Dr. Tettelbach collects seawater to measure phytoplankton chlorophyll as part of one of several funded research projects.
Photo courtesy of Dr. Steve Tettelbach

Coast

New Insights About South Shore Estuary Hard Clams

Mercenaria mercenaria

The story of the Long Island south shore hard clam industry's boom to bust harvest since the late 1960's is no secret. Figuring out what can be done about it has been a mystery, however. While much has been learned through research, seeding efforts, and demonstration projects in the past decades, the clams *(Mercenaria mercenaria)* have not rebounded. A complicating factor is that the ecosystem is probably quite different now than it was during the 10 years (1969-78) when more than 500,000 bushels were pulled annually from Great South Bay alone. So, to make progress toward restoration, we need to determine what conditions are limiting hard clam abundance *today*. Since 1999, with support from Congressmen Michael Forbes and Felix Grucci and others, New York Sea Grant has been spearheading what became an $810,500 co-funding partnership with NOAA's National Marine Fisheries Service, the South Shore Estuary Reserve, and the Port Authority of NY and NJ, to do just that.

So far, three intensive research projects, designed and conducted by nationally-reputed shellfish experts, have shed new light on the situation. The results have been shared with state and federal agency representatives, town shellfish managers, and other groups interested in hard clams and shellfish restoration.

Hard clams filter phytoplankton as their main source of food. However, if these small algal cells are less than 4-5µm in size, they cannot be captured very efficiently. The <3µm size brown tide alga, *Aureococcus anophagefferens,* also can inhibit clam feeding through a toxic effect when its cells are at high densities. What are we finding in the estuary these days? Field sampling from fall 2000 to fall 2001 revealed large differences in phytoplankton composition between several south shore estuary sites, with those in the center portion (Bay Shore, Babylon, and Patchogue) having higher percentages of the very small plankton, including some brown tide. In 2002, study areas in Copaigue, Babylon, and Patchogue also mostly had phytoplankton in this very small range, but with insignificant numbers of brown tide cells.

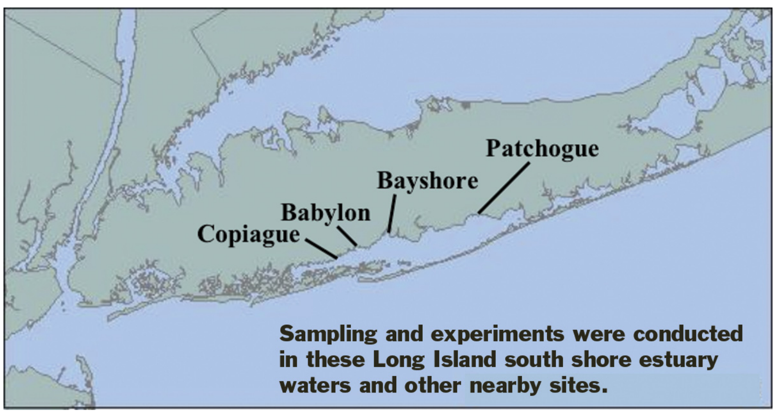
We know from previous research that growth of seed and adult clams is affected by poor food, but what about reproduction? Quantitative techniques examining field collected samples showed that the timing of peak reproductive condition and spawning is not

A Southampton College student prepares field samples for tissue analyses.
Photo courtesy of Dr. Steve Tettelbach

Watch

One of several platforms holding submerged tanks for filtering and growth experiments.
Photo courtesy of Dr. Robert Cerrato

off-schedule and occurred May to July, just as it has historically. However, the nutritional status of hard clams was poorest at sites where very small plankton (including brown tide) predominated, causing them to have a much lower relative reproductive output compared to other areas sampled. This has important implications for restoration efforts. Watershed-scale changes in nutrient levels and ratios may be necessary to enhance the phytoplankton more beneficial to hard clams, but we do not know enough about the interactions and overall ecosystem effects to recommend a specific course of action at this point. On a smaller scale, however, spawner sanctuaries (areas where reproductively mature clams are protected from harvest) could be targeted to areas with phytoplankton species that are a good food source for hard clams.



Sampling and experiments were conducted in these Long Island south shore estuary waters and other nearby sites.

Another novel approach was investigated through controlled experiments that showed the presence of adult clams had a positive effect on the growth of juvenile clams, apparently due to increased food quality. This means that clams themselves seem to be able to change the composition of the phytoplankton towards more nutritious species just through their own feeding activity. Ecosystem interactions are complicated (e.g., the researchers also discovered that hard clams are effective consumers of a copepod that also grazes on phytoplankton), but planting large numbers of adult hard clams to have a high filtration rate could be a strategy to enhance the recovery of this species.

Additional results and conclusions came from the research group that developed a mathematical model to simulate the growth and development of hard clam populations under various environmental conditions. With its current low levels, recovery time for the hard clam population will be on the order of a decade or more, even if harvest is stopped and conditions are optimal. At densities of 0.5-1 clam/m^2 the population will have a hard time recovering due to reproductive difficulties, and some areas are currently at or below that range. Adding clams to the system should positively influence these factors, but we need to keep the food situation in mind. The model offers a valuable tool that can be used to make predictions about the expected effects of specific environmental conditions and management options.

The multi-year Hard Clam Research Initiative is providing science-based information to agencies and organizations directing considerable attention and resources toward restoring shellfish populations in NY's estuaries. Two new, additional research studies are currently underway. Please see www.seagrant.sunysb.edu/HardClam for more information.

— **Cornelia Schlenk**

Juvenile clams were 2-4 mm at the start of growth experiments. For scale, they are about 1000 times larger than brown tide cells.
Photo courtesy of Dr. Robert Cerrato

Research Roster

The Hard Clam Research Initiative scientist teams include experts from five states and Canada:

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