping of the left valve and conchiolin rings ("brown rings") on the internal surface of the shells.

Quahogs, *Mercenaria mercenaria*

- QPX (Quahog Parasite Unknown) is a fungus-like parasite of quahogs (Labyrinthomorpha, Thraustochytriales). QPX causes massive inflammatory responses in the clams and is associated with mortalities in several sites on east coast US; however, in Connecticut only a few QPX-positive specimens (0.3%) have been found during years of monitoring in several thousand animals examined.

Soft-shell clams, *Mya arenaria*

- Connecticut's soft-shell clams have seasonally high prevalence of a blood disease called hemic neoplasia. Healthy hemocytes (blood cells) are gradually replaced with

abnormal cells and high mortalities occur. Annual prevalence along Connecticut's shoreline at different sites varies from 6 to 13%, but peak prevalence of up to 60% occurs in the late fall and winter¹⁹.

Mussels, *Mytilus edulis*

- Connecticut's blue mussels have high prevalence infestations (over 60%) with the trematode (flatworm) parasite *Proctoeces maculatus*. The prevalence is highest in the fall with visible orange blisters in the mantle. The condition of the mussels is poor during the infestation, however, the hemocyte (blood cell) response is able to combat the infection and the mussels eventually recover²⁰.

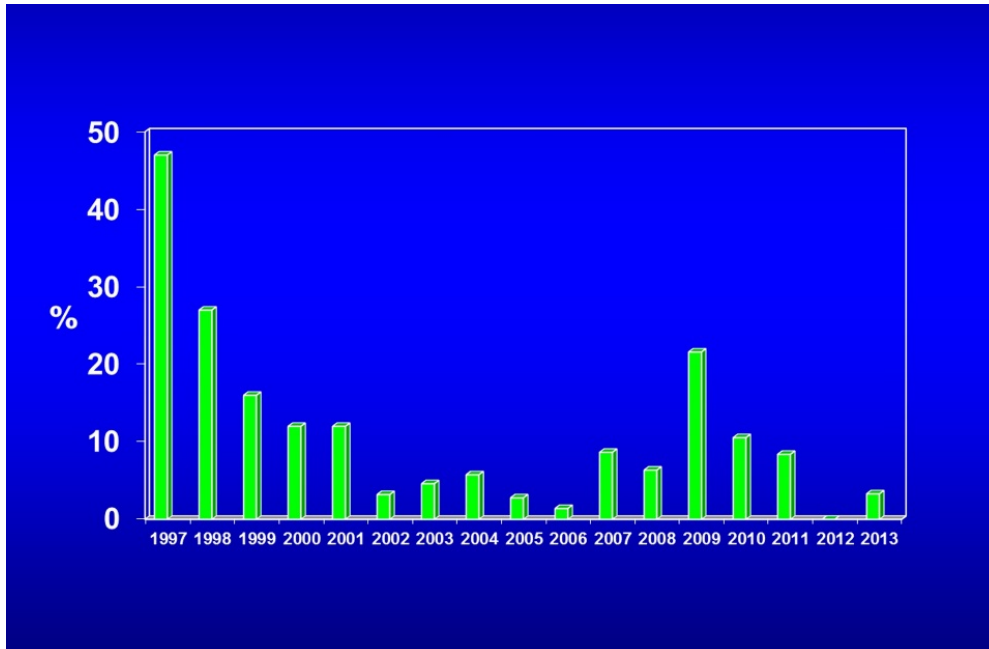
Bay scallops, *Argopecten irradians*

- Bay scallops in Connecticut are infected with *Pseudoclossia* sp. (Scallop Kidney Coccidian). This parasite causes enlargement of the kidney epithelial cells and parasites can be seen in kidney tubules. Heavy infections cause kidney damage. The parasite has not been reported to cause mortalities.

General health management guidelines

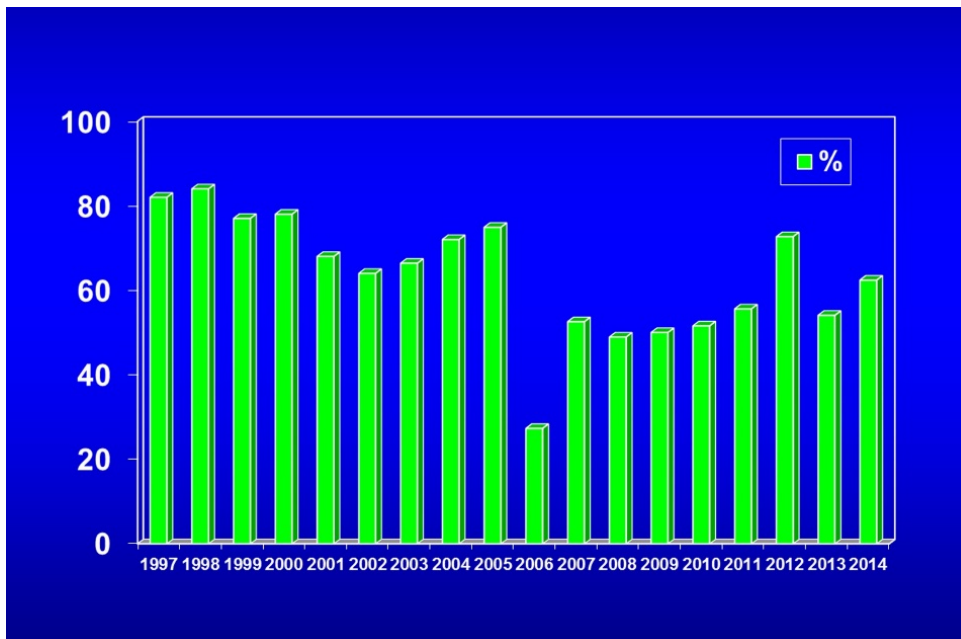
- Prior to establishing a new bivalve aquaculture operation, the suitability of the site for the bivalve species in question should be surveyed with regard to salinity and temperature, the amount of dissolved oxygen, sediment type, siltation and the availability of plankton.
- Most economically important infectious shellfish diseases originate from importations. The importation of larvae, seed, broodstock or adult bivalves from a hatchery or any supplier outside of Connecticut requires health certification by a shellfish pathologist approved by the Bureau of Aquaculture. The imported product should be free of any pathogens not present in Connecticut's shellfish, or have the same or lower average prevalence of a known pathogen already present in Connecticut's shellfish. The shellfish sample should be carefully studied for potential new and emerging pathogens.
- The imported shellfish should be studied for the presence of fouling organisms, predators or hitchhikers not present in Connecticut to protect not only shellfish, but also other marine organisms of Long Island Sound. It also should be checked that the imported bivalves do not originate from a location closed due an active harmful algae bloom (HAB).
- Eastern oysters should not be imported from outside Long Island Sound with the exception of hatchery-raised seed from New York, Massachusetts or Rhode Island. Seed can be imported from other nearby east coast states if the oyster broodstock originates from Long Island Sound. Hard clams should not be imported south of New Jersey.

Fig. 1. Prevalences of MSX, *Haplosporidium nelsoni*, in Connecticut oysters.



Credit: Inke Sunila, Connecticut Department of Agriculture/Bureau of Aquaculture

Fig. 2. Prevalences of Dermo, *Perkinsus marinus*, in Connecticut oysters.



Credit: Inke Sunila, Connecticut Department of Agriculture, Bureau of Aquaculture.

Fig. 3. Intensity of Dermo, *Perkinsus marinus*, in Connecticut in market-size oysters. Mackin Scale ranges from 0, when no parasites are detected to 5, when a high number of parasites infect the oyster.



Credit: Inke Sunila, Connecticut Department of Agriculture, Bureau of Aquaculture.