



## News Update

# Hard Clam Resiliency: Researchers Closing In On A Solution

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A collaborative [team](#) led by Bassem Allam at Stony Brook University's Marine Animal Disease Lab and funded by NOAA National Sea Grant College Program, is working on characterizing genetic diversity in the hard clam to identify which gene (or genes) regulate various traits in the hopes of using genomic methods to select lines of clams with desired traits. Those traits might include rapid growth or resistance to disease and environmental stressors.

While clams are only susceptible to few parasites and diseases, growers in several northeastern states have experienced widespread mortalities related to a parasite historically known as QPX (Quahog Parasite Unknown) and recently named as *Mucochytrium quahogii*. QPX belongs to the phylum Labyrinthulomycota and is widespread in the environment. Pathologists have theorized for years that since the parasite is widespread, but mortalities are rare mortalities related to QPX were probably caused by stress, temperature, salinity, food conditions – and, most importantly, genetics.

Since 2002 researchers have known that there was a genetic link to QPX resistance in clams which they were able to demonstrate by planting stocks of clams from different areas into a location with high mortalities. As some lines consistently survived better than others, it became clear there was a genetic basis for resistance. By using high-throughput sequencing tools, researchers have been working to identify which genes or genetic variations are linked to survival. Once those genetic

features are identified, breeders can select animals with those desired features for broodstock to create lines of resistant clams.



*Notata clam with its distinctive reddish-brown markings (above). Photo by Melissa Devine.*

Genetic sequencing allows researchers to look for single nucleotide polymorphisms (SNPs) in various populations of clams. SNPs are single mutations in the genetic code where a single nucleotide has been replaced. These SNPs will often be linked to traits that influence things like protein and enzyme synthesis (essentially every single metabolic process is controlled by an enzyme). For example, the reddish-brown pattern on the shell (also known as “[notata](#) marking”) is caused by changes in the genetic code of clams. In this framework, researchers have been focusing on understanding the

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genetic diversity in the hard clam and linking genetic features to target traits. For example, researchers at VIMS (Ann Ropp and collaborators) performed a population genetics investigation and characterized the genetic diversity in clams collected from Canada to South Carolina. In parallel, a team of investigators led by Allam recently identified genetic markers (SNPs) associated with clam resistance to QPX [disease](#)<sup>2</sup>.

The current research effort funded by NOAA aims to significantly improve available information on the genetic diversity of the species along the U.S. Atlantic coasts and develop affordable genotyping methods (e.g., SNP arrays) to identify genetic markers associated with relevant traits and use these for selective breeding. While this initial focus is to identify clam stocks for QPX disease resistance and heat tolerance, future research can target additional traits. Ultimately, commercial hatcheries will have access to these resistant strains from research hatchery collaborators in the participating states.

To date, previous and ongoing work allows the identification of a large set of markers that can be used as a solid basis to apply marker-assisted selection of hard clams for various economically important traits. Stay tuned!

## References

<sup>2</sup> Farhat S., Tanguy A., Pales Espinosa E., Guo X., Boutet I., Smolowitz R., Murphy D., Rivara G., Allam B. (2020). Identification of variants associated with hard clam, *Mercenaria mercenaria*, resistance to Quahog Parasite Unknown disease. *Genomics* 112(6): 4887-4896.

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*Visit the National Sea Grant Hard Clam Selective Breeding Collaborative at [www.nyseagrant.org/hardclamhub](http://www.nyseagrant.org/hardclamhub) for additional information.*