T he Shellfish Aquaculture Extension Program (SAEP) works with research faculty in the Department of Fisheries and Aquatic Sciences (FAS) to develop and implement applied research and extension educational projects for the state’s shellfish aquaculture industry. In collaboration with industry, institutional, and agency stakeholders, these projects are focused on four major areas: (1) genetic stock improvement; (2) water quality monitoring; (3) animal health and (4) production technologies.

G enetic Stock Improvement Using federal and state funds, SAEP and FAS faculty conduct applied research to help develop a hardier clam strain through breeding techniques that improve survival during prolonged hot summers. A combination of high water temperature, reduced oxygen and high clam metabolism may contribute to increasingly high summer mortalities observed in Florida hard clams. A Florida Sea Grant-funded project is evaluating the use of triploidy to enhance clam production. Results from field trials conducted with industry partners and laboratory studies conducted by Dr. Shirley Baker and her graduate students will determine if triploid clams have greater resistance to summer environmental stressors through reduced gametogenesis. The use of hybrids between the hard clam *Mercenaria mercenaria* and southern quahog clam *M. campechiensis* for increasing survival and production is being examined with USDA special research grant funding procured through the efforts of the Cedar Key Aquaculture Association. Triplicate families of each, and their reciprocal hybrids, are being produced this fall by Dr. John Scarpa at the FAU Harbor Branch Oceanographic Institution and will be evaluated under commercial conditions during 2008-09.

W ater Quality Monitoring SAEP has developed a partnership with federal and state agriculture agencies for continued operation of water quality and weather monitoring stations to provide data for a decision support tool used by the clam industry. Currently, stations are located at 7 high-density lease areas in 5 coastal counties. These stations provide timely continuous information to clam growers, allowing them to make informed management decisions based on temperature and salinity measurements. This program, however, does not allow for an in-depth understanding of the influence of temperature on clam production. Smaller data loggers (that can fit inside clam bags) were recently purchased with Hatch funding, and will allow for greater spatial resolution and broader data coverage. This summer clam growers are deploying these units at multiple lease sites so that temperature variability can be related to water depth, substrate characteristics, currents and other parameters.

A nimal Health In 2003, FAS and SAEP faculty conducted a preliminary health assessment of cultured clams by examining samples from several growing areas. No serious disease-causing agents were detected. However, there is a concern regarding the health of stocks as growers report crop losses during summer. Pathology may be exacerbated by stressors or high stocking densities. With Hatch funding, a more thorough examination of stocks prior, during and after the summer months by Dr. Denise Petty will help determine if environmental diseases or disease pathogens are present. In addition, low larval survival has been reported in Florida hatcheries in recent years and has impacted clam seed production. Therefore, site visits by Dr. Petty will include assessment of hatchery protocols and health of larvae and post-set seed. The goal is to reveal practices that are limiting to seed production.

P roduction Technology Diversifying the hard clam culture industry by developing farming technology and markets for other bivalve species would increase economic stability and growth. Florida Sea Grant is funding a project where faculty from SAEP, FAS, Food and Resource Economics Department and FAU Harbor Branch will develop and demonstrate biological and technical procedures for spawning and culturing the sunray venus clam *Macrocallista nimbosa*. The sunray venus is an attractive venerid clam distributed from South Carolina to the Florida and the Gulf states. Commercial fishermen targeted the large 4-7 inch clam in the late 1960s off the northwest Florida coast for the chowder market but the erratic size of the fishing grounds precluded large-scale exploitation of this fishery. Recent growth experiments, using marked individuals, suggest that these popular clams can attain a length of 3 to 12 inches in just 12 months, similar to market size of hard clams in Florida. The existence of a prior fishery, market potential and growth rate, along with it being a native species, make the sunray venus a logical choice as a new species to diversify the shellfish aquaculture industry. Broodstock have been selected and spawned and the juveniles are being cultured by industry partners in land-based nurseries and commercial leases.

Leslie Sturmer is a multi-county shellfish aquaculture extension agent and faculty member in the Department of Fisheries and Aquatic Sciences

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The northern hard clam (*Mercenaria mercenaria*) has been a popular seafood item for many years, and is an important aquaculture crop along the eastern seaboard. Aquaculture of the northern hard clam became prevalent on the west coast of Florida in the 1990s after a retraining program was initiated for fishermen impacted by poor oyster harvests and Florida’s gillnet ban. Clam farming has been a success story for Florida’s coastal fishermen, where the warm plankton-rich waters allow clams to reach market size in 12 to 18 months, faster than other areas along the east coast. With a net profit of 10.7 million dollars in 2005, the Northern hard clam is one of the most economically important aquaculture species in Florida’s marine waters.

In recent years, clam farmers on the West coast have reported lower than average survival and crop losses during the long hot summers. This has been attributed to higher than average water temperatures combined with fluctuating salinities, low dissolved oxygen levels, and potentially lower food availability. In addition to stressful environmental conditions, the hard clam loses a significant amount of energy reserves to reproductive activity during the spring in Florida, leaving them more susceptible to poor conditions.

Clam farmers met with scientists, managers and extension agents to discuss concerns with the high clam mortalities. Triploidy was suggested as a possible solution, since triploid bivalves have been shown to have reduced reproduction, which could then be realized in additional energy stores available during summer months. Hard clams are diploid in nature, meaning they have 2 sets of chromosomes per cell, whereas triploid organisms have three sets of chromosomes. Triploid hard clams were produced at FAU Harbor Branch Oceanographic Institution.

As part of my master’s thesis, I conducted laboratory experiments to assess the value of triploidy for hard clam aquaculture. I challenged two sizes of clams to a range of water quality conditions and assessed their survival. I tested growout-size seed clams (20 mm average shell-length) and pasta-size clams (46 mm average shell-length) which represent the two size classes that are typically in the field during summer months. Groups of clams were exposed to 14 different treatments, representing the range of salinity, temperature and dissolved oxygen conditions to which clams might be exposed during summer in Florida.

I found that there was only one treatment in which triploids survived in greater numbers than diploids. Pasta-size triploid hard clams performed well at high temperatures and low dissolved oxygen, while diploid hard clams had lower survival. Growout-size diploid clams performed better or the same as triploids in all of the experimental conditions, suggesting there may be a disadvantage to triploidy at a smaller size.

Is triploidy a potential solution for Florida’s hard clam industry?

Based on the results of these laboratory challenges, probably not. However, additional on-going research relating to this project, including scope for growth studies and larger-scale field experiments, will provide additional information and perhaps a modified answer to that question.

Despite the apparent lack of higher survival rates under adverse conditions, triploidy does have other benefits. Sterility, or lack of reproductive activity, would be beneficial in areas interested in containment of non-native species for aquaculture use. In addition, sterility has been found to correlate with higher glycogen content in triploid oysters, giving them a sweeter taste. This may also be the case for clams.

Elise is a Master’s student and her advisor is Dr. Shirley Baker.
Design and Management of Artificial Reefs for Fisheries was the title of a European Union-funded short course held in May 2007, as the first of its kind in the world.

Attendees from various natural resource-related ministries, academia and businesses came to Zaragoza, Spain from several countries of the Mediterranean Sea basin, but also from as far away as Malaysia, Mexico and Norway.

One of the invited organizers and lecturers was Bill Seaman of the FAS faculty, who delivered presentations on matching reef ecology to ecosystem management and on reef planning concepts and practices. Major topics of the course included the ecology of artificial reefs, their design and evaluation, and role in fishery management, with theory balanced by a week-long case study and independent reef system planning exercises.

While artificial reef-related research and development may have peaked in some nations, in others areas there is growing interest in fisheries, conservation and eco-tourism applications. There were about 100 applications for 28 openings. The course was held under the auspices of the International Centre for Advanced Mediterranean Agronomic Studies, through its Mediterranean Agronomic Institute of Zaragoza. The Institute offers both short courses and graduate residential programs in subjects including aquaculture.

Dr. William Seaman is Professor Emeritus in FAS. For much of his career, he has been involved with developing and extending the scientific basis for artificial reef technology, and continues this effort as part of broader, more recent activities related to stewardship and sustainability of earth and sea resources globally. He is an invited speaker for the 2008 World Fisheries Congress.

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WaterWorks is a publication of the UF/IFAS Department of Fisheries and Aquatic Sciences, aimed at providing up-to-date information on activities of the Department to prospective students, alumni, stakeholders, and agency & academic partners.

If you would like to contribute an article or informational bullet for a future issue of WaterWorks, please contact the Editor, Dr. Karl Havens, by email at khavens@ufl.edu or by telephone at 352-392-9617 x 232.

Thank you.
**Rock Lobster!**

Don Behringer is our newest FAS faculty member. His research focuses on near-shore marine environments where he studies the impact of human-related changes in habitat and water quality on organisms at population and community levels. His current research deals with the dynamics of a lethal pathogen that infects the Caribbean spiny lobster.

This research is centered on PaV1, an irido-like virus that he and colleagues at Old Dominion University and the Virginia Institute of Marine Sciences discovered in 1999. It is the first naturally-occurring virus found in any lobster.

The goal of this research program is to determine how stressful environmental conditions, coupled with life history changes in host behavior and disease susceptibility, generate the pattern of infection prevalence and distribution observed in the Florida Keys. One important early result is a finding that healthy lobsters are able to detect and avoid diseased lobsters, potentially limiting disease transmission in the wild. This is the first discovery of such a behavior and it stands to change our perceptions regarding the role of behavior in the transmission of disease in social animals.

In addition to this work with spiny lobsters, Dr. Behringer has worked on the inter-habitat connectance of food webs using stable isotope tracer techniques. In the Caribbean, seagrasses produce much of the organic carbon in shallow waters, and it has long been assumed that much of this carbon is exported to nearby habitats, supporting their foodwebs. However, recent results with hard bottom habitats suggest they are largely supported by autochthonous production of algae rather than seagrass.

Dr. Behringer also is interested in the influence of enhancement, restoration, and conservation efforts on populations and communities. The use of artificial enhancement mechanisms to maximize animal abundances is widespread and while most investigators have studied the efficacy of the mechanism, the effect of habitat enhancement on the processes creating such patterns remains largely unknown.

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