Biosecure Domestication of Native Geoduck Clams

Project Summary: Our research stemmed from concern over the rapid development of geoduck aquaculture at sites in close proximity to native geoduck beds, and the potential risk of genetic interactions from hatchery reared geoducks. At the same time, geoduck aquaculture was hampered by the inability to use selected broodstocks that could greatly increase the domestication potential for this species through breeding for desirable production traits. Our research proposed to help resolve both issues by focusing on the creation and development of tetraploid geoduck stocks, coupled with the development of diploid geoduck broodlines to ultimately produce 100% triploid seed supplies for the shellfish industry.

Results: We used existing 4 year old triploid geoducks outplanted in Washington State to begin our research toward the creation and evaluation of tetraploids. This resulted in 14 geoduck families having approximately equal numbers of triploid (chemically induced) and diploid clams. We determined the sterility in triploid geoduck and showed that triploid by diploid embryos are not viable. A total of 1,656 triploids and diploids were planted at a commercial intertidal farm on Eld Inlet, in southern Puget Sound, and one farm site on Thorndyke Bay in Hood Canal. Selected subsets were harvested and examined in October 2012 and April 2013. Survival and growth were similar between triploid and diploid geoducks, with a slight trend toward greater shell length versus width in triploids. Despite differences in growth and survival between sites, differences in family performance were subtle and generally non-significant.

Next we conducted pilot studies to determine the efficacy of tetraploid induction, and found that activating oocytes from a diploid female using sperm treated with ultraviolet light, followed by inhibition of both polar bodies resulted in ~20% tetraploids. We successfully produced the first tetraploid geoducks, but did not, unfortunately, succeed in producing triploids by mating tetraploid males with diploid females because insufficient tetraploids were produced to rear to maturity. Finally, we prepared simple, step-by-step methodologies for future attempts to spawn and produce triploid and tetraploid geoduck.

The important message from this research is that treatment timing is critical to successful tetraploid induction. Further experiments are necessary to optimize induction. A major impediment to assessing whether tetraploids can be produced using oocytes from triploid females is the number of available triploid geoduck. Considerably more triploids were produced via this project, and once these attain maturity it would be advantageous to conduct follow-up experiments.

Results of these experiments were presented by Joth Davis, Brent Vadopalas and Molly Jackson at the Pacific Coast Shellfish Growers Association (PCSGA), the National Shellfisheries Association (NSA) and World Aquaculture Association conferences in 2011, 2012 and 2013.

Science Team: The science team consisted of Joth Davis, Brent Vadopalas, Andy Suhrbier, Bobbi Hudson and a number of PSI, University of Washington and Taylor support staff. The work was supported with a grant (#NA09NMF4270092) from the NOAA Saltonstall Kennedy (SK) program and generous contributions from Taylor Shellfish Farms, Baywater Inc., and Chelsea Farms.