

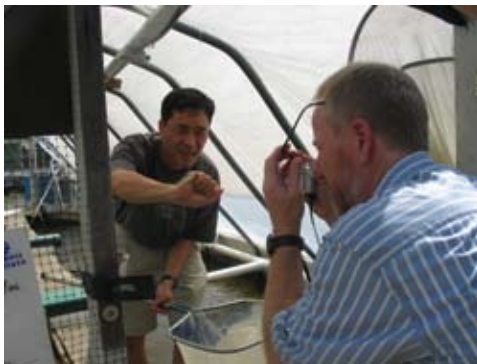
# Partial harvest economic\$: More shrimp, more profits

In its quest to assist shrimp farmers in achieving optimum profits from their operations, U.S. Marine Shrimp Farming Program Consortium researchers and scientists explore and continue to refine partial harvesting techniques.

“We know we need to do this to be competitive,” said Terrill Hanson, Ph.D., an associate professor at Mississippi State University who specializes in agricultural economics. “If we are going to put our shrimp up there with imported frozen shrimp or wild caught shrimp fresh off the dock, we need to know what it costs to produce.”

And it’s important that the Consortium have access to an economic model that can help it plot strategies and scenarios to help farmers who have their own particular circumstances: lay of the land, weather, equipment, fuel costs, shipping and broodstock costs.

Hanson and his fellow colleague Mississippi State economic professor, Benedict Posadas Ph.D., together with Consortium member Addison



*Oceanic Institute's Clete Otoshi holds one of its shrimp for economist Terry Hanson to photograph.*

Lawrence, Ph.D., from Texas A&M Universi-



*Oceanic Institute's Clete Otoshi explains his ideas to economist Terry Hanson as Shrimp Department Program Manager Shaun Moss looks on.*

ty's Shrimp Mariculture Research department, have created such a model backed by Consortium funding. Initially, Hanson and Posadas created the “Bio-Economic Modeling of Recirculating Shrimp Production Systems” software to address farmers’ and researchers’ scenarios. With input from Lawrence, the questions of partial harvests were addressed. And, this past spring at the USMSFP’s special session at the World Aquaculture Society conference in Las Vegas, Hanson presented “Economics of Partial Harvesting in Super-Intensive Recirculating Shrimp Production Raceways.”

USMSFP Consortium researchers and scientists are always looking to build a better, bigger, healthier shrimp. Oceanic Institute Shrimp Department’s Shaun Moss, Ph.D., and Clete Otoshi, are no exception. They invited Hanson to Waimanalo, Oahu, to observe their program and provide advice. OI’s shrimp department had already shown partial-harvesting techniques and high-stocking densities in super-intensive recirculating systems to be more profitable than single final harvests. Hanson and his colleagues cite OI’s 2005 study where 76 percent

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*Anthony Ostrowski, Ph.D.  
Consortium Director*

## On the right road

One of my favorite quotes when clarity is needed—especially when helping my 12-year-old daughter with her school projects—comes from Alice in Wonderland as the Cheshire cat responds to Alice's plea for directions, "Well, if you don't know where you're going, any road will get you there."

That quote has never been so relevant and urgent for the U.S. shrimp farming industry as it has struggled over the last few years to find direction and ways to compete in the rapidly evolving world shrimp marketplace.

But direction is being found and the road becoming clearer within the industry to leverage the truly unique qualities of U.S.-farmed shrimp in their freshness, home-grown appeal, niche marketing and value-added opportunities.

Our feature article is on recent work Consortium institutions are exploring on the economics of partial harvesting with our partners from Mississippi State University, Drs. Terry Hanson and Ben Posodas. We brought the bio-economic model concept into the program three years ago to develop a tool to help guide our super-intensive (SI) production system research as well as investment in the systems. The evolving model has made a tremendous difference in the way Consortium researchers are approaching development of their systems. Sensitivity analyses have made us examine alternative management scenarios such as partial harvesting to address production costs and profitability, instead of primarily focusing on increasing density or other purely biological parameters. Terry and Ben work closely with the entire Consortium to develop realistic and meaningful approaches.

A related article outlines results of the Oceanic Institute (OI) SI production system research presented by researcher Cleto Otoshi at the recent International Conference on Recirculating Aquaculture in Roanoke, Virginia. Previous issues outlined successes occurring elsewhere across the Consortium. There is a growing convergence of findings and techniques within the Consortium. We appear very close to bringing the technology of SI shrimp farming to fruition.

In fact, this month's article on AgraTech International's partnership with Ocean's Bounty Seafarms, LLC, in South Carolina, is testimony to the growing interest and confidence in the profitability of SI shrimp production in the United States. Mills Rooks, president of Ocean's Bounty, worked closely with and based his farm on the SI research conducted by Waddell Mariculture Center. The approach of AgraTech's president and CEO Richard DeMarco to turn processed shells into chitosan is just the type of innovation needed. Both Mills and Richard have found a niche and are well positioned to fill it.

Also see our article highlighting how OI plans to step up its own biosecurity efforts in light of its expanding research, educational, and community support role within Hawaii. In his multiple roles with the Consortium, Dr. Don Lightner from the University of Arizona visited OI twice within the last six months to advise and assist. OI's Shrimp Nucleus Breeding Center has been a model of biosecurity for the worldwide shrimp farming industry. It is the intent of the entire OI campus to be a model for similar, multi-use institutions worldwide as well.



The U.S. Marine Shrimp Farming Program is a congressional initiative administered by the USDA/CREES and is an integral part of its agricultural development effort executed by members of the U.S. Marine Shrimp farming Consortium:

### Oceanic Institute

Waimanalo, Hawaii

### Gulf Coast Research Laboratory

University of Southern Mississippi  
Ocean Springs, Mississippi

### Tufts University

Tufts Cummings School of  
Veterinary Medicine  
North Grafton, Massachusetts

### Waddell Mariculture Center

South Carolina Department of  
Natural Resources

Bluffton, South Carolina

### Texas Agricultural Experiment Station

Texas A&M University  
College Station, Texas

### University of Arizona

Department of Veterinary Science  
Tucson, Arizona

### Nicholls State University

Department of Biological Science  
Thibodaux, Louisiana

## INDUSTRY BRIEFS

U.S. Marine Shrimp Farming  
Program

41-202 Kalaniana'ole Hwy  
Waimanalo, HI 96795  
Phone: (808) 259-3141  
Fax: (808) 259-3121

[HTTP://www.usmsfp.org](http://www.usmsfp.org)  
Editor: Paula Bender

# *Oceanic Institute improving bio-security protocols to protect its research programs*

Consortium members of the U.S. Marine Shrimp Farming Program are taking measures to step up biosecurity programs to prevent diseases and viruses from infiltrating their facilities, including Oceanic Institute (OI).

Toward that end, in December 2005 and in June 2006, Consortium member Donald Lightner, Ph.D., of the University of Arizona Veterinary Science department, visited OI to assess its campus and make recommendations. Like other Consortium campuses, OI not only houses sensitive research facilities, but provides classes for high-school students, college students, and for industry workshops. Tours are frequently provided to dignitaries, the general public and visitors from around the world interested in its work in aquaculture. OI is also the landlord to Sea Life Park, which is adjacent to the OI campus and shares its water sources.



*Don Lightner*

“A biosecurity program has always been in effect for our shrimp Nucleus Breeding Center at OI,” said Consortium Director Anthony Ostrowski, who also chairs OI’s biosecurity committee. “But we now need a more comprehensive program to encompass all of OI’s activities.”

OI’s shrimp broodstock program is noted worldwide for its success, in no small part because of its adherence to strict bio-security protocols. Program Manager Shaun Moss, Ph.D., and the shrimp department, is passionate about the safety of its prized *Litopenaeus vannamei* broodstock. Charles Laidley, Ph.D., program manager of OI’s finfish department, is eager to see more stringent security measures taken as his department at OI expands into other species such as ornamentals and various food fish.

Bruce Anderson, president of Oceanic Institute, said that rather than taking a stab at surveillance, prevention should be OI’s priority.

“If you find something, it’s too late,” Anderson

*Part of the OI campus.*



said. “We need to look at the high risks and make sure our focus is on prevention and not just on monitoring. Let’s look at organizing our activities to minimize risks.”

For any site that relies upon protecting fragile scientific studies, assessing the physical plant is the first step. Does the layout of the campus and its structures support research? What changes need to be made? Would security card readers help in limiting unnecessary traffic in OI’s Nucleus Breeding Center and other sensitive areas? And, a look beyond human traffic brings up the issue of water sources. Is it disease free? Does it deliver pathogens and parasites damaging to OI’s animals? What about the transportation aspects? Trucks that visit fish ponds and shrimp farms could return with risky materials clinging to tires and bumpers. Would service trucks from public utilities that come on campus need to have their tires run through a rinsing station upon arrival?

Lightner suggests that OI’s bio-security zones be identified, that some programs and activities be relocated, that traffic be limited, gates and fences be installed, and that footbaths and wash areas be created.

“OI needs to put in the right measures to minimize its bio-security risks,” Lightner said. “It needs to identify its problem areas, and determine the likely causes for things such as parasite issues.”

Lightner also recommended that OI review case studies to determine patterns of bio-security breaches.

“Implementation of a strong biosecurity program is the best thing we can do for OI to protect its years of investment in research,” Ostrowski said. “A lot needs to be done physically and operationally, including instilling our staff with this mindset.”

# Beyond the menu: AgraTech International processing plant to convert shrimp

U.S. marine shrimp farmers eager to develop a market for their in-land grown disease-free shrimp should take note as Mills Rooks' Ocean's Bounty Seafarms LLC forges a partnership with AgraTech International to buy all of its shrimp.

Rooks, a veteran securities trader who is developing his super-intensive shrimp farm in Jasper, South Carolina, will ship harvested shrimp to AgraTech's planned seafood processing plant about two hours north in Salter, South Carolina. AgraTech will process the shrimp into value-added food items such as coconut shrimp, breaded shrimp, scampi and other top-selling favorites. But AgraTech sees income potential beyond the fancy foods. Rather than let the shells go to waste, AgraTech plans on processing them into chitin and chitosan.

AgraTech asserts that the millions of tons of crustacean waste present a long-running ecological disposal problem for the world's seafood processing industries. Regulations are in place within every seafood-processing region throughout the United States for the handling of such waste. A byproduct of all of that shell waste is polysaccharide, a biopolymer. Its uses boggle the mind.

AgraTech expects to develop and market products with chitin and chitosan for use in countless fields including water and wastewater treatment, agriculture and agrochemicals, cosmetics and toiletries, and in the areas of food and beverage, and healthcare and medical fields. Because it is a natural biodegradable polymer, chitosan has been used for many years in Asian countries as the preferred coagulant for the clarification of waste streams. The American Association of Feed Control Officials allows it to be used to recover food

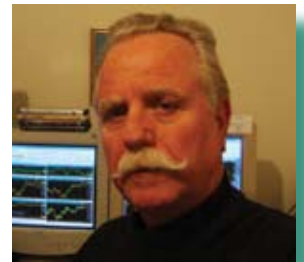
wastes suitable for animal feed. And the Federal Drug Administration has licensed its use in the flocculation of protein during the water treatment process. It separates protein from water and can replace synthetic resins employed for this purpose.



Craig Browdy

AgraTech isn't the only entity betting on Rooks' success. According to U.S. Marine Shrimp Farming Program Consortium member Craig Browdy, Ph.D., a marine scientist with Waddell Mariculture Center, South Carolina Department of Natural Resources, one of the keys to successful commercialization of these [super-intensive shrimp] systems will be proving that product differentiation and market premiums can be achieved for large quantities of locally produced, fresh, high-quality, environmentally sustainable shrimp. Since 1984, Waddell has been researching the development of super-intensive shrimp production alternatives for raising marine shrimp. Rooks tapped Waddell for guidance as he looked into the shrimp farming industry and as he worked on the development of Ocean's Bounty Seafarms' biosecure, super-intensive closed-loop production system. His goals included raising high-quality, disease-, chemical- and drug-free *Litopenaeus vannamei* that would further establish South Carolina's position on the shrimp farming map.

"I am sold on Mills Rooks," said Richard DeMarco, chairman and chief executive officer of AgraTech. "The United States can absorb every shrimp imported and every shrimp caught, butterflied, scampied and



Mills Rooks

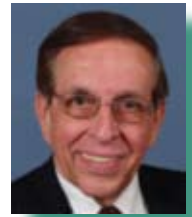
**OCEAN'S BOUNTY SEAFARMS, LLC**



# International's shrimp shells into chitosan

coated in coconut. Having said that, there is room for shrimp farming. It is the wave of the future.”

As Hurricane Katrina neared New Orleans a year ago, DeMarco boarded the



Richard DeMarco

last flight out. AgraTech's plans to build a \$6 million processing plant in New Orleans were literally blown out of the water like so many shrimp boats in Louisiana's Saint Bernard's Parish.

As unfortunate as Hurricane Katrina was for New Orleans and its surrounding areas—many of which are still limping toward recovery—the storm forced AgraTech to execute Plan B and DeMarco set his sights on South Carolina. Rooks, eager to flip the switch at his Jasper shrimp facility Ocean's Bounty Seafarms LLC, would secure a contract with AgraTech to provide all the shrimp he could raise.



John Bristow

South Carolina government officials were quite receptive to AgraTech's proposal to build a shrimp processing facility, which has agreed to take on all the wild-caught shrimp hauled in by the South Carolina shrimp fleet as well.

“We're looking at providing higher prices for the shrimpers so they can maintain their boats and make a living,” said John Bristow, Ph.D., AgraTech's vice president of manufacturing and quality control. “We hope to bring some more of those shrimpers back. And with what Mills Rooks can do year round, we can buy all of his shrimp, too.”

In fact, DeMarco emphasized that it's quite possible AgraTech could double market prices for shrimp producers, simply because of the revenue expected to be generated by chitosan production.

“I call it accidental brilliance,” DeMarco said. “There is no other entity on the planet anywhere that I can find doing shrimp processing and shrimp waste removal for chitosan at the same facility.”

Among its other virtues, the crustacean shell derivative chitosan can be used to replace some plastics that are created from oil, lessening U.S. dependence on the controversial commodity.

“It's a good time for it to come into play,” Bristow said. “There is plenty of interest in biodegradable materials, and chitosan is one of them. Given the oil situation, there is a lot of interest in getting these materials into the marketplace.”

Bristow said that great quantities of shellfish waste are generated in the United States annually. It's expensive to dump, but that's what's done most of the time.

“Chitosan production can turn that around,” Bristow said.

And the South Carolina Department of Commerce sees it as something that can turn its own economic doldrums around as well. They've embraced the idea of the shrimp processing plant for food, and its accompanying plant for chitosan production, as a way to keep its shrimpers afloat. AgraTech officials know their project is being closely watched, no doubt with a bit of hope. There's a future beyond boiled and battered shrimp. AgraTech would like to build more processing facilities around the United States.

“We are coming in with a new project and grand plans and no proof we can do it,” Bristow said. “That's still the case now. But the need is so great we have to try. Otherwise shrimpers will go away and that will be it. We are looking to shift the paradigm. Let domestic shrimp become the high-quality niche. Let the importers take care of general demand.”



U.S. MARINE SHRIMP FARMING PROGRAM

From page 1

## Weighing the variables of partial harvests

of the animals were partially harvested at a shrimp biomass of 8.9kg/m<sup>3</sup>, reducing it to 2.1kg/m<sup>3</sup>. At this point, the shrimp harvested were 17.9g. The remaining shrimp were grown an additional 10 weeks, where the system biomass had increased to 3.5kg/m<sup>3</sup> and showing results of shrimp averaging 34.2g. Following the partial harvest, the growth rate for the remaining shrimp had actually increased from .95g per week to 2.6g per week—during the first two weeks. It slowed considerably after that, leading OI to conclude that higher returns would be realized if the shrimp were only grown for an additional four weeks instead of 10 weeks.

“I think Terry’s model can help scientists prioritize their research,” Moss said. “OI’s approach to shrimp production is nearing economic feasibility by sustaining high biomass with reduced capital and operating costs.”



Terry Hanson and Shaun Moss at an OI raceway.

Depending on the location and available resources, the software can be massaged to accommodate different variables.

“There are a handful of biological parameters that can be changed to represent any of the consortium systems right now,” Hanson said. “The program allows for investor analysis by estimating capital requirements, operational expenditures, and financial indicators of profitability under varying input/output prices, raceway/greenhouse component choices, and biological growth parameters.”

Ultimately, the software is designed to help investors ready to take the plunge into shrimp farming make educated decisions based on their needs and available resources. But it is the Consortium’s scientists and researchers who use the program’s muscle to help determine the best way to raise big, healthy, disease-free shrimp while reducing costs.

Factors to consider include shrimp size, growth rate, feed conversion ratio, stocking density and survival. Shrimp size at initial stocking is critical because it affects survival. And harvest shrimp size is important because it has implications for marketing and prices received.

The model requires an on-going discussion between researchers and investors to find the most profitable combination of inputs, greenhouse designs, size and components.

“The revenue function in the model uses historical shrimp selling prices by size category and is so critical in determining a profitable operation that



Terry Hanson perfects his Hawaiian-styled “shaka” for Tony Ostrowski.

a manual price entering mechanism is included,” Hanson said. “The cost of production is high, but you can still make money if you have a market that can pay a higher price.”

Indeed, shrimp selling prices are important in any economic analysis, and for this particular study authored by Hanson, Posadas and Lawrence, the 1992-2002 “green” sheet shrimp prices for a variety of sizes of shrimp was averaged. The Consortium is now looking at recent off-the-farm price trends for more realistic inputs and measures of success. Consortium Director Anthony Ostrowski said that given current market prices, and for those in the foreseeable future, production costs should target near \$1.75 per pound.

Hanson and his colleagues conclude that partial harvesting can increase the amount of biomass produced in a super-intensive recirculating shrimp production system. But will it result in higher net returns? If too few shrimp are removed, the remaining number of shrimp may be too great to allow a larger targeted size to be achieved. If too few are initially harvested, then it’s possible the biomass will not help the farmer achieve the targeted size shrimp for market. They also conclude that if too many shrimp are harvested initially, then the remaining shrimp might not be enough to provide the greatest returns.

“The right mix of partial harvesting, stocking density, final sizes, number of crops per year and shrimp selling prices are needed to maximize profits,” the report asserts. “The trick to maximizing profits from a partial harvesting approach is for the carrying capacity of the system to be met twice.”

More goals loom on the horizon for Consortium researchers regarding growth and survival rates at higher densities and sizes beyond 30 grams. It appears that partial harvesting, under the right circumstances, is more profitable.

# Recirculating Aquaculture conference featured OI's Super-Intensive shrimp growth system

Oceanic Institute Research Associate Clete Otoshi recently attended the Sixth International Conference on Recirculating Aquaculture hosted by Virginia Tech at The Hotel Roanoke Conference Center. On behalf of OI's shrimp department, Otoshi presented a paper titled "Super-intensive growout of the Pacific white shrimp, *Litopenaeus vannamei*: Recent advances at the Oceanic Institute."



Clete Otoshi

Otoshi's presentation addressed problems such as disease and environmental issues that continue to plague traditional shrimp farmers.

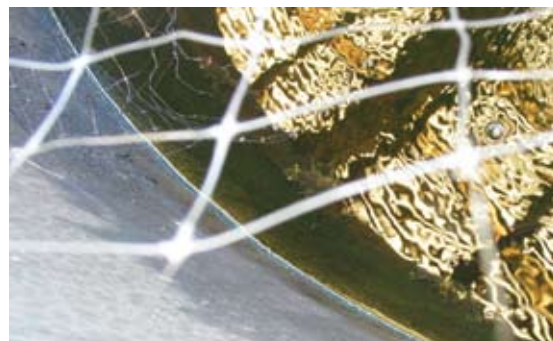
"Progress in the development of environmentally friendly and biosecure super-intensive recirculating systems offer a possible alternative," Otoshi asserts. "However, reduction in costs must occur for this technology to become a viable alternative."

From its selective breeding program, Specific Pathogen Free (SPF) growth-line shrimp were provided by the U.S. Marine Shrimp Farming Consortium to stock a 75 m<sup>2</sup> (76 cm depth) recirculating raceway at a density of 300 shrimp/m<sup>2</sup> (~400 shrimp/m<sup>3</sup>).

At 14 weeks, the shrimp were harvested with the following results:

According to Otoshi, improved management techniques and system design resulted in significant improvements in survival, FCR and water use over previous trials. An external bio-filter was not used in this trial and nitrification was completed by bacteria attached to particles suspended in the water column. On day 58, total DAPI bacterial count was  $3.9 \times 10^8$  cells/ml. Florescence *In Situ* Hybridization showed that the nitrifying bacteria of the genera *Nitrospira* were present at a concentration of  $1.2 \times 10^8$  cells/ml, which is 31 percent of the total count.

"The improved shrimp performance and simplified design demonstrated in this trial constitutes a significant step toward economic viability of such a systems," Otoshi concluded.



Stocking Weight	0.8 g
Harvest Weight	21.7 g
Survival	89.5 percent
Production	4.7 kg/m <sup>2</sup> (7.5 kg/m <sup>3</sup> )
Growth Rate	1.44 g/week
FCR	1.5
Water Usage	187 L/kg shrimp
Water Exchange	0.3 percent per day

Otoshi credits several colleagues at Oceanic Institute for their contributions to this study, including Larren R. Tang, Dion Dagdagan, Carrie Holl, Ph.D., Christine Tallamy, and Shaun M. Moss, Ph.D.

## **SHRIMP FARMING SURVEY ALERT!**

At our website is an on-line survey regarding the private aquaculture sector on unmet label claim drug needs that can be quickly filled out because participants only need answer questions relating to their species. Please download the survey, complete it for shrimp and email it to [RozSchnick@centurytel.net](mailto:RozSchnick@centurytel.net) as soon as possible.

The survey allows participants to identify what is necessary for a basic medicine chest for (1) the species they culture, (2) the diseases they need to control, (3) the procedures for which they need a zero withdrawal anesthetic or sedative so that they can release or slaughter the fish immediately after treatment, (4) for artificial spawning procedures, (5) gender manipulation, and (6) for marking.

## **SOLD OUT!**

Getting into the Texas Shrimp Farming Short Course is one of the toughest tickets in the industry.

The September 6-13, 2006, session is sold out. But those interested should know that enrollment for the 2007 session is underway. It's presented by The Texas A&M University System (Sea Grant College Program, Texas Cooperative Extension & Texas Agricultural Experiment Station) and the University of Texas at Austin (Marine Science Institute, Port Aransas).

To find information for the 2007 course, visit this link: [http://texas-sea-grant.tamu.edu/short\\_course.php](http://texas-sea-grant.tamu.edu/short_course.php).

This short course is designed for individuals who are actively involved in shrimp farming as well as for potential aquaculture entrepreneurs and investors who are considering opportunities in the commercial culture of shrimp. Others who might be interested in the course include bank personnel needing more information on the business potential, individuals considering a career in aquaculture, and researchers interested in the practical aspects of raising shrimp.



## **INDUSTRY BRIEFS**

The US Marine Shrimp Farming Program

Oceanic Institute  
41-202 Kalaniana'ole Hwy.  
Waimanalo, HI 96795

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