USMSFP

INDUSTRY BRIEFS

THE U.S. MARINE SHRIMP FARMING PROGRAM

The US Marine Shrimp Farming Program is a congressional initiative administered by the USDA/CSREES. It is an integral part of their aquaculture development effort and is executed by the US Marine Shrimp Farming Consortium:

The Oceanic Institute
Center for Applied Aquaculture and Marine Biotechnology
Waimanalo, HI

University of Southern Mississippi
Gulf Coast Research Laboratory
Ocean Springs, MS

Tufts University
School of Veterinary Medicine
North Grafton, MA

South Carolina Department of Natural Resources
Waddell Mariculture Center
Bluffton, SC

Texas A&M University
Texas Agricultural Experiment Station
Port Aransas, TX

University of Arizona
Department of Veterinary Science
Tucson, AZ

Nicholls State University
Department of Biological Science
Thibodaux, LA

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by Brad J. McAbee, Craig L. Browdy, Raymond J. Rhodes and Alvin D. Stokes

Waddell Mariculture Center Greenhouse Enclosed Super-Intensive Raceway

Several factors have limited the growth and expansion of the pond-based shrimp farming industry in the United States (US). Extensive and semi-intensive pond production systems are typically managed with high rates of water exchange. This production method raises environmental concerns regarding effluent discharge into receiving waters. Pond-based culture systems are also typically restricted to coastal regions, where land costs are inherently high. Another major concern is the limited growing season often found in temperate and subtropical regions. Recent research efforts in the US have been focusing on the use of greenhouse enclosed raceways for intensive to super-intensive shrimp production. These production systems offer several advantages over the typical pond-based systems. The raceways can be managed with zero to minimal water exchange thus greatly reducing the environmental impact due to effluent discharge. Biosecurity protocols can be implemented to manage disease vectors. Greenhouse enclosed systems also provide opportunities for inland culture operations and year-round production can be achieved in temperate regions.

At the Waddell Mariculture Center (WMC), experiments have been carried out on the application of greenhouse enclosed super-intensive raceways for nursery and growout culture of *Litopenaeus vannamei*. Temperature was maintained at a stable optimal levels by the heat exchange system despite outside temperatures which neared freezing on several occasions. Data on temperature inside and outside the greenhouse and in the raceway coupled with information on propane usage, will form the basis for system engineering to optimize passive heat gain and to provide a basis for system financial feasibility analyses for

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Link your farm to the USMSFP website!

The USMSFP Consortium website is adding a new section to assist United States marine shrimp farmers in the sales and marketing of US farmed-raised shrimp.

Farms with a current website should send their http address to: bherwig@oceanicinstitute.org

Farms without a website may request a free one page site to list contact and product information.

The USMSFP Consortium is encouraging the participation of all US marine shrimp farms.

For more information log on to the USMSFP website at:

http://www.USMSFP.org

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US Marine Shrimp Farming Program
The Oceanic Institute
Center for Applied Aquaculture and Marine Biology
41-202 Kalanianaole Hwy.
Waimanalo, HI 96795
Phone: (808) 259-3141
Fax: (808) 259-3121

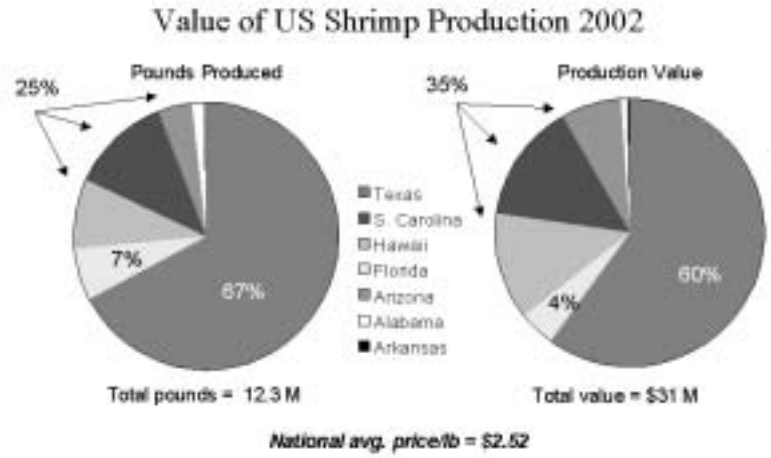
editor: B. Herwig
www.usmsfp.org

Anthony C. Ostrowski, Ph.D.
USMSFP Consortium Director

The price of shrimp is no small matter

The year 2002 was difficult for domestic shrimp farmers. Prices fell sharply as the downturn in Japan's economy persisted and import restrictions in Europe funneled excess shrimp to the US. The events of September 11 also altered the eating habits of Americans. Farm gate prices for shrimp dropped to a national average of $2.52/lb, with state averages as low as $1.75/lb. Several states, however, offset falling prices by developing strategies that yielded higher than average sales. These states contributed a greater percentage to the value of US farmed shrimp than to the pounds they actually produced (see below). Direct marketing, promotion of product freshness, and even sales of live animals into ethnic markets were used to leverage the unique quality and advantages of US farm-raised shrimp. Taking heed, many of these same strategies are being used this season in other states as farmers work in concert with state marketing programs to find and develop new and more profitable markets for their shrimp.

Our 2002 Industry Survey indicated that a critical priority for US marine shrimp farmers was developing strategies to offset falling prices. In direct response, the USMSFP 2003 Implementation Plan added a major research objective to assess the value of marketing strategies for shrimp, which is currently ongoing. We also emphasized production economics, using sensitivity analyses to target research to improve farm production efficiencies and lower overall costs. In this issue of *Industry Briefs*, we focus on other



USMSFP efforts to provide a competitive edge to US farmers by developing viable, super-intensive nursery and growout production systems. Results at the Waddell Mariculture Center and Texas Agricultural Experiment Station, Shrimp Mariculture Research Facility, have brought us much closer to realizing the benefits of these emerging technologies. In fact, nursery phases are already in use on several US shrimp farms to provide a head start in growout, employ double cropping, produce larger shrimp to gain market advantage, or to better manage production strategies for sales. An article from an independent news source also touts key value-added attributes of these systems, fresh shrimp and off-season production. With low shrimp prices likely here to stay, the USMSFP is well positioned to help the domestic shrimp farming industry meet the challenges of the future in a big way.

TAES Juvenile Shrimp Break Records in Limited Discharge Production

By Tzachi M. Samocha, Ph.D.

A greenhouse-enclosed raceway used in a nursery with limited discharge.

Texas Agricultural Experiment Station, Shrimp Mariculture Research Facility (TAES-SMRF) in Corpus Christi is developing a biosecure intensive nursery raceway system with limited discharge and the preliminary results are encouraging. A study was conducted to evaluate the effects of three methods to reduce particulate matter load in nursery tanks and the effect on growth, survival, feed utilization and selected water quality indicators. One raceway (#1) was equipped with a bead filter, the second raceway (#2) was equipped with a rapid sand filter, while the third raceway (#3) was provided with a foam fractionator.

On June 20, 2003, TAES-SMRF finished the harvest of the three 45 m^3 raceways stocked 74 days earlier with five-day-old PL of the Pacific white shrimp *Lito-penaeus vannamei*. Each raceway was equipped with a center partition, six banks of 5.1 cm airlift pumps, six air diffusers, a rapid sand filter, a Venturi injector and sensors with dial out alarm system. To evaluate the effect of bead filter and foam fractionator, the rapid sand filter was not used on raceway #1 and #3.

The airlift pumps created water circulation enhanced by a high-pressure centrifugal pump that pumped water through a pipe with spray nozzles positioned under the partition. Raw seawater was treated with 10-ppm chlorine prior to stocking of the raceways.

Temperature, DO, pH and salinity were monitored at least twice daily. Settleable solids were recorded daily starting on day 49. Ammonia, nitrite, nitrate, reactive P, TSS, VSS, cBOD5 and COD were monitored weekly.

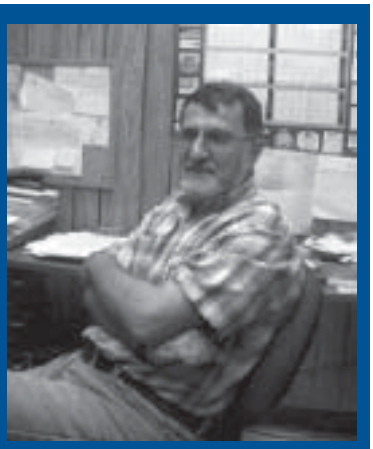
The best results were received in a raceway that was equipped with a rapid sand filter that was stocked at a density of about 6,500 PL/m^3. Shrimp survival at harvest in this raceway was: 100%; average weight: 0.89 g; FCR: 1.09; biomass load: 5.25 kg/m^3 and with less than 0.5% of new water added daily to offset evaporation and water losses to cleaning of the sand filter. Feed used was Rangen 45/10 and 40/5 (crumble # 0, 1, 2, 3 & 4). During the first week after stocking, the postlarvae were fed Zeigler PL Redi Reserve and newly hatched *Artemia* nauplii. It is important to mention that throughout the nursery study the shrimp showed no external fouling or signs of infection by chitenoclastic bacteria. The survival rates in the other two raceways were 96.3% and 97.8% for the bead filter and foam fractionator, respectively, although a lower stocking density was used in the raceway operated with the bead filter (3,800 PL/m^3 vs. 5,000 PL/m^3).

The result from raceways operated with the sand filter represents a world record for juvenile shrimp production under limited discharge. Although these are preliminary results, further research in this area certainly looks promising.

Profile: Dr. Tzachi M. Samocha

Dr. Tzachi M. Samocha is a professor with dual appointment at the Texas Agricultural Experiment Station (TAES), and Texas A&M University-Corpus Christi, Texas. Dr. Samocha plans and conducts shrimp culture experiments in raceways and ponds to develop new concepts in intensive nursery and growout techniques under biosecure and limited discharge conditions. Additional research objectives include planning and carrying out aquaculture technology transfer to commercial producers and industry related businesses.

Eventually, Dr. Samocha thinks water discharges can be greatly reduced in commercial shrimp production operations. “We hope to have super-intensive, closed, recirculating production systems in greenhouses with only limited water discharge,” he said. “It will require development of new concepts and treatment methods for improving mariculture water.



Dr. Tzachi M. Samocha TAES

Super-Intensive Success

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varying geographical locations. Water reuse between cycles has been tested by storing water at harvest of the previous run and re-flooding the raceways with this water for the subsequent cycle. The reuse of water coupled with a relatively fast turn around and re-flooding around suspended Aquamat™ material resulted in consistently low ammonia and nitrite levels. In contrast, freshly filled and bloomed tanks or use of new Aquamat material resulted in midseason ammonia increases followed by nitrite spikes. Thus, system designs which reuse water between crops may serve to stabilize microbial communities and associated water quality parameters while enhancing opportunities for application of these technologies away from the coastal zone.

Results from the most recent growout trial continued to demonstrate trends toward improvement in production parameters. At harvest, production results were: survival, 91%; mean weight, 16.6 g; FCR, 1.54; avg. growth/week, 1.44 g; and yield, 4.50 kg/m². For this trial the raceway was stocked with 1g juveniles from a nursery system. Together with improved growth rates, growout time was reduced to 11 weeks. Use of juveniles may also have contributed to the improvement in survival rates.

As described above, important modifications were made to system operations during this trial including use of a bead filter and removal of solids during the backwash cycle and injection of oxygen. Figure 1 shows the growth of the shrimp and system dissolved oxygen levels before and after addition of oxygen and filtration. The apparent increase in growth during the latter half of the cycle is in stark contrast to the typical plateau effect observed in previous trials as solid levels continued to increase late in the growing season. The use of oxygen can have positive benefits in terms of improved growth and condition of the target crop and increased system carrying capacity, however, negative effects of CO_2 buildup and associated pH drops must be addressed.

The economic feasibility of commercial shrimp culture in South Carolina using the state-of-the-art indoor recirculating biosecure systems has also been initiated. The purpose of the analysis is two-fold: (1) to develop bioeconomic model specific to South Carolina that will assist researchers in investigating the sensitivities of projected profits and risks to various culture techniques and related variables (e.g., market prices), and (2) to provide commercial feasibility analysis information germane to private sector needs (e.g., preparation of business plans). As an initial starting point of this analysis, a "base case" production system along with production and economic assumptions were selected based upon experimental work at the Waddell Mariculture Center and other information sources. The hypothetical, base case production unit in the initial analysis is comprised of five modules each of which is comprised of six, 750/m² raceways covered by biosecure interlinked greenhouses. It was assumed that seawater would be pumped in and treated from nearby source (e.g., an estuarine creek) and this treated seawater would be heated via a heat exchanger system during the colder months. Major preliminary base case production assumptions included direct stocking of shrimp 1g animals at 300/m², overall survival to harvest size of 85%, mean harvest size of

Figure 1. Shrimp growth and system dissolved oxygen levels before and after addition of oxygen and filtration.

17g, growth rate of 1.3 g/wk allowing four crops per raceway over a 12 month period, and 1.50 FCR. Major economic assumptions included juvenile stocking costs of $11.50/1,000 and feed costs of $0.50/kg. The projected total estimated cost of production per kg is $4.36 with variable costs making up $3.27 per kg. This preliminary analysis indicates that one of the most important parameters relative to reducing production costs is growth rate. For example, maintaining growth averaging 1.44g/wk rather than the 1.3 g/wk in the base case scenario, would reduce projected total production costs by $0.21 per kg. Consequently, it appears that cost-effective techniques that can improve growth rates such as the selection of fast growing shrimp strains could significantly improve the financial performance of indoor recirculating biosecure systems.

Conclusions

The WMC prototype systems provide an insight into alternative culture technologies that have excellent potential to allow development and expansion of the US shrimp farming industry. By embracing these technologies, the environmental impact of discharged effluents would be reduced substantially if not eliminated, biosecurity protocols and procedures could be implemented to prevent the spread of disease agents to and from the culture facility, and year round culture could be achieved irrespective of location. In addition, systems could be located inland, potentially near market centers, opening up new opportunities for value added fresh or live product sales.

In summary, it appears that the commercial development of greenhouse, superintensive shrimp culturing is favorable in the US, but it will remain dependent upon applied research and development of cost-effective production techniques coupled with marketing approaches that can buffer US commercial shrimp farm products from the vicissitudes of major US shrimp market segments, especially those segments that are apparently subject to shrimp import induced price reductions.

For complete article go to http://www.usmsfp.org

Super-Intensive Greenhouse Harvest Nets Local Markets a Fresh Catch!

By Matt Coffey

Thanks to the Waddell Mariculture Center on Sawmill Creek Road, fresh shrimp was on the menu of a local restaurant.

Using something called a Super-Intensive Greenhouse Production System (basically a mobile greenhouse) biologists harvested approximately 2,500 pounds of shrimp.

The shrimp were sold to the Bluffton Oyster Co. and Pepper's Porch, both in Bluffton.

The system was established "so local markets won't have to rely on imported shrimp in the off-season," said marine biologist, Jeff Bruce.

The system consists of a greenhouse and a biological filtration system for water. The shrimp are grown in a controlled climate until they are ready to be harvested.

"I looked at the quality of these shrimp and they looked good, so I decided to buy some," said Larry Toomer, owner of the Bluffton Oyster Co.

The money raised from the sale will support programs at the mariculture center.

With the greenhouse system in place at the Waddell Mariculture Center, Toomer can buy fresh shrimp after the season has closed.

"Even though they're farm-raised, they're farm-raised in Bluffton," Toomer said. "It's better to get live shrimp because you don't have to worry about where it came from." Another program goal, Bruce said, is for the public to consider raising shrimp.

"With this system, you don't have to live on the coast to grow shrimp," Bruce said.

Shrimp can be harvested every 75 days, which means three to four crops a year.

"What we'd like to do is make the system twice as long and twice as wide," Bruce said. "That way, it makes it financially feasible for people to raise shrimp."

Bruce said the water used in the system can be recycled and used for an entire year.

Harvesting shrimp in the Super-Intensive Greenhouse Production System

"If you live in Colombia and want to raise shrimp, you would only have to truck in water once a year," Bruce said. "That's one of the benefits of the system."

For more information about the greenhouse system, call the Waddell Mariculture Center at 837-5795.

Reporter Matt Coffey can be reached at: mcoffey@lowcountrynow.com

NEWS FROM THE CONSORTIUM

Dr. Marilyn B. Kilgen
Nicholls State University

Nicholls State University is collaborating with the USMSFP Consortium in the development of super-intensive systems.

Dr. Marilyn B. Kilgen, Professor and Head, Department of Biological Sciences, is the lead Principal Investigator (PI). Dr. Ramaraj Boopathy and Dr. Quentin C. Fontenot are co-PIs in the investigation of cultured shrimp wastewater remediation and treatment.

Effluent continues to be a concern in the industry. Shrimp aquaculture must meet strict environmental standards relating to environmental degradation and introduction of pathogens. The research team at NSU will further efforts to address this issue in ways that are sustainable and economically viable.

Nicholls State University is located in Thibodaux, LA

Coming Up in the Winter Issue...

Don't miss the next issue of Industry Briefs!

The January 2004 issue will focus on USMSFP efforts to help protect our domestic industry through the identification, treatment, and control of disease.

Dr. Jeff Lotz and his team at USM will relay recent laboratory advances on Necrotizing hepatopancreatitis (NHP).

Dr. Don Lightner and his team at UAZ will update us on the status of USMSFP cooperation with the Texas Aquaculture Association and the FDA's Center for Veterinary Medicine on approval of oxytetracycline for use in shrimp, continued efforts on Taura Syndrome Virus, and recent graduate research on seabirds as vectors for viral disease transmission."

Publications

"USMSFP Annotated Bibliography," is now available! This publication includes more than 850 abstracts published by the USMSFP consortium members from 1985 - 2001.

$25
shipping included

"Controlled and Biosecure Production Systems, Evolution and Integration of Shrimp and Chicken Models," compares advanced farming technologies and the vertical integration of each of these modern agricultural industries.

$15
shipping included

"Proceedings of the USMSFP Bio-security Workshop," was first published in 1998. This handbook will be useful for anyone who wants to establish effective bio-secure production systems.

$10
shipping included

Please send a check or money order payable to The Oceanic Institute, attention: Susan Sparaga, USMSFP, at The Oceanic Institute, 41-202 Kalanianaole Hwy, Waimanalo, HI 96795. Phone (808) 259-3129, fax (808) 259-3121, or e-mail: ssparaga@oceanicinstitute.org.

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The Oceanic Institute
Center for Applied Aquaculture and Marine Biotechnology
41-202 Kalanianaole Hwy.
Waimanalo, HI 96795

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