VIMS Researchers Complete Three-Year Study on Hard Clam Disease

VIMS scientists plant clams during field study.

During the past few decades hard clam aquaculture has emerged as one of Virginia's most important crops. Recent estimates indicate that nearly 600 million cultured clams are being grown in Virginia waters— a $35 million industry to the Commonwealth. Unlike the oyster industry, the hard clam industry has flourished in the absence of any disease threat. However, scientists and aquaculturists have become increasingly concerned about QPX (Quahag Parasite Unknown), a parasite that has caused significant disease problems in hard clams in New Jersey, Massachusetts, and Canada. QPX was first detected in Virginia in 1996 and has been found in cultured hard clams at 10 coastal bay sites on Virginia's Eastern Shore. Localized outbreaks of the disease in 2001 and 2002 caused extensive clam mortalities at two of the ten Eastern Shore grow-out sites. VIMS scientists Lisa Ragone Calvo and Eugene Burreson, in collaboration with researchers from Rutgers University and Woods Hole Oceanographic Institute, recently completed a three-year study to gain a better understanding of the disease. A report issued in August 2002 outlines their work and findings.

The focus of the study was to determine the effect of genetic origin of clams and geographic location of grow-out on QPX disease susceptibility. The scientists obtained brood stock of five commercially important clam strains from hatcheries in Massachusetts, New Jersey, South Carolina, and Virginia. Seed clams were produced from each of the stocks at VIMS in the spring of 1999. In the fall of 1999, the seed produced from these five brood stocks was planted at grow-out sites in Massachusetts, New Jersey, and Virginia.

The stocks were monitored for growth, condition, QPX disease, and survival as they grew to market size during the following 30 months. At the termination of the study, in the spring of 2002, all live and dead clams remaining in the experimental plots were collected and quantified to determine final cumulative mortality. All strains performed well in terms of growth and condition. However, the clams originating from South Carolina and Florida brood stocks had significantly higher prevalence of QPX and higher mortality than clams originating from Virginia, New Jersey, and Massachusetts brood stocks. "This work shows that geographic origin of clam seed is an important factor in QPX disease susceptibility. We don't really understand the reasons for this yet, but we are beginning new studies that we hope will address some of these questions," said Calvo, a VIMS shellfish pathologist. "This work suggests that there is a genetic basis for QPX disease susceptibility. This is important as clam culturists may be able to avoid the disease by using seed produced from stocks that are more resistant to QPX disease," added Calvo. "We are fortunate to have an excellent team of molecular biologists and geneticists at VIMS that are already working to develop QPX-resistant clam strains."

With recent funding from the USDA and Virginia Sea Grant, Mark Camara and Kimberly Reece of VIMS will begin work that focuses on the genetic aspects of domesticating and improving clam stocks for traits such as QPX resistance and enhanced performance. Hatchery operators have been domesticating clams for many years; however, due to the very large numbers of eggs produced by female clams and the high variance in male mating success in typical spawns, hatchery reared stocks can become highly inbred. Inbred lines may have reduced fitness and are less likely to survive new disease and environmental stresses. The VIMS team will develop molecular (DNA) tools to determine the levels of relatedness among individuals and apply these tools to selective breeding of class stocks for QPX resistance and for improved performance. In addition, molecular markers will enable the researchers to genetically type (or fingerprint) parents before crossing brood clams, allowing them to design breeding strategies that will reduce inbreeding.

"These technologies will enable us to make rapid progress in clam stock development. Ultimately we hope to provide aquaculturists genetic services that will enable them to develop selected stocks that are tailored to the particular conditions unique to their hatchery systems and grow out sites," said Camara.

— *QPX Facts* —

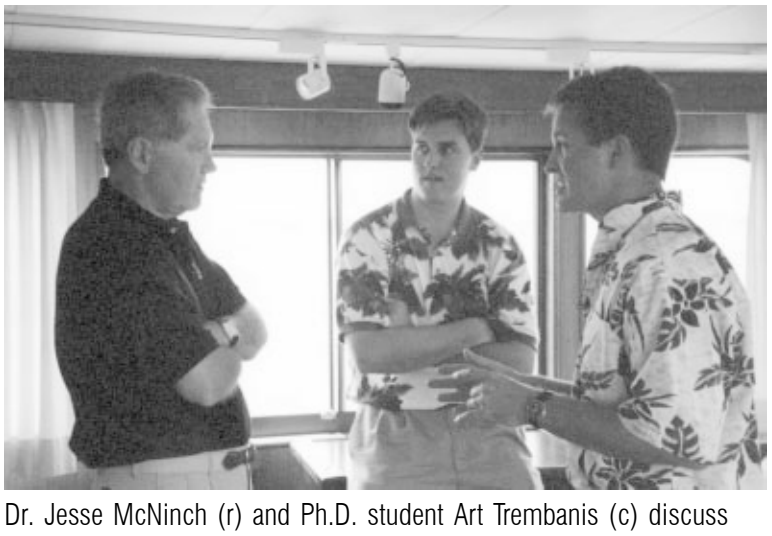
QPX (Quahog Parasite Unknown) is a protozoan parasite of the hard clam *Mercenaria mercenaria*. QPX is:

- Tentatively placed in the Phylum Labyrinthulomycota, whose members are ubiquitous in marine and estuarine habitats and include several disease agents
- Associated with sediments, benthic algae, and marine plants
- Generally saprophytic (obtains its food from dissolved organic matter)
- Found in coastal waters from Canada to Virginia
- An opportunistic parasite (it does not absolutely depend on a parasitic way of life, but easily adapts to it)
- Limited to high salinity (>25-27 ppt) environments
- Most prevalent in cultured clams
- Found in market or near-market size clams
- Acquired in field during first or second year after planting (it does not originate in hatcheries)

McNinch Receives Young Investigator Award from Army Research Office

Dr. Jesse McNinch, Dept. of Physical Sciences, recently received a Young Investigator Award from the Army Research Office to continue his work on erosional hotspots. These highly competitive awards are bestowed upon outstanding young researchers during the first five years of their career. McNinch's work has received a great deal of attention in recent months from federal and state agencies.

Research conducted by McNinch at the US Army Corps of Engineers' Field Research Facility in Duck, North Carolina suggests that hotspots are caused by a complex chain reaction that begins when large storm waves expose muddy patches beneath the sandy surf zone. Exposure of these muddy patches causes changes in bottom currents that alter the configuration of offshore sandbars. This summer, McNinch and others began a similar study at Sandbridge in Virginia Beach.



Dr. Jesse McNinch (r) and Ph.D. student Art Trembanis (c) discuss "hotspot" research with William and Mary Rector Donald Patten (l).

Erosional hotspots are short stretches of sandy beach that suffer severe erosion during storms. Shortly after a storm passes, hotspots refill with sand, leaving little or no evidence of their previous existence, making it difficult to study the phenomena. Traditional measures of beach erosion, including pre- and post-storm surveys, can completely miss a hotspot's presence. Hotspots have the potential to damage seawalls, hinder beach replenishment efforts, and disrupt military maneuvers.