



# INDUSTRY BRIEFS

April 2005 THE U.S. MARINE SHRIMP FARMING PROGRAM  
Vol. 11 No. 2

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

## *SPF Shrimp: Asking the right questions, clearing the myths & mysteries*

By Shaun M. Moss, Ph.D.  
Oceanic Institute



The newly constructed Nucleus Breeding Center at Oceanic Institute. The USMSFP established the world's first and most advanced breeding genetic selection program for marine shrimp.

The first population of specific pathogen free (SPF) Pacific white shrimp (*Litopenaeus vannamei*) was developed in 1989 when Dr. Don Lightner and his colleagues at the University of Arizona imported about 15,000 postlarvae from a commercial hatchery in Sinaloa, Mexico.

These shrimp underwent histological evaluation and did not appear to be infected with any known pathogen. About 10,000 of these "candidate" SPF shrimp were shipped to the Oceanic Institute in Hawaii where they were raised to broodstock, mated and spawned to produce SPF offspring.

Since then, SPF shrimp have played an important role in the U.S. shrimp farming industry. Despite that recognition, the SPF concept is not clearly understood by many stakeholders in

the industry—that SPF shrimp are free of specified pathogens.

Three essential criteria are required for a pathogen to be included on an SPF list. These are: 1) the pathogen must be reliably diagnosed, 2) it must be physically excluded from a facility, and 3) it must pose a significant threat to the industry.

Although there is no internationally recognized SPF list used by the global shrimp farming industry to date, the current working list of specific pathogens for SPF penaeid shrimp in the United States includes eight viruses, one prokaryote, and certain classes of parasitic protozoa (see Table 1 on P4). It is important to note that this list is dynamic and will be revised and expanded as new pathogens are identified and more accurate disease diagnostic tools become available.

**IN THIS ISSUE**

DEMYSTIFYING SPF	P1
SPF ZONES IN HAWAII	P3
WRANGLING TEXAS TSV	P6
U.S. SPF PROTECTION	P7
WEB WATCH	P8

**Sales of Oceanic Institute Kona (TSV-Susceptible) & TSV-Resistant *L. vannamei* lines will be posted to [www.usmsfp.org](http://www.usmsfp.org) beginning June 1, 2005**



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

**Securing an Opportunity**

Disease continues to be the most challenging and industry-altering issue in the world of shrimp farming.

Less than five years ago the global industry focused 60 percent of its production on *P. monodon* and only 15 percent on *L. Vannamei*, with little interest for specific-pathogen-free (SPF) or specific-pathogen-resistant (SPR) breeding programs. Today, the situation is nearly completely reversed. Diseases, the lack of quality wild broodstock and the absence of SPF programs for *P. monodon* have sparked a world-wide demand for domesticated *L. vannamei*. This switch represents both challenges and a tremendous opportunity for U.S. broodstock producers.

Concurrent with increased use of *L. vannamei* worldwide, new diseases and variations of old ones are emerging like infectious myonecrosis virus (IMNV), identified last year in Brazil, and the new variant of TSV recently found in Venezuela. With new diseases, there is also a new threat of disease transfer through commodity imports that requires a reexamination of basic biosecurity protocols for our domestic production farms and breeders. U.S. producers have a 20-year edge on breeding SPF *L. vannamei* stocks because of the pioneering work of the USMSFP. The emerging challenge for the industry is to ensure the sustainability of the opportunity presented to make domestic *L. vannamei* stocks the gold standard for the world-wide shrimp farming industry.

In this issue of *Industry Briefs*, we examine how disease has provided that opportunity for domestic broodstock producers yet threatens its sustainability if not properly leveraged. Our feature article is by Dr. Shaun Moss, director of Shrimp Technology at Oceanic Institute and leader of the USMSFP's selective breeding objective. Dr. Moss takes the opportunity to continue his crusade to inform the industry on correct SPF shrimp terminology and misconceptions that affect proper use of the animals and could ultimately threaten production. It is essential domestic breeders distinguish their stocks to ensure clients do not confuse origins, pedigrees, or disease status.

In an effort to protect the broodstock sector of the industry in Hawaii, the state in which most shrimp broodstock suppliers are located, Dee Montgomery-Brock and Clyde Tamaru of the State of Hawaii discuss how imports may threaten local suppliers and a controversial proposal to develop regional zones limiting commodity imports to reduce the risk of disease transfer to their operations. Despite the industry's best efforts at managing disease risk, there are always those factors currently not under control of the industry that continue to threaten its existence.

As a reminder of the industry's vulnerability, our final article by Ken Gaines, a Ph.D. candidate at TAES, reviews the 2004 outbreak of TSV in Texas, the multi-institutional effort to study and isolate the spread, and what is being planned in response to further minimize the risk.

A commercial viewpoint is shared in our interview with Dr. Jim Wyban, President of High Health Aquaculture, Inc., of Kailua-Kona, Hawaii. Dr. Wyban provides insight into the opportunities and challenges of being a domestic breeder and broodstock supplier, and his views on securing that opportunity for the future.

As indicated in previous issues, there is great opportunity for the U.S. shrimp farming industry in a changing world market. We need to leverage the advantages, put in place the elements to ensure success, and secure our future. There is great opportunity for the U.S. shrimp farming industry in a changing world market.



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, HI

**Gulf Coast Research Laboratory**

University of Southern Mississippi  
Ocean Springs, MS

**Tufts University**

School of Veterinary Medicine  
North Grafton, MA

**Waddell Mariculture Center**

Department of Natural Resources  
Bluffton, SC

**Texas Agricultural Experiment Station**

Texas A&M University

**University of Arizona**

Department of Veterinary Science  
Tucson, AZ

**Nicholls State University**

Department of Biological Science  
Thibodaux, LA

**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

# Weighing the risks of imported commodity shrimp to Hawaii's SPF shrimp industry

By Dee Montgomery-Brock, CTSA, Hawaii Department of Agriculture Development Program and Clyde S. Tamura, Sea Grant Extension, University of Hawaii

Hawaii's Specific Pathogen Free (SPF) shrimp farming industry has grown tremendously over the last nine years.

After a modest beginning in 1996 when Hawaii had only two private facilities actively selling SPF shrimp broodstock, the state now has nine such facilities with annual sales in the multi-million dollar range. Last year, one of these Hawaii SPF companies, Kona Bay Marine, received the 2004 Governor's Exporter of the Year Award.

To a large degree, the increase in the value and sales can be attributed to the fact that Hawaii's shrimp have a reputation as being pathogen free. By combining the efforts of government and private industry we have been able to increase the sales and marketability of Hawaii's SPF shrimp by protecting shrimp populations from exposure to certain viruses not present in the Islands.

The term SPF implies that the facilities, operations and animals are free of the named pathogens to the limits of the diagnostic tests available. The State currently has in place quarantine and disease surveillance programs for live shrimp to prevent the accidental introduction of shrimp pathogens. However, it is still possible for the most damaging shrimp viruses to enter Hawaii via frozen,

unprocessed commodity shrimp. On the islands of Oahu and Kauai, shrimp viruses have been detected in frozen unprocessed commodity shrimp from individual "mom and pop" stores and from various large chain supermarkets.

The challenge to the industry and supporting government agencies is to find cost effective and equitable means in preventing the contamination of SPF production facilities from outside sources of infected commodity shrimp. Collaborative efforts are being made to solicit support to study the idea of designating SPF shrimp zones in the State of Hawaii. The short-term goal of this project is to obtain the necessary information whereby decision makers will be able to rationally decide on whether SPF shrimp zones can be established and enforced within the State of Hawaii. Ideally, these SPF-free zones would encircle a production facility that markets its shrimp with the SPF label. How large of a zone is required, and how the zone will be legally established and enforced, are

challenges that will also need to be addressed. The long-term goal of this project is to protect the State of Hawaii SPF shrimp farming industry from the economically devastating pathogens detected in imported commodity shrimp.



Dee Montgomery-Brock

## Polymerase Chain Reaction results of commodity shrimp collected from supermarkets in Hawaii (DNA viruses)

Source	ADP Case #	WSSV	IHHNV
Small Local Market	03-30 A1	Positive	Positive
Small Local Market	03-30 B1	Not Detected	Positive
Small Local Market	03-30 C1	Not Detected	Positive
Large Local Food Chain	03-141 A1	Positive	Not Detected
Large Local Food Chain	03-141 A2	Positive	Positive
Large National Food Chain	03-142 A1	Positive	Not Detected
Large National Food Chain	03-142 A2	Not Detected	Positive
Large National Food Chain	03-327 A1	Positive	Positive
Large National Food Chain	03-327 A2	Positive	Positive
Large National Food Chain	03-327 A3	Positive	Positive
Large National Food Chain	03-327 A4	Positive	Positive

from page 1: *SPF Verification*

To develop SPF shrimp from the wild, specimens are collected and transferred to a primary quarantine facility where they are analyzed for specifically listed pathogens using appropriate disease diagnostic tools (see table on P5). If shrimp test positive for any of the listed pathogens, they are destroyed in the primary quarantine facility. If shrimp test negative for specifically listed pathogens after several successive screenings, they are transferred to a secondary quarantine facility where they are matured and spawned to produce an F<sub>1</sub> generation of "candidate" SPF shrimp. If shrimp from the F<sub>1</sub> generation test negative for specifically listed pathogens after several successive screenings, they are transferred out of the secondary quarantine facility and can be

included as part of the germplasm in a nucleus breeding center (NBC). Shrimp that are maintained in a well-established NBC (i.e. where there is a history of negative disease status documented through a surveillance program) may be designated as SPF. However, once shrimp leave an SPF-NBC, they no longer are referred to as SPF even though they may be free of

specifically listed pathogens. If shrimp are transferred from an SPF-NBC to a medium-biosecurity facility, their new designation is High Health (HH), indicating that these shrimp are at greater risk of pathogen exposure and infection.

If shrimp are transferred to a low-biosecurity shrimp farm, they have entered the Commodity Production (CP) stream, which is most vulnerable to pathogen outbreaks, and the shrimp are neither SPF nor HH.

The important message here is that the SPF designation refers to present pathogen status only, and is a function of where the shrimp are maintained (i.e. the level of biosecurity where the shrimp are cultured). SPF shrimp are not necessarily disease or pathogen free. Although SPF shrimp are, by definition, free of all specifically listed pathogens, SPF shrimp may be infected with a known pathogen that is

### USMSFP Working List of Specific Pathogens for "SPF" Penaeids in the United States

Pathogen	Pathogen Type	Category
<b>VIRUSES</b>		
TSV	dicistrovirus (n.f.)	C-1*
WSSV	nimavirus (n.f.)	C-1*
YHV, GAV, LOV	ronivirus (n.f.)	C-1,2*
IHHNV	parvovirus	C-2*
BP	occluded baculovirus	C-2*
MBV	occluded baculovirus	C-2*
BMN	unclassified nonoccl'd BV	C-2
HPV	parvovirus	C-2
IMNV**	totivirus	C-1,2
<b>PROCARYOTES</b>		
NHP	alpha proteobacteria	C-2
<b>PROTOZOA</b>		
Microsporidians	Microsporidia	C-2
Haplosporidians	Haplosporidia	C-2
Gregarines	Apicomplexa	C-3

\* = OIE listed; \*\* = proposed addition for 2004-2005

**Sales of Oceanic Institute Kona (TSV-Susceptible) & TSV-Resistant L. vannamei lines will be posted to [www.usmsfp.org](http://www.usmsfp.org) beginning June 1, 2005**



*Biosecurity is key to an effective SPF shrimp breeding program.*



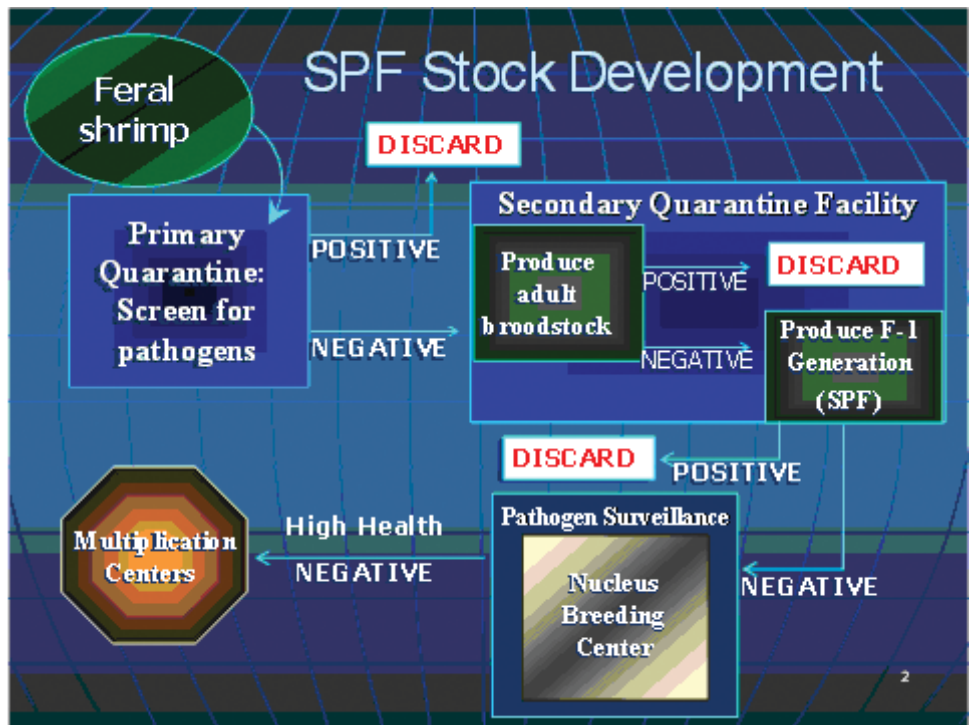
*Hatchery area of the Nucleus Breeding Center at Oceanic Institute.*

not included on the SPF list of the shrimp supplier, or with an unknown pathogen that has not yet been described. SPF status is not a heritable trait. Although there are a number of commercially important traits exhibited by shrimp that are heritable, SPF status is not one of them. Offspring of SPF shrimp are not considered SPF unless they are produced and maintained at an SPF facility. SPF status changes with the pathogen condition of the shrimp, as well as the type of environment within which they are cultured (i.e. the level of biosecurity).

SPF shrimp do not have enhanced resistance or susceptibility to viral pathogens. SPF shrimp have no innate resistance to a particular pathogen, nor are they innately susceptible. Disease resistance or susceptibility can be bred into a line of shrimp through selective breeding or other approaches, but this has no bearing on SPF status. Finally, SPF status is not an indication of the shrimp's genotype.

SPF status depends on the presence or absence of specific pathogens in the shrimp, and this status changes depending on the level of biosecurity where the shrimp are maintained. Shrimp farmers who want to purchase SPF shrimp need to ask the following questions: What specific pathogens are on the supplier's SPF list? What disease diagnostic tools were used to screen the shrimp? When was the most recent screening performed and by whom? What disease surveillance program does the supplier follow to monitor his stocks? What is the disease history of the facility? The purchaser of SPF shrimp should also receive a copy of the most recent disease screening results and appropriate certification.

The future of the US shrimp farming industry is predicated on using *bona fide* SPF shrimp and it is incumbent on all relevant stakeholders to understand what SPF means and to enforce this critically important biosecurity concept.



Research Associate Dustin Moss tends the *L. vannamei* in a raceway at the Nucleus Breeding Center.

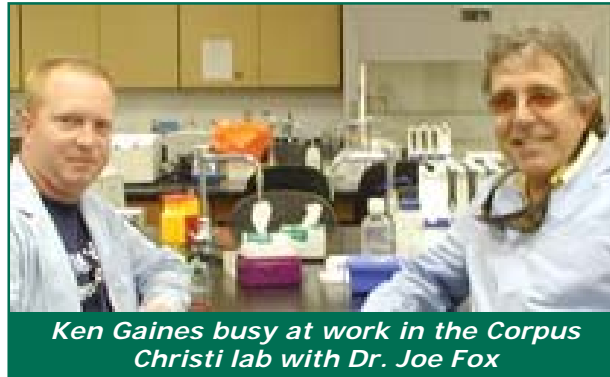
# Researchers & farmers combine efforts to eradicate TSV from Texas

By Ken Gaines, Texas A&M Corpus Christi

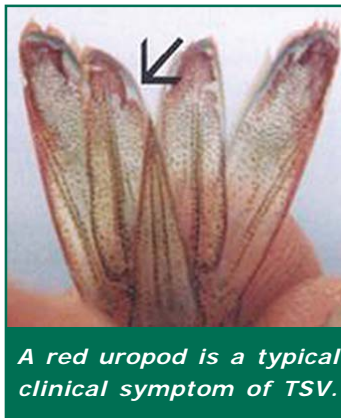
The 2004 Taura Syndrome Virus (TSV) outbreak in South Texas afforded researchers an opportunity to study the mechanics of the disease in groups of organisms other than farmed shrimp. The mode of transmission of TSV is not yet very well understood. An increased understanding of its transmission could help shrimp farmers minimize or prevent infections in their shrimp.

During the 2004 TSV outbreak, a coalition of researchers undertook an extensive sampling effort on three affected farms to identify and characterize any other organisms that may have been associated with the disease. Analyzed were samples of shrimp, zooplankton and ambient macroinvertebrates. Reverse-transcriptase PCR and gel electrophoresis were used to reveal the presence of the virus in the overall culture pond community. The entire project was completed over five months during which biweekly sampling and analysis were conducted. The project was finalized by taking a set of samples from each pond after harvest.

Other efforts during the 2004 TSV epizootic included sequencing and identification of the causative agent as an Asiatic strain of the virus, accomplished in the laboratories of Dr. Don Lightner at the University of Arizona; sampling in preparation for a study by Dr. Acacia Alcivar-Warren at Tufts University that seeks to use genetic markers to help trace broodstock lines; and Texas aquaculturists' efforts to review biosecurity protocols to curb or prevent continued spread of the



Ken Gaines busy at work in the Corpus Christi lab with Dr. Joe Fox



A red uropod is a typical clinical symptom of TSV.

disease, spearheaded by Mr. Granvil Treece of the Texas Sea Grant Program.

Results of the study revealed that TSV can in fact be associated with organisms other than shrimp in a pond culture situation. These included water boatmen (*Trichocorixa reticulata*), grass shrimp (*Palaemonetes* sp.), barnacles (*Order Cirripedia*), and mussels (*Mytilus edulis*).

Also noted was an apparently cyclical dynamic in the disease and its presence in the culture pond. Finally, when looking at the overall prevalence of TSV on affected farms, it was noted that the disease appeared to spread outward from one farm geographically central to the others. It is important to note that although the disease was shown to be associated with other organisms, no data was produced that confirmed an active infection in the other organisms.

Currently, research is funded by and conducted at Texas A&M University-Corpus Christi to determine environmental persistence of TSV. Results could help researchers determine if it is carried and transmitted to farmed shrimp from an outside source or if it relies on farmed shrimp for initial transmission and establishment in the pond.

Possibilities for future research could include both challenges with TSV-associated intermediate hosts, identification and characterization of organisms capable of transmitting an active TSV infection to farmed penaeid shrimp, and further genetic variability studies of the virus on a geographic and temporal basis.

## Texas TSV Research Coalition

Texas A&M University-Corpus Christi:  
Ken Gaines, Dr. Joe Fox, Dr. David McKee,  
Dr. Patrick Larkin, Dr. Joanna Mott

Texas Agricultural Experiment Station-  
Shrimp Mariculture Project:  
Dr. Addison Lawrence

University of Arizona:  
Dr. Donald Lightner

Harlingen Shrimp Farms Ltd.:  
Kieth Gregg, Kim Page, Robert Smiley,  
John Brauner, Brent Burkott

Texas Parks & Wildlife Department:  
Dr. Robert Vega, Dr. Ya-Sheng Juan,  
Robert Adami

Texas Veterinary Medical Diagnostic Lab:  
Dr. Kenneth Hasson, Dr. Patricia Varner

# Protecting U.S.-grown SPF broodstocks

By Paula Bender  
Industry Briefs Editor

According to Jim Wyban, founder of High Health Aquaculture Inc. in Kona, Hawaii, there is a tremendous amount of confusion regarding the term Specific-Pathogen-Free or SPF shrimp.

Wyban sells shrimp broodstock all over the world and it's a point of pride that it is disease and virus free. Unfortunately for Wyban and other US breeders of *L. vannamei* stocks, it's a gamble: No two years are the same, planning for the future is difficult, and almost immediately customers could become competitors.

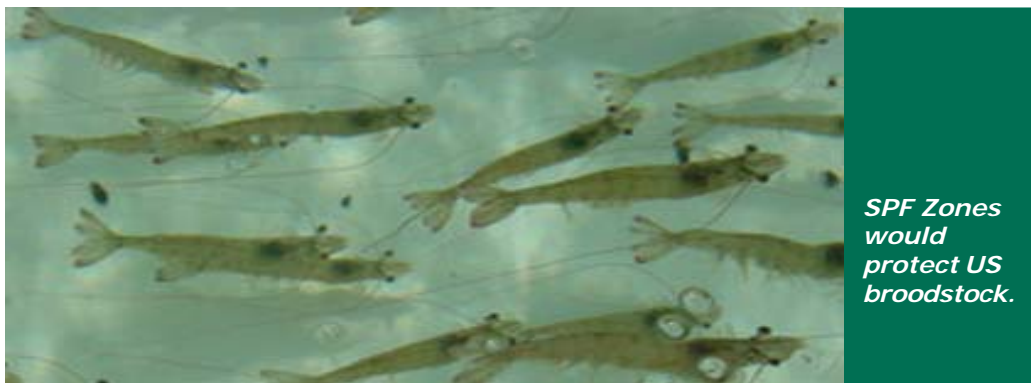
Wyban said that the United States Marine Shrimp Farming Program has the most stringent standards in its SPF criteria and the program should be more assertive about promoting those standards and adherence to them.

"The U.S. consortium sets the standard and should take credit for it," Wyban said. "I'd like to see a unified standard of what SPF is," Wyban said. "I'd like to promote the shrimp consortium's definition that's used by Don Lightner and others in their literature. It's more strict than what the [Office International des Epizooties] goes by."

Wyban is right. Foreign growers have seized on the fact that the consortium has referred to SPF as a dynamic list of viruses and diseases. As a result, if a disease such as IHNN is dropped from the list in Thailand, the country asserts its farmers are growing and selling SPF shrimp because the malady is no longer listed there as a problem.



High Health Aquaculture, Inc.  
President Jim Wyban



**SPF Zones  
would  
protect US  
broodstock.**

"This adds tremendous confusion within the industry. The breeders seem to know better but they don't tell the farmers about it," Wyban said. "If they grow broodstock from Hawaii four generations ago, they still call it Hawaii stock. Maybe they know better. They claim it's Hawaii SPF stock when in fact it's grown in China. What we need to do

in the industry is get the word out to differentiate U.S. shrimp."

Radical as it might seem, Wyban said he likes the idea of turning the tables on the world to protect U.S. shrimp broodstocks.

"I think Hawaii should be identified as an SPF zone so no raw shrimp products could be imported into the state," Wyban said. "Australia has the same thing in place to protect its local industry in farming and fisheries so as to not introduce pathogens. If Hawaii could initiate something like that, it would protect the SPF broodstock suppliers and create an opportunity for the food shrimp growers to promote their unique and fresh shrimp instead of competing with frozen imports from Thailand. This would be based on science, not trade barriers. If it worked in Hawaii, a longer-termed vision would be to implement this for the entire United States."

Wyban blames the import of raw shrimp into the U.S. as a direct threat to the U.S. shrimp industry and to coastal fisheries. If Wyban--and other U.S. broodstock suppliers were to succeed in our domestic market, it would be indicative of a strong, biosecure industry.

"The task for us is to organize a strategic plan to incorporate the U.S. shrimp farming industry with suppliers, processors and marketers," he said. "After all, the U.S. is the biggest market for shrimp."

**Virtual Visitors Welcome!**

Have you been to <http://www.usmsfp.org> lately? If not, then what are you waiting for?

Our News & Headlines link features timely updates of industry news. Get connected to various farms around the United States.

Communicate with Consortium members and follow their links to see what their institutions are up to. Check it out and let us know what you think.

**Sales of Oceanic Institute Kona (TSV-Susceptible) & TSV-Resistant L. vannamei lines will be posted to [www.usmsfp.org](http://www.usmsfp.org) June 1, 2005**

**Watch for our July 2005 Industry Briefs**

Will farmed shrimp suffer the same bum rap as farmed salmon? We'll discuss how shrimp, by far the most popular seafood in the world, can stay on top of the heap.

Industry Briefs welcomes letters and commentary from researchers, farmers and others interested in breeding disease-free *L. vannamei* in the United States. Connect through our on-line link, or send us your correspondence:

The US Marine Shrimp Farming Program  
Oceanic Institute  
41-202 Kalaniana'ole Hwy  
Waimanalo, HI 96795

**INDUSTRY BRIEFS**

The US Marine Shrimp Farming Program

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

Non-profit  
U.S. Postage  
PAID  
Honolulu, HI  
Permit No. 1252



