



**Florida Aquaculture  
Interagency  
Coordinating Council  
Annual Report 2003-2004**

Florida Department of Agriculture and Consumer Services

Presented by:

**The Honorable Charles H. Bronson  
Commissioner of Agriculture**



December 1, 2004

The Honorable Jeb Bush  
Governor  
The Capitol  
Tallahassee, Florida 32399-0001

Dear Governor Bush:

I am pleased to submit the Aquaculture Interagency Coordinating Council's (AICC) Annual Report as required by Florida Statutes, Section 597.006. This report documents the Council's activities and recommendations from July 2003 to June 2004, and includes a summary of agency activities and expenditures on aquaculture programs.

The State of Florida has been a leader in aquaculture production and support for many years. Being home to top producers, researchers, marketing experts and supply companies, our state has much to offer existing and prospective producers. Florida's unique regulatory program employing Aquaculture Certification and Best Management Practices makes for sound management of natural resources and clear requirements for producers. The agencies of the Coordinating Council have and will continue to work together to provide the highest level of service to this industry while protecting Florida's environment.

Recent statistics documenting aquaculture sales of \$95.5 million and full and part-time employment for over 1,500 citizens further substantiate the economic importance of Florida's aquafarms. As Florida enters a year of rebuilding lives and industries, the relationships among the member agencies of the AICC will help ensure the continued viability of the state's aquaculture industry. Thank you for your support.

Sincerely,

CHARLES H. BRONSON  
COMMISSIONER OF AGRICULTURE

cc: President of the Senate  
Speaker of the House  
Chairman of the Senate Ways & Means Committee  
Chairman of the House Appropriation  
Chairman of the House Agriculture Committee  
Chairman of the Senate Agriculture Committee

**Annual Report:  
Aquaculture Interagency Coordinating Council (AICC)  
December 1, 2004**

**Table of Contents**

<b>AICC 2004 MEMBERSHIP LIST .....</b>	<b>3</b>
<b>AICC SUMMARY OF ACTIVITIES July 2003 - June 2004 .....</b>	<b>5</b>
<b>AGENDA AND MINUTES OF MEETINGS</b>	
August 26, 2003.....	7
March 24, 2004.....	12
<b>MEMBER AGENCY REPORTS.....</b>	<b>17</b>
Florida Agricultural and Mechanical University.....	19
Florida Department of Agriculture & Consumer Services.....	20
Florida Department of Community Affairs.....	25
Florida Department of Environmental Protection.....	26
Florida Game and Fresh Water Fish Commission.....	27
Florida Institute of Oceanography.....	32
Florida Sea Grant College Program.....	33
Office of Trade, Tourism and Economic Development.....	51
University of Florida - Institute of Food and Agricultural Sciences.....	52



## AICC 2004 MEMBERSHIP LIST

Lawrence Carter  
Cooperative Extension  
**Florida A&M University**  
Division of Agricultural Sciences  
215 South Perry Paige  
Tallahassee, Florida 32307  
Phone: 850/599-3546



Sherman Wilhelm  
**Florida Department of Agriculture and Consumer Services**  
Division of Aquaculture  
1203 Governor's Square Boulevard, 5<sup>th</sup> Floor  
Tallahassee, Florida 32301  
Phone: 850/488-4033  
Fax: 850/410-0893  
Suncom: 278-9780



Ray Eubanks  
Bureau of State Planning  
**Florida Department of Community Affairs**  
2555 Shumard Oak Boulevard  
Tallahassee, Florida 32399-2100  
Phone: 850/922-1767



Katherine Andrews  
**Florida Department of Environmental Protection**  
3900 Commonwealth Boulevard, MS235  
Tallahassee, Florida 32399  
Phone: 850/488-3456  
Fax: 850/488-3896



William Halstead  
**Florida Fish and Wildlife Conservation Commission**  
14495 Harlee Road  
Port Manatee, Florida 34221-19260  
Phone: 941/723-4505

Larry Robinson  
Florida A & M University - Department of Environmental Sciences  
**Florida Institute of Oceanography**  
1520 South Bronough Street  
Tallahassee, Florida 32307  
Phone: 850/599-8553  
Fax: 850/561-2248



James C. Cato  
**Florida Sea Grant**  
University of Florida  
Building 803, McMarty Drive  
Gainesville, Florida 32611  
Phone: 352/392-5870  
Fax: 352/392-5113



Pamela Dana  
**Office of Trade, Tourism and Economic Development**  
2001 The Capitol  
Tallahassee, Florida 32399  
Phone: 850/487-2568  
Fax: 850/487-3014



William J. Lindberg  
**University of Florida, IFAS**  
Dept. of Fisheries and Aquatic Sciences  
Gainesville, Florida 32611  
Phone: 352/392-9617  
Fax: 352/846-1088

## **AICC SUMMARY OF ACTIVITIES July 2003 - June 2004**

### **Introduction**

The Aquaculture Interagency Coordinating Council (AICC) was legislatively created in 1984 by the Florida Aquaculture Policy Act (Chapter 597, Florida Statutes). The Council was created to encourage the development of Florida aquaculture by establishing positive interagency cooperation. The AICC is charged with serving as a forum for the discussion of governmental aquaculture regulations and with the formulation of policy alternatives to facilitate aquaculture development. The AICC is also charged with establishing and maintaining effective cooperative linkages between member agencies, the Aquaculture Review Council, and institutions to ensure that recommendations for improvement are responsive to the needs of aquaculturists.

### **AICC Meetings**

The AICC met on August 26, 2003 and March 24, 2004. These were the only meetings held during the report period of July 1, 2003 through June 30, 2004. For details of the Council's discussion and actions, the agenda and minutes follow.



**FLORIDA AQUACULTURE INTERAGENCY  
COORDINATING COUNCIL MEETING  
Division of Aquaculture Conference Room  
1203 Governor's Square Blvd., 5th Floor  
Tallahassee, Florida  
August 26, 2003  
10:00 a.m.**

---

**AGENDA**

- I. CALL TO ORDER**
  
- II. MINUTES OF MEETING** Joint Aquaculture Review Council/Interagency  
Coordinating Council October 13, 2000
  
- III. NEW BUSINESS**
  - A. Agency Updates
  - B. Other New Business
  
- IV. NEXT MEETING**
  
- V. ADJOURN**

**Minutes**  
**Aquaculture Interagency Coordinating Council**  
**Division of Aquaculture Conference Room**  
**Tallahassee, Florida**

**August 26, 2003**

**I. Call to Order**

The meeting was called to order at 10:03 am.

**Members Present**

Chuck Adams	Florida Sea Grant
Katherine Andrews	Florida Department of Environmental Protection (DEP)
Mary Helen Blakeslee	Office of Trade, Tourism and Economic Development (OTTED)
Bill Halstead	Florida Fish and Wildlife Conservation Commission (FWC)
Craig Watson	University of Florida - Institute of Food and Agricultural Science (IFAS)
Sherman Wilhelm	Florida Department of Agriculture & Consumer Services (DACS)

**Members Absent**

Lawrence Carter	Florida A&M University
Ray Eubanks	Florida Department of Community Affairs
Larry Robinson	Florida Institute of Oceanography

**II. Minutes of Previous Meetings** October 13, 2000 and December 20, 2002.

The minutes were approved as written.

**III. New Business**

A. AICC Annual Report

Copies of the 2001-2002 Annual Report were distributed, AICC members were asked to submit reports for the 2002-2003 fiscal year by October 1.

B. Review of Proposed Aquaculture Projects

The Florida Aquaculture Review Council (ARC) has submitted a list of recommended projects. The AICC should review these proposals and make comments to the ARC if they have any. There was a question about who would be the economist to review the rearing cons for year three of the pompano project. Dr. Adams will call the investigator to discuss this matter.

C. Agency Updates

Florida Department of Agriculture & Consumer Services: The Division of Aquaculture was funded for the current fiscal year with the loss of one position. The Division

continues to work on Best Management Practices (BPMs) for alligator farms. They will look at pond aeration techniques as a BMP for farm management. The Division is also doing an analysis of how other states regulate clam producers in the water. There was a recent pilot project completed by the Division examining the impact of on-the-water washing and grading. No difference was found in micro-flora and fauna in the pilot compared to traditional land-based washing, so the Division will be allowing on-water washing in the future..

There have been no changes in the status of net pen culture in the state. The Gulf of Mexico consortium removed their offshore cage from the water. That project is now over.

The Division has erected BMP informational signs at the extension office in Cedar Key and the Tropical Aquaculture Lab in Ruskin. Signs are also planned for the Indian River Extension office and University of Florida's Department of Fisheries and Aquatic Sciences. The Division is also finalizing materials for an informational kiosk on clam farming.

The next production survey of the industry will be done next year for production in 2003. The Sturgeon Production Working Group is now within the Department, but there are no funds. There is likewise no funding for the aquaculture projects recommended by the Aquaculture Review Council.

Florida Fish and Wildlife Conservation Commission: Freshwater: The Commission is refurbishing the Richloam Fish Hatchery and will become the Florida Bass Conservation Center. Construction of a new building is underway.

Saltwater: The Stock Enhancement Research Facility continues on red drum enhancement in Tampa Bay. An important end result will be a cost/benefit analysis. Currently, the hatchery produces 1.2 million fish per year, all of which are being released in Tampa Bay.

The conch project in the Keys is no longer using hatchery-produced seed stocks. They have gone to a method of relocating sexually mature animals to areas that have proven better for natural production.

The Commission now has a committee to develop a genetics policy for stocking. This was already developed for marine animals, but is new for freshwater.

Florida Department of Environmental Protection: The Department of Environmental Protection's current aquaculture activities are related to a facility under development south of the University of Florida's Whitney Laboratory. DEP is working with the National Estuarine Research Reserve, Whitney Lab and DACS. The project would involve acquiring land south of the Whitney Lab to develop a marine animal health facility that could benefit aquaculture and natural resources. A comment was made that

the Whitney Lab is not part of the Institute of Food and Agricultural Sciences and that those within IFAS who deal with aquaculture should be involved.

The group asked if there was any resolution to the issues DEP and DACS had over docks. There is a difference of opinion that legislation gives DACS authority to give permission to build docks. DEP has drafted a rule for commercial docks and has made aquaculture docks at residences exempt from the revenue generating definition. Without a residence, aquaculture docks are still subject to the rule. The Trustees can issue consent of use on these docks. Both agencies agree that DACS can issue the consent of use if they go through the Trustees.

University of Florida - Institute of Food and Agricultural Science Department of Fisheries and Aquatic Sciences: With respect to shrimp, IFAS is trying to keep pace with the demand for information. Not much is available on the economics of shrimp production in Florida. IFAS is looking at a theoretical low-cost system that a farmer could use as a pilot (one-acre pond and required aeration, well, etc.). When completed, this will be available to interested producers.

The shrimp demonstration project in Indian River is underway. The ponds are lined. There were problems with the well, which had to be much deeper than originally planned. IFAS has agreed to pay for this well. The project is late and may not be able to stock shrimp this year.

IFAS will be hiring an aquaculture facility person to be housed at the Indian River facility. This person will have statewide responsibility.

The clam extension program did not receive a USDA grant as expected.

IFAS aquaculture programs in Gainesville continue with some aquatic medicine work and sturgeon work. The sturgeon program has shifted solely to non-native species.

The Tropical Aquaculture Lab is expanding with the addition of a building with six new offices. One of the offices is for a USDA vet services veterinary medical officer, Kathleen Hartman. She has filled this position to assist the industry with overseas shipment and will also be given a courtesy faculty appointment. The lab also expects funds to build a dormitory and add a greenhouse for marine species production work. New projects include BMP signs, feed color testing, pesticide research, swamp eel diet research, marine ornamental inland production systems, clown loach production extension to commercial facilities and work on aquatic animal health protocol assistance for FWC.

Sea Grant: Florida Sea Grant reported on a number of projects. The sturgeon economics, nutrition and marketing project was problematic but did examine buyer demand.

The clam remote setting project is completed. As expected, producers may reduce seed costs by employing this technique, though it is most attractive in years when seed costs

are higher. A study of the economic impact of the clam industry is completed. This type of information could be used for a cost/benefit analysis of managing and administering the industry. A clam inventory management plan software program is not available to producers. Additionally, Sea Grant works on identifying production techniques and marketability of alternative shellfish species.

*Marine Ornamental Species* is now published from the Marine Ornamentals 2001 conference held in Orlando. Sea Grant researchers published articles on the economic feasibility of lined ponds in Nicaragua in *Global Aquaculture Advocate*.

A marine baitfish survey in 1998 indicated that there is a big market for marine baitfish. Some work was done on the production of bull minnows. Now producers in Nassau County want to begin production. Sea Grant may hold a workshop in bait fish production.

Office of Trade, Tourism and Economic Development: A loan to the Withalacoochee Planning Council was repaid last summer. This loan was made to help clam producers who suffered losses during 1998. OTTED has considered assisting with a cooperative community hatchery. They have not been approached by an entity with a formal plan. OTTED has met with producers to discuss incentives they have available (e.g., rural job tax credit, enterprise zone incentives).

#### **D. Other Business**

Harbor Branch is hosting a Sustainable Marine Fish Culture Workshop in October.

There was a question about whether cobia and pompano could be sold as ornamentals. There are no restrictions on the sale of these aquaculture products.

A Risk Management Agency project is surveying the clam industry on their interest in a statewide clam farmer association.

#### **IV. Next Meeting**

The next meeting will be scheduled in January or February.

#### **V. Adjourn**

The meeting was adjourned at 11:50 am.

Submitted by: Karen Metcalf

FLORIDA AQUACULTURE INTERAGENCY  
COORDINATING COUNCIL MEETING  
Division of Aquaculture Conference Room  
1203 Governor's Square Boulevard, Fifth Floor  
Tallahassee, Florida  
March 24, 2004  
1:00 p.m.

---

AGENDA

- I. CALL TO ORDER**
- II. MINUTES OF MEETING August 26, 2003**
- III. NEW BUSINESS**
  - A. Agency Updates**
  - B. Transgenic Fish**
  - C. Other New Business**
- IV. NEXT MEETING**
- V. ADJOURN**

**Draft Minutes**  
**Aquaculture Interagency Coordinating Council**  
**Division of Aquaculture Conference Room**  
**Tallahassee, Florida**

**March 24, 2004**

**I. Call to Order**

The meeting was called to order at 1:05 pm.

**Members Present**

Chuck Adams	Florida Sea Grant
Katherine Andrews	Florida Department of Environmental Protection (DEP)
Mary Helen Blakeslee	Office of Trade, Tourism and Economic Development (OTTED)
Ray Eubanks	Florida Department of Community Affairs (DCA)
Bill Halstead	Florida Fish and Wildlife Conservation Commission (FWC)
Craig Watson	University of Florida - Institute of Food and Agricultural Science (IFAS)
Sherman Wilhelm	Florida Department of Agriculture & Consumer Services (DACS)

**Members Absent**

Lawrence Carter	Florida A&M University
Larry Robinson	Florida Institute of Oceanography

**II. Minutes of Previous Meetings August 26, 2003.**

The minutes were approved as written.

**III. New Business**

**A. Agency Updates**

University of Florida - Institute of Food and Agricultural Science Department of Fisheries and Aquatic Sciences (IFAS): IFAS continues to work on projects described at the last meeting. They were able to get funding from US Department of Agriculture for ornamental research. IFAS is interviewing a faculty person to be based at the Indian River Center. This position will have statewide research and extension responsibilities. It was reported that the industry is seeing business pick up.

Florida Department of Community Affairs (DCA): The DCA had no aquaculture activities to report. The agency is in a waiting position related to what the Legislature will do for growth management. There is additionally a rural economic development bill before the Legislature. The DCA is working with the military on security issues.

Florida Fish and Wildlife Conservation Commission (FWC): The FWC submitted a report of activities which is attached. In summary, the Richloam hatchery is being refurbished. Ground was broken on the Florida Bass Conservation Center. The Richloam Hatchery stocked over 1.4 million fish (bass, catfish, carp) and introduced them into 101 public and institutional sites. They are currently working on nutrition research.

The Blackwater Center has been working on stocking and research. They have examined effects of hormone use to induce sexual maturity in female largemouth bass. Success with this technique will allow them to produce more fish. They are ending a three-year project to identify rare and endangered fish in Florida.

The Keys laboratory has deactivated its conch hatchery. Efforts now focus on relocating wild adults to offshore areas more appropriate for spawning. A partnership with Mote and Harbor Branch has the lab collecting wild egg masses, transferring them to a hatchery at Harbor Branch with rearing at Mote's conch facility.

The Port Manatee facility is in the final year of a five-year test release project. They will now focus on one of three size classes as optimum for release. A committee from FWC consisting of freshwater and marine hatcheries and the marine research institute have developed a policy on genetics for releases of fish into the wild. Also, the Marine Fisheries division has added draft language to the rule on Special Activity Licenses related to aquaculture. This information will be forwarded to the rest of the AICC.

Sea Grant: Florida Sea Grant has three new projects related to aquaculture, 1) a project to improve clam culture that examines survival of triploid clams, 2) a project examining ways to reduce the cost of feeding marine ornamental fish, and 3) a project examining microbial management in cultured cobia.

Most of the Sea Grant agents have some activities related to aquaculture. The Indian River shrimp project is moving along. They expect to have shrimp in the ponds by mid-April. Clam workshops have been held to instruct producers in the use of the new clam inventory management software. The CLAMMRS project continues to monitor water quality in clam producing areas. An expert assistance project is helping producers with phytoplankton identification. Sea Grant has been involved in making recommendations to the clam industry on establishing an organization. A baitfish production workshop has been held and a summary report is in preparation.

Florida Department of Environmental Protection (DEP): The DEP is now headed by a new Secretary, Colleen Castille. The DEP aquaculture representative has been making site visits to aquaculture facilities around the state. Progress Energy Mariculture (Crystal River) is releasing fish produced as part of their mitigation project into the St. Martins Marsh Aquatic Preserve. DEP serves as a member of the Sturgeon Production Working Group.

The AICC was alerted to the US Commission on Ocean Policy report due out next month. A chapter will be included on aquaculture. This document will be delivered for comment by the states and Florida will proceed with the review through the

Clearinghouse. Agencies should carefully review the appropriate sections and comment to the Clearinghouse. April 21 will be Oceans Day at the Capitol.

There was a question about whether growing seagrass on land was considered aquaculture. DACS considers it to be aquaculture and would expect the facility to be certified (the facility in question is currently certified).

As an aside, there was a comment about a project between IFAS and the University of Houston examining hard coral propagation and restoration. They are looking at issues of disease and survival of reintroduced corals. The project is in the Florida Keys National Marine Sanctuary and funded by US Department of Agriculture.

An update was given on the status of leases near Everglades City. The county commission has requested DACS to go forward. They will plan a public workshop to talk about the process of applying for a lease and try to gauge interest. To this point about 20 people have expressed interest. The two sites proposed have not received any objections.

Office of Trade, Tourism and Economic Development (OTTED): OTTED's Rural Economic Development Initiative (REDI) has heard a presentation on the Bass Conservation Center. Resources are available if the county applies. This could include funds for an education center or amenities. OTTED will have a planning meeting with IFAS in May on the REDI program. In August or September they will have a meeting to build a more interactive relationship between the two groups.

OTTED has been working on the issue of imported shrimp and problems that trade has had for Florida's wild shrimp harvesters. It was noted that Sea Grant will hold a workshop related to the trade petition on catfish. If the shrimp petition goes through they will hold workshops for shrimpers.

Florida Department of Agriculture & Consumer Services (DACS): DACS continues compliance monitoring of all aquaculture facilities. There has been additional effort toward delisting shortnose sturgeon. A delisting petition has been prepared by DACS and will be reviewed by the Sturgeon Production Working Group this month. The petition uses the same concept as was used for the delisting of alligators. The BMP manual is being updated.

The Division of Aquaculture is dealing with invasive species issues. They are using laboratory techniques to differentiate the Mediterranean strain of *Caulerpa* algae versus natives. Many of the species were shown to be identical. They will have a lab complete DNA typing to examine these species more closely. There at least 12 native species, of which some are claimed to be invasive. Additionally, the Division is doing genetic manipulation with the intent of producing fish that will have only males as offspring. These fish could be introduced to water bodies as a means of population control.

## **B. Transgenic Fish**

Two farmers in the state are raising transgenic zebra danio (Glofish). A task force has been created of state agency scientists to discuss cases where aquaculturists want to raise

transgenics. The task force has met two times. They have voted to allow red Glofish to be raised on the Florida farms.

The choice of this particular fish was fortunate as there is a great body of existing research. The task force was able to get expert advice from researchers at the University of Florida College of Medicine. There are other transgenic organisms in research that are aquaculture candidates including salmon and catfish. Additionally, there are other colors of zebrafish (green, yellow and blue).

The task force review process will require all certified farms to report transgenics to the Division of Aquaculture. This information will be provided to the task force who will meet on each organism separately. The task force can then approve an organism or do a risk assessment. Risk assessments will include a mitigation component.

The FDA's Center for Food Safety has met with Florida officials. They had been concerned that little is being done about transgenics in aquaculture. Even if an organism is for food, the task force will still review each case, regardless of what the FDA rules.

### **C. Other New Business**

Senate and House budgets are out, but do not match. There is funding in the Senate budget for the cobia nursery and pompano project.

A proposal was submitted to Sea Grant for research on a net pen in state waters. Florida State University was to provide water quality testing. The AICC was to act as an advisory group. This project was not funded, but will continue to be pursued by DACS. The project required \$800,000 over two years. There was a question about partnering with Florida Offshore Aquaculture. This study is separate from any private entities because it needs to be seen as completely unbiased.

There was a comment about a project some years ago near Fort Walton Beach. Water quality at that time was monitored by Dan Roberts of FWC. Bill Halstead will get a copy of the report to DACS. It was noted that a study in Hawaii found the limit of water quality impact was 100 meters from net pens. This site has significant flushing as does a similar project in Puerto Rico. A study is necessary under conditions likely to be experienced in Florida.

There was a question about the sturgeon delisting. Why does DACS feel that there would be a better chance now than when it was attempted several years ago? The timing of the submittal with the current administration and the work on the delisting petition is felt to give a better chance for success. We now have a legal document requesting delisting. In the meantime, Florida has imported non-natives for culture.

## **IV. Adjourn**

The meeting was adjourned at 2:45 pm.

Submitted by: Karen Metcalf

## **MEMBER AGENCY REPORTS**

One purpose of the AICC annual report is to compile all aquaculture activities undertaken by member agencies. Each member agency is expected to provide a list to include; the needs each activity is designed to address, the results, the funds expended on each activity, and the source of those funds. The remainder of this report consists of activity summaries, as submitted, for each of those agencies.



Florida Agricultural and Mechanical University

*No report submitted.*



Florida Department of Agriculture & Consumer Services  
CHARLES H. BRONSON, Commissioner

**Annual Report**  
**July 2003 – June 2004**

**Division of Aquaculture**

The Division of Aquaculture was created in 1999 by the Florida Legislature and is responsible for six programs: aquaculture certification, aquaculture leasing of sovereignty submerged land, shellfish resources development, shellfish processing plant certification, shellfish harvesting area management, and technical support. Florida's aquaculture industry is one of the leading producers in the nation with \$95 million in farm gate value during the 2003 production year.

Aquaculture Certification Program

Chapter 597, Florida Statutes, established the Aquaculture Certificate of Registration to recognize aqua-farming businesses. Aquacultural businesses in Florida are required to be certified annually and to attest that they will comply with the Best Management Practices provided in Chapter 5L-3, Florida Administrative Code. The Aquaculture Certificate of Registration is used to identify aquaculture producers as members of Florida's agricultural community and to identify aquacultural products produced in the state. Site inspections are conducted at aquaculture facilities to ensure compliance.

The Department certified 1,018 aquaculture facilities during fiscal year 2003-04. Shellfish producers make up 50 percent of certified farms, 22 percent are ornamental producers and 20 percent produce food fish, with the remaining producing live rock, alligators and bait. Certified farms are found in 61 of the state's 67 counties, with the highest number of certified farms (20 percent) occurring in Levy County. Dixie and Hillsborough counties are next with 9 percent each.

Sovereignty Submerged Lands Leasing Program

The Department is responsible for the Aquaculture Lease Program under the provisions in Chapter 253, Florida Statutes. Currently, the Department administers 664 aquaculture leases containing about 1,581 acres and 82 shellfish leases containing about 1,301 acres. Aquaculture leases are located in Brevard, Charlotte, Dixie, Franklin, Indian River, Lee, Levy, Monroe, Pinellas, St. Johns and Volusia Counties. In response to its statutory mandate, the Department identifies tracts of submerged lands throughout the state that are suitable for aquacultural development. Twenty Aquaculture Use Areas have been identified by the Department and authorized by the Board of Trustees in eight coastal counties; including Franklin, Dixie, Levy, Charlotte, Lee, Indian River, Brevard, and Volusia.

### Oyster Culture and Shellfish Resource Development Program

Under the mandate to improve, enlarge, and protect the oyster and clam resources of the state, the Department is actively engaged in enhancing shellfish resources and restoring oyster reefs on public submerged lands. During fiscal year 2003-04, the Department collected 63,116 bushels of processed oyster shell from processors in Franklin County, and planted 127,872 bushels of shell on public reefs. Oyster resource development projects were conducted in cooperation with local oystermen's associations in four coastal counties. A total of 261,870 bushels of live oysters were re-planted on public reefs in Franklin, Wakulla, Dixie, and Levy Counties.

### Conserving Public Oyster Reefs

The Department is involved in a unique project applying its expertise and equipment to mitigate potential impacts on oyster resources in Apalachicola Bay. The Department is in a joint project with the Department of Transportation and the Department of Environmental Protection to enhance and restore public oyster reefs that may be adversely affected during the St. George Island Bridge Replacement Project. The mitigation plan involves the restoration of oyster reef habitat by placing processed oyster shell and live oysters on designated reefs.

### Shellfish Harvesting Area Classification and Management Program

This program seeks to classify and manage Florida coastal waters for maximum use of shellfish resource, protection of public health, and promotion of a healthy coastal environment. The program is audited each year by the U.S. Food and Drug Administration to ensure compliance with the provisions of the National Shellfish Sanitation Program.

A total of 38 shellfish harvesting areas are currently classified and managed statewide. During fiscal year 2003-04, the required annual update reports were completed for all 38 shellfish harvesting areas and all of the shellfish harvesting areas requiring a triennial reappraisal report were completed. The data and reports support current classification and management for all shellfish harvesting areas.

During fiscal year 2003-04, a total of 577 sampling excursions were conducted to collect and analyze 13,832 water samples for fecal coliform bacteria and there were a total of 494 closures and reopenings of shellfish harvesting areas.

### Shellfish Processing Facility Program

This program seeks to ensure wholesome shellfish products through inspection, education and enforcement of state regulations and national guidelines. The program is audited each year by the U.S. Food and Drug Administration to ensure compliance with the provisions of the National Shellfish Sanitation Program.

A total of 106 Shellfish Processing Plant Certifications Licenses were issued during fiscal year 2003-04. A total of 464 regulatory processing plant inspections were conducted.

Based on fiscal year 2003-04 inspection results, a total of 88 warning letters were issued and 22 settlement letters were issued. Action was taken to destroy shellfish products when they were found to be adulterated, contaminated, unwholesome, mislabeled, or exceeding the product shelf life.

#### Technical Support Programs

The Division provides substantial technical and administrative support for aquacultural and shellfish operations. Staff provides and participates in workshops, seminars and problem solving activities to help provide information to Florida farmers. In addition, staff manages contracts to researchers for legislative appropriation to provide quick answers to industry issues.

### **Division of Plant Industry**

For the year ending June 30, 2004, the Division of Plant Industry had 127 aquatic nurseries registered and under inspection with the Department. These nurseries are inspected to insure that the aquatic plants sold or distributed by these nurseries are free from pests and diseases and meet the export certification requirements of other states and countries.

Also in conjunction with the aquatic nursery inspection activities, the Division of Plant Industry, through the authority granted in a Memorandum of Understanding with the Florida Department of Environmental Protection, issued 2 Class II Prohibited Aquatic Plant Permits to registered aquatic nurseries for the out-of-state sale of Class II Prohibited Aquatic Plants, as listed in DEP's Chapter 62C-52.011, F.A.C.

### **Division of Marketing**

#### Tropical Fish Campaign

*DIVE IN!* Aquarium Fish is a national marketing campaign aimed at increasing tropical fish sales, by increasing awareness and ownership of freshwater aquariums and water gardens. The campaign has been in operation since October 2000. Funding for the program is provided by the American Pet Products Manufacturers Association (\$50,000), the Florida Tropical Fish Farms Association (\$100,000) and aquatic industry companies (\$15,000). Activities for 2003-2004 included development and distribution of point-of-purchase materials for aquatics retailers, participation at pet industry trade shows, partnering with PETSMART, PETCO and Wal-Mart and development of press kits. To date, approximately 4,000 retailers nationwide participate in the program.

#### Florida Alligator Products Marketing Campaign

The Florida Department of Agriculture and Consumer Services' Marketing Division assisted the Florida alligator industry in 2003-04 with marketing initiatives designed to increase the sale of Florida alligator meat and skin products via an international educational campaign. Increased awareness of Florida's conservation success with the American

alligator has been the driving force behind this campaign. The Florida Alligator Marketing and Education Committee (FAME) oversaw the campaign and expenditures.

Activities for 2003-04 consisted of press releases distributed to 50,000+ daily newspapers for holiday meat recipes. In addition, the Department printed a new alligator meat recipe brochure that includes updated nutrition information. The Department participated with the industry in the Magic Leather show in Las Vegas in February 2004. FAME and the Department undertook a joint funded project with the State of Louisiana, a report on Global Economic Trade of Crocodilian products in an effort to analyze the economic considerations in the crocodilian leather trade.

### **Division of Animal Industry**

During the 2003-2004 fiscal year, the Division of Animal Industry continued to support Florida's rapidly developing aquaculture industry by maintaining its' current testing capabilities at the Kissimmee Diagnostic Laboratory and researching new areas for expansion. Two fish cell lines, a sturgeon spleen cell line (WSS-2) and a Koi fin cell line (KF-1) are maintained for the viral isolation of Koi herpesvirus (KHV) and Largemouth virus (LMBV). These cell lines promote growth of several sturgeon viruses that can be devastating to the industry. The KF-1 cell line promotes the growth of KHV, a cause of high mortality in ornamental Koi carp. PCR based tests for KHV and LMBV have been developed and are currently available.

The Division's Diagnostic Laboratory system is certified by the USDA to perform regulatory testing for the export of catfish and clams. Specimens are routinely submitted for Perkinsus, QPX, Haplosporidium and other organisms important to the aquaculture industry. We are working to acquire the necessary certification from USDA to perform viral testing for shrimp diseases; yellow head syndrome (YHS), white spot syndrome (WSS), Taura virus (TV) and for spring viremia of carp (SVC); both viral isolation and PCR diagnostics. Animal Industry continues to develop cooperation and coordination at state and national levels to benefit the Department and the aquaculture industry.

Summary of Department of Agriculture and Consumer Services  
 Aquaculture Funds  
 Fiscal year 2003-2004

Division	Category	Amount	Source
		\$3,241,547	General Revenue
Aquaculture	Division Operating Funds	\$776,189	General Inspection Trust Fund
	Grants and Contracts	\$359,340	US Department of Agriculture, US Environmental Protection Agency Gulf of Mexico Program, Florida Ag in the Classroom
Plant Industry	Aquaculture Inspection Activities	\$25,298	General Revenue/Plant Industry Trust Fund
Marketing	Tropical Fish Marketing	\$165,000	FL Trop. Fish Farms Assn., Amer. Pet Prod. Mfg. Assn, aquatics industry companies
Animal Industry	Salary	\$57,350	General Revenue and General Inspection Trust Fund
	Total Expenditure	\$4,624,724	



## Florida Department of Community Affairs

*No report submitted.*



## Florida Department of Environmental Protection

### Department of Environmental Protection AICC annual report for FY 2003-2004

Rookery Bay National Estuarine Research Reserve (RBNERR): Working with the Division of Aquaculture to find clams for Bill Arnold's species identification work. RBNERR verified that there are no seagrasses in the proposed lease area and have provided comments when requested. The only clams that should legally be in the water at this stage are the Division of Aquaculture test bags. The applicants are going through the lease process.

Charlotte Harbor Aquatic Preserve (CHAP): CHAP has been coordinating with the Division of Aquaculture in the current relocation request of 10 acres of clam leases (5 two-acre) from the Demere Key high density aquaculture site in Pine Island Sound Aquatic Preserve (closer west of the Intra-coastal Waterway). CHAP staff has been monitoring for the last 10 months the test clams placed at the proposed location, including those during the hurricanes of August and September. The new site indicates a slightly lower (average) growth rate, but significantly higher survival rate over that time period. The lease owner (Mr. Connery) would like to move forward with his request to relocate the 10 acres. DACS will provide CAMA staff with GPS coordinates for the lease area and within the next 3 to 4 weeks a thorough inspection of the 12 to 14 acres (leases + easements) will be performed to look for seagrass and native clam populations.

FKNMS: Only one live rock permit site lease survey (Lease No. 44-AQ-859) conducted on May 3, 2004, by FKNMS staff. Two additional sites were surveyed on Federal waters.

North West Florida Region: Chad Bedee in the Crystal River Aquatic Preserve office serves on the Department of Agriculture and Consumer Service's Transgenics Task Force which is a risk assessment committee for commercial production of transgenics species (the task force met a couple of times to discuss zebra fish). Seth Blitch in the Apalachicola National Estuarine Research Reserve office continues to serve as DEP representative on the Sturgeon Production Working Group. There was one meeting for FY03/04. Much of the discussion has dealt with getting commercially produced sturgeon that is federally listed available for commercial sale (one meeting for FY03/04). DEP staff worked with DACS to get an aquatic preserve sign placed in a kiosk on Alligator Harbor with 2 other signs developed by DACS touting clean water and the aquaculture industry (the sign is currently in production).



## Florida Fish and Wildlife Conservation Commission

### Report on Aquaculture Activities Florida Fish & Wildlife Conservation Commission FY 2003/04

#### Division of Freshwater Fisheries Management

#### Blackwater Fisheries Research & Development Center

The Blackwater Fisheries Research & Development Center, located in the Blackwater River State Forest near Holt, includes both a production facility helping to stock the rivers and reservoirs of the panhandle, and a hatchery research operation to improve production. The Center raised freshwater fish including largemouth bass, sunshine bass, palmetto bass, striped bass, channel catfish, and bluegill.

Production techniques for *Morone* species were similar to those used in the past using HCG to induce ovulation (Yeager et al, 1992). Eggs are fertilized using the dry fertilization method. Eggs and sperm are stripped into a dry pan and water added to activate the sperm and induce fertilization. After eggs hatch, fry are held in aquaria for three to four days. Fry are then stocked in fertilized grow-out ponds until they reach a size between 30 and 50 mm.

Female striped bass with marginal to stage I eggs were injected with LHRHa 48 to 52 hours prior to injection with HCG. Injections were administered intramuscularly at 25 micrograms per kilogram ( $\mu$ /kg) of body weight for LHRHa and 275 international units per kilogram (IU/kg) for HCG.

Stocking two 1.75-acre ponds with fingerlings produced advanced fingerling largemouth bass. Largemouth bass were stocked at a rate of 10,300 fingerlings/acre. Two weeks prior to stocking, cottonseed meal was initially applied to these ponds at a rate of 400 lbs/acre. Thereafter, supplemental applications were made at 100 lbs/acre twice weekly to stimulate and maintain plankton blooms. An initial application of calcium chloride at 1,000 lbs/acre was also made to these ponds.

In addition to pond raised fish, largemouth bass fingerlings were also stocked into two 2,650-liter raceways. Fingerlings were trained to feed on a commercially prepared fish feed formulated by Dr. Paul Cardeilhac from the University of Florida, College of Veterinary Medicine.

Hybrid striped bass and channel catfish fingerlings were stocked in ponds and also fed pellet fish food for phase II grow-out. Channel catfish and largemouth bass fingerlings were produced at Richloam Fish Hatchery.

A total of 3,099,000 fry, 657,000 fingerlings and 461,505 phase II fish were produced during fiscal 2003-2004 (Table 1). These fish were distributed to a variety of lakes, rivers and ponds in the panhandle as well as to the Mississippi Gulf Coast Research Laboratory; Inks Dam National Fish Hatchery, Texas; Warm Springs National Fish Hatchery, Georgia; and Richloam Fish Hatchery, Florida.

Table 1. Total fry, fingerling and phase II fish produced at Blackwater Fisheries Research & Development Center July 1, 2003 to June 30, 2004.

Species	Fry	Fingerlings (1.5-2.5")	Phase II (7-10")
Striped Bass	2,456,000	657,000	
Palmetto Bass	643,000		
Sunshine Bass			4,000
Largemouth Bass			56,755
Channel Catfish			42,250
Bluegill			358,500
Totals	3,099,000	657,000	461,505

Efforts continued this year to spawn female striped bass with early egg stage development by using luteinizing hormone-releasing hormone analog (LHRHa). In the past, efforts to spawn striped bass with marginal to stage II eggs (egg development at 14 to 16 hours prior to ovulation, Rees and Harrell, 1990) using HCG (human chorionic gonadotropin) have been relatively unsuccessful. Recent studies have documented success using LHRHa pellet implants to stimulate egg maturation and ovulation in striped bass with early egg stage development (Hodson and Sullivan, 1993; Woods and Sullivan, 1983; Sullivan et al., 1997). In this study intra-muscular injections of LHRHa were used to stimulate final egg maturation in early egg staged females prior to injection of HCG.

The expense budget for rearing the fish was \$84,325 and came from the State Game Trust Fund and the CARL Program Trust Fund. No salary money is included.

### **Richloam State Fish Hatchery**

The Richloam State Fish Hatchery, located in the Richloam State Forest, cultures and distributes selected fish species statewide in order to achieve specific research and management objectives and to enhance Florida's public freshwater fisheries. Activities included site specific stocking accomplishments, cooperation with two federal fisheries facilities, local county mosquito control districts, and various outreach activities involving

elementary, secondary and college-level science programs, fishing derbies, public library extension programs, and newspaper and radio interviews dealing with Division programs.

Construction activities for the new Florida Bass Conservation Center were initiated this fiscal year, with ground breaking ceremonies and demolition of two existing structures, drastically altering the hatchery landscape. Site-work preparations were initiated by the contractor and foundations have been poured for the new fish production / office complex, maintenance shop and harvest pavilion. During this construction period, the hatchery lost access to 16 ponds (7.1 acres of production water) in areas which were marked for construction activities.

Species cultured and distributed during FY 2003-2004 included: Florida largemouth bass (*Micropterus salmoides floridanus*), palmetto bass (*Morone saxatilis x M. chrysops*), channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*), bluegill (*Lepomis micropterus*), redear sunfish (*L. microlophus*), and Chinese grass carp (*Ctenopharyngodon idellus*).

Production numbers were artificially reduced due to construction activities; however, numbers of cultured fish totaled 1,346,831, which were distributed to 121 public and institutional sites, totaling 92 km of rivers and 18,866 hectares of state-owned lakes and ponds. Palmetto bass fingerlings represented the dominant species cultured by number, totaling 428,195 stocked fingerlings, following by Florida largemouth bass fingerlings (399,361), channel catfish sub-adults (273,941), redear sunfish (76,313), and bluegill (33,770), white catfish (5,530), feed trained largemouth bass (4,838) and triploid grass carp (1,589).

The fiscal year hatchery operational budget, which funds annual fish production activities, operational budgets, salaries and equipment purchases totaled \$471,065. Salaries for eleven FTE position equated to \$358,755, operational expenses \$111,000 (which included \$26,000 dedicated to largemouth bass nutrition funding), and \$1,310 in OCO equipment funding. All funding was provided through the State Game Trust Fund.

## **Fish & Wildlife Research Institute**

### **Stock Enhancement Research Facility (SERF)**

The Stock Enhancement Research program, based at the FWC Stock Enhancement Research Facility (SERF) at Port Manatee, conducts applied research to develop aquaculture technology for selected marine fish and invertebrates. The animals reared are used to develop strategies for releasing cultured organisms as a management tool for important recreational fisheries and to evaluate the effect and the cost-effectiveness of marine stock enhancement.

Fish culture and stock enhancement research activities at SERF during this period continued to focus on red drum *Sciaenops ocellatus*. These fish are being reared for release into Tampa Bay in a multi-year multi-agency project to determine cost-effective release

strategies (size-at-release, season, habitat, and release magnitude) to increase the recreational catch rate of this species.

Although the technology to condition and spawn red drum in captivity was developed almost 30 years ago, we continue to investigate methods to improve predictability and timing of spawns as well as reduce costs. During the period of this report more than 1.5 million red drum fingerlings of three discreet sizes were reared and more than 880 thousand were released into Tampa Bay.

Table 3. Number of red drum, *Sciaenops ocellatus*, produced and released by size (phase) from July 1, 2003 through June 30, 2004.

	Phase I (25-45 mm SL)	Phase II (60-110 mm SL)	Phase III (130-180 mm SL)	Total
Fish produced	1,535,600	165,032	70,461	1,771,093
Fish Released	793,662	75,496	15,108	884,266

All batches of animals scheduled for release receive both an in-house health check and a USDA health certification exam by a veterinarian associated with the University of Florida Tropical Aquaculture Laboratory in Ruskin, Florida. This comprehensive approach to health management has allowed us to produce cultured fish for stock enhancement and aquaculture efficiently while maintaining the highest possible health standards. Our applied research into stress and disease control methods may have wide application to the production of many species of marine fish and bivalves.

As part of a 1996 Florida Legislative mandate to encourage the development of commercial aquaculture in the state, excess juvenile red drum produced at SERF are made available to private companies. No requests for fish were received during this reporting period. Fish are also loaned to schools, aquaria, and businesses for research and educational purposes. During the period of this report fish were loaned to Bass Pro Shops Outdoor World, The Pier Aquarium, Florida Aquarium, John D. MacArthur Beach State Park, four middle and high schools, and Florida Institute of Technology.

The expense budget for rearing red drum during this period was \$73,190 not including salaries. The money came from the Marine Resource Conservation Trust Fund.

## Literature Cited

- Hodson, R. G and C. V. Sullivan. 1993. Induced maturation and spawning of domestic and wild striped bass (*Morone saxatilis*) broodstock with implanted GnRH analogue and injected HCG. *Journal of Aquaculture and Fisheries Management*, 24: 271-280.
- Rees, R. A. and R. M. Harrell. 1990. Artificial spawning and fry production of striped bass and hybrids. Pages 43-72 in R. M. Harrell, J. H. Kerby and R. V. Minton, editors. *Culture and propagation of striped bass and its hybrids*. Striped Bass Committee, Southern Division, American Fisheries Society, Bethesda, MD.
- Sullivan, C. V., D. L. Berlinsky, and R. G. Hodson. 1997. Reproduction. Pages 11-73 in R. M. Harrell, editor. *Striped bass and other Morone culture*. Elsevier Science B. V.
- Woods, L. C., III and C. V. Sullivan. 1993. Reproduction of striped bass (*Morone saxatilis*) broodstock: monitoring maturation and hormonal induction of spawning. *Aquaculture and Fisheries Management*, 24: 213-224.



Florida Institute of Oceanography

*No report submitted.*



**Report on  
Aquaculture Activities  
Florida Sea Grant College Program  
Florida Board of Education  
University of Florida  
2003-2004**

The following is a summary of aquaculture activities carried out by the Florida Sea Grant College Program. Florida Sea Grant (FSG) is a statewide program of Florida's public and cooperating private universities. Federal sponsors (NOAA), state and county governments, industry groups, and foundations participate in the program. Scientific research is conducted and public information reports, conferences, workshops and personal contacts by Sea Grant Extension and research faculty ensure that information required to meet environmental and economic goals reaches those who need it on a statewide basis.

Each year Florida Sea Grant determines its research and extension tasks scheduled for completion the coming year. For 2003, these tasks were published as the 2003 Work Plan. Then, in mid 2004, the accomplishments and benefits derived from the 2003 tasks were collected and reported as our "Performance Counts," Annual Progress Report for 2003. This is available upon request from the Florida Sea Grant office or is available on our website [www.flseagrant.org](http://www.flseagrant.org). The following section contains each of our 2003 tasks and results for marine aquaculture. Our plans for 2004 are also listed in this report, and are also available from our office and/or website. Our overall goal is to assist in the development of the food and hobby segments of Florida's marine aquaculture industry.

Florida Sea Grant has made a substantial investment in marine aquaculture research and Extension. This has been possible due to raising aquaculture (particularly marine ornamentals and shellfish) to a higher priority and also due to the increased availability of federal funds devoted to marine aquaculture. Florida faculty and students have been highly successful in competing for these funds. FSG Extension faculty also work on aquaculture projects and aquaculture is one of the six statewide programs for FSG Extension. Between 1 July 2003 and 30 June 2004, including federal and Sea Grant matching funds, approximately \$314K was spent during this twelve-month period on research. An approximate \$150K was invested in aquaculture Extension activities, for a total of \$464K.

## 2003 Accomplishments

Accomplishments for 2003 for marine ornamental species (MO), shellfish (S), finfish (F) and general activities (G) are reported below. Each task and the response is listed, and the person responsible for the activity is listed after each task.

### Marine Ornamental Species

MO.1      Certain marine algal species make up an important part of the natural diet of Atlantic surgeonfish, which have economic importance in Florida, and are traded globally for the aquarium trade. An experimental diet that approximates the natural diet of these fish will be developed and tested. The goal is to develop diets that can be used to improve the health and management of Atlantic surgeonfish and to enhance efforts for captive propagation. (Francis-Floyd/ Phlips/ Berzins/ Cardeilhac: R/LR-A-30)

This project encountered problems ranging from manufacturing experimental diets, changes in the availability of lab space suitable for replicated study and subsequent lab modification problems. However, this line of research still is likely to result in significant advancement. There is a great deal of interest in this work by the aquarium community, as tangibly demonstrated by Walt Disney World's willingness to invest in the project. The scientific community has also expressed significant interest. The project has demonstrated that diet affects growth rate of captive surgeonfish, that fatty liver syndrome does not seem to be a problem in fish fed the diets tested, and that HLLES-like lesions developed in fish fed one diet but not another. Success in demonstrating that either vitamin A or ascorbic acid are playing a role in these observations, will be a huge step forward. There have been almost no controlled studies on the effect of nutritional management on captive maintenance of reef fish. It is essential to improve longevity of captive specimens and a prerequisite for successful culture. There is every reason to believe that the scientists are on the threshold of making a major contribution to this new line of research.

Historically, the development of HLLES-like lesions is one of the most common health problems of captive marine fish, and acanthurids are an excellent model for this anomaly because they seem to develop the lesions relatively quickly. There have been numerous hypotheses proposed as the etiology of HLLES-like lesions, including nutrition, nitrate toxicity, stray electrical voltage and virus. Very little work has been done that has used controlled laboratory experiments, yet one of the most compelling papers on HLLES etiology involved a very small scale study evaluating ascorbic acid deficiency. The paper was very weak for a number of reasons including a very small number of animals, poor controls and premature death of the animals due to water quality problems. None-the-less, there was some intriguing data that were developed. The line of research currently in progress should provide a definitive answer as to whether that investigator was on the right track or not. That contribution alone will be a significant advancement to the field.

Two graduate and one undergraduate students worked on the project. Eight publications and four presentations were made with some at the request of major aquaria.

- MO.2 This study utilizes a novel approach to understanding key factors about a major problem in aquaculture. High mortality rates occur during the first-feeding stage of hatchery-reared marine fish larvae. Development of techniques that will increase the survival rate is critical. (Turingan/Coleman/Creswell: R/LR-A-38PD)

This is the first time that digital high-speed videography has been used to investigate the feeding performance of cultured fish or any aquacultured species. This state-of-the-art technology allowed the investigators to directly observe the interaction between the larval-fish predator and its prey. Based on the results of this study, pilot studies at a business will be conducted to explore the feasibility of scaling up the experimental nature of this study for the aquaculture industry. Recommendations for setting up the criteria for choosing the right copepod prey for a particular species and developmental stage of marine fish being raised in hatcheries have been proposed.

### Shellfish

- S.1. Depletion of bay scallops in the Eastern Gulf of Mexico is largely due to loss of seagrasses that form an essential habitat. Seagrasses are recovering, but bay scallop spawning stocks are at an all-time low abundance in Tampa Bay. The goal is to significantly advance developing hatchery-release technology to replenish bay scallop populations on the Florida West Coast and to test the relative efficiency of cage versus free-planting cultured scallops in the field. (Leber/Halstead/Arnold/Blake: R/LR-A-34 [TAQ-99-104])

Scallops planted in Sarasota Bay during 2000 grew rapidly and effectively doubled in shell height between late July and mid-October. Survival was poor especially between planting and the first sampling date in early September. Those scallops that did survive appeared to develop normally and spawn during fall as is typical for naturally occurring scallops in Florida waters.

A more coherent planting and monitoring effort was initiated during 2001, and the success was considerably improved relative to 2000 restoration activities in Sarasota Bay. Scallops were planted during spring, rather than summer, during the 2001 effort. Although shell growth was not rapid during 2001 relative to 2000, mortality was considerably reduced at two of the three study sites and over 30% of the scallops remained alive at those two sites by late August. Although those mortality rates appear high, they compare favorably with mortality rates reported for other scallop restoration projects.

Results indicate that scallops planted in Sarasota Bay initiated spawning during summer, suggesting that a large proportion of the scallops planted during 2001 had an opportunity to spawn prior to death. It was unfortunate that a severe bloom of *K. brevis* penetrated Sarasota Bay waters during early September and killed all of the scallops in the various treatment plots. Although no evidence of successful recruitment was detected during that time, these results support the feasibility of scallop restoration in Sarasota Bay.

Genetic assessment efforts did not produce positive results, but sample sizes were very small and essentially no recruits were collected. Linking recruits captured during late summer or fall, 2001, with adults planted during May 2001 would have provided the most direct and definitive evidence of a contribution from the planted stock to the wild population.

Future scallop restoration efforts in Sarasota Bay will benefit from a more careful, hydrodynamically based selection of planting sites. That approach will allow for a risk assessment of exposure to *K. brevis* and a hydrodynamic model also can be used to predict spatfall and from those locations chosen for deployment of recruit collectors. A hydrodynamic model of Sarasota Bay is available and should be applied to this task. Additionally, a more intensive recruitment monitoring program, closely linked to a genetic assessment effort, will be needed to better ascertain any contribution from the planted stock to the following year class. Otherwise, scallop restoration efforts should be continued in Sarasota Bay in an effort to determine if and under what conditions a viable bay scallop population can be returned to this urbanized coastal estuary. Results from bay scallop restoration programs throughout the eastern and Gulf of Mexico coasts of the United States indicate that success is a long-term proposition.

S.2 Clam aquaculture is currently focused on a single species. Diversification is needed to allow the industry to grow. This project will help determine the production feasibility of two marine bivalve species. Limited stocks of these species have prevented the development of major fisheries, but aquaculture could provide a source of seed for both species. This project will focus on spawning and larval rearing technologies. (Baldwin: R/LR-A-37-PD)

One hypothesis was that blood ark and ponderous ark clam seed can be obtained from a hatchery and subsequently reared to harvestable size by shellfish growers using culture methods similar to those employed by the hard clam industry. To test this hypothesis, early development events, embryonic and larval development were documented and described since little information exists on the reproductive cycle of these mollusks. The findings indicated that typical spawning techniques used in the hard clam hatcheries and the early embryonic development events of the blood ark, *A. ovalis* and ponderous ark, *N. ponderosa* are congruent with that of *M. mercenaria*. As a result, it is expected that these two native ark species could supplement current hard clam production with minimal operational changes in the early hatchery stages.

The UF Cooperative Extension Service and the Florida Sea Grant Extension Program each provided extension assistance via a network of specialists and publication distribution. The findings of this project will provide information necessary for one to make an informed decision regarding investing in the commercial culture of these alternative molluscan species. Interested shellfish growers will be able to compare the projected performance of ark clam culture with that of hard clam culture in Florida.

This project's goal is linked to that of USDA Special Grants project (Baker, Sturmer, Nunez and Creswell, 2001) which allows for an experimental shellfish hatchery to be established at the Whitney Lab, as well as preliminary investigation of ark clam to determine hatchery, nursery, and growout production in 2001-02. The USDA project and this Florida Sea Grant proposal do not overlap in terms of their specific objectives, but are complimentary to each other. This coordinated collaboration and partnership among the hard clam farming community, the University of Florida, Institute of Food and Agricultural Sciences, the Whitney Lab, and Florida Atlantic University was developed to focus and leverage available resources to enable the sustainable development of shellfish aquaculture. The results of both studies are expected to be combined into a hatchery manual for ark clams upon the completion of all research projects.

- S.3 The objective of the 14<sup>th</sup> International Scallop (Pectinid) Biology and Aquaculture Workshop is to provide unique opportunities for researchers and managers to exchange new information. About 125 people from 25 countries are expected to attend the Conference to be held in Florida. University of South Florida researchers and Florida Sea Grant Extension faculty are organizing the conference. (Blake/Sweat: PD-01-08)

The workshop was attended by 122 participants from 21 countries. It was held in St. Petersburg April 23-29, 2003. Twenty two of the participants were students and awards were made to the students making the best oral and poster presentations. The book of abstracts of the 53 oral presentations and the 53 poster presentations was provided to each participant. Interest in scallops, which belong to the family Pectinidae, is rapidly expanding especially as the world demand for the meats has increased and natural stocks have dwindled.

- S.4 A series of workshops will be held to demonstrate record keeping principles and practices to clam growers in Florida. (Sturmer/Adams) Conduct a nation-wide survey of agricultural and aquacultural organizations and associations, targeting the association's directors. The survey will assist the Florida hard clam growers as they intend to start their own association. (Adams, Sturmer)

The agricultural/aquacultural organization survey was completed. The findings have been published as a Final Report, with a version of this report to be published as a Sea Grant report. A summary workshop was held in Ocala, Fl during October 2003,

which was attended by approximately 50 individuals representing the shellfish culture industry in Florida. The findings of the survey have provided the shellfish culture industry with alternative organizational strategies some of which have been recognized by industry as having potential for a statewide shellfish growers association in Florida.

Taught clam growers how to use the CLAM software program during training sessions and individual consultations. Sessions were conducted on June 23, June 24, and June 25 in Cedar Key (Levy County); on October 2 in Carrabelle (Franklin County), on October 21 in Sebastian (Indian River County), October 22 in Cocoa (Brevard County), December 3 and 9 in Cedar Key (Levy County), and December 11 in Cross City (Dixie County). A free copy of the CLAM software program and a companion User's Guide was provided at these sessions. These efforts resulted in 42 clam growers, or 9% of the growers in that state, to better refine their business and record keeping practices through an understanding and adoption of computerized spreadsheets. In addition, 2 Sea Grant agents in counties (Brevard and Franklin) where clam farming is ongoing were trained in the use of the software program to provide support to growers in their area.

A mechanism was developed and implemented with which to obtain information from successful agricultural and aquacultural organizations in Florida and the nation. A 23-item descriptive survey was utilized to gather essential information from these organizations. A 35% response rate was obtained from 85 organizational representatives. The analyzed survey results were the basis of an extension-style report that provided information on the following categories: respondents, structures, revenue generating strategies, inter-organizational structure, membership, initial consideration for organizing, possible roadblocks, measurement of success, and recommendations from organizations. The report also revealed several options and alternatives the Florida clam aquaculture industry could evaluate in determining how to organize through a unified industry approach. These suggestions provide a starting point for industry leaders to consider, adopt or reject. Further, the report can be used in providing guidance and suggestions for other individuals or industries that are interested in organizing.

- S.5 Complete the USDA-funded study that is developing a low cost investment strategy for inland shrimp culture in Florida. The study will provide an assessment of the investment and operating costs of a one-acre, dug-pond system. The final report will provide investors with a strategy for trying shrimp culture with a low-cost method. (Adams, Sweat)

This USDA-funded study is on-going, but scheduled to be completed in 2004. The study has developed a pro-forma financial analysis for a hypothetical inland, earthen pond shrimp culture system. The system provides a low-cost, low-tech strategy for the culture of shrimp in low-salinity water in an inland environment. Given the current market conditions, however, the system is not financially feasible.

Completion of USDA-funded study for inland shrimp culture in Florida not yet complete, but lacking only publication which is pending.

- S.6 Participate in the Aquaculture America 2003 meetings in Louisville, KY. Present a paper on the economic impact of commercial hard clam culture in Florida. The paper will be included in a special edition of the Journal of Applied Aquaculture. (Adams)

A presentation discussed the economic impact of the hard clam culture industry in Florida. The paper has been adapted into a journal article that is currently in-press with the Journal of Applied Aquaculture.

- S.7 Develop educational program, technical assistance and materials and provide educational support to local agents on sustainable hard clam aquaculture production throughout the state. (Sturmer)

Continued to establish a network within those counties where clam farming is ongoing by working with county marine agents and providing technical assistance and educational materials. Efforts during the third program year focused on Charlotte County (Novak) and Lee County (Wasno) in southwest Florida where growers have faced significant crop losses and on Franklin County (Mahan) where new leases have recently been established. Continued to deliver educational workshops, demonstrations and research results, previously delivered only in the Big Bend area, to these other areas of the state. (3.15 and 3.16 are really the same)

- S.8 Continue to establish an extension network in counties where clam farming is ongoing, or projected. Counties involved will include Levy, Dixie, Charlotte, Lee, Brevard, St. Lucie, Indian River and Apalachicola. (Sturmer, Novak, Wasno, Combs, Creswell, Mahan)

The Franklin County Agent continued to network with UF-IFAS Clam Aquaculture Agent Leslie Sturmer to provide clam aquaculture education programs and technical assistance to the clam farmers in Franklin County. (see 3.28)

The St. Lucie County Agent continues to work with clam growers as requested and to facilitate workshops conducted by the state-wide shellfish aquaculture specialist.

The Brevard County agent worked with Sea Grant Clam Specialist, Leslie Sturmer to assist local clam farmers and hatchery and/or nursery facilities (approximately a dozen).

- S.9 Continue to provide technical assistance to the 4-year Clam Lease Assessment, Management, and Modeling using Remote Sensing (CLAMMRS) project. This USDA-funded project allows for adoption of remote sensing technology for the clam aquaculture industry. (Sturmer)

This year continued to work with clam industry members in an effort to make them aware of the CLAMMRS water quality monitoring stations located in 7 counties. Over 25% of the active growers in the Big Bend area reviewed the "real-time" continuous water quality data posted to a web site. With archived water quality data available for 2002-3 developed procedures to graph monthly data of selected parameters for each CLAMMRS station. These "farmer friendly" graphs were used by growers in comparing annual clam production and documenting crop insurance claims. In addition, participated in over 120 office visits, telephone conversations, and e-mail discussions with clam farmers for the purpose of providing information on how to access the water quality data, providing monthly water quality graphs of archived data, how to interpret the values, and to discuss their implication on clam production. Growers are beginning to identify trends in environmental conditions critical to clam health and production. This information will let the industry begin to refine and improve management practices. The need to become efficient and cost-effective in making management decisions has become imperative as profit margins have become slimmer.

- S.10 Provide technical assistance on the Expert Assistance and Distance Identification Network (EADIN), a USDA-funded project that establishes protocol and implementation procedures for the rapid distance identification of biological samples, specially focused on phytoplankton. (Sturmer)

With Department of Fisheries and Aquatic Sciences faculty (Phlips, Baker) continued efforts to develop a system and protocol for rapid identification of biological samples, in particular phytoplankton, through the EADIN: Expert Assistance and Distance Identification Network, a USDA-funded project. Microscopes equipped with digital imagery at both the Department in Gainesville and at the Shellfish Extension Office in Cedar Key were field-tested using the proposed protocol and samples were archived for future reference. Further efforts to implement this project have been stymied.

- S.11 Establish a health monitoring program that will provide baseline information on important shellfish pathogens. (Sturmer)

Participated in a week-long (January 26-30) continuing education program, entitled "Health Management and Introduction to Shellfish Diseases," in which both public and private aquatic health professionals in the state were introduced to shellfish issues. In addition to conducting a workshop in Brevard County, specifically for the clam seed suppliers in the area; provided a tour of clam aquaculture facilities in the county for program participants. During lectures and "hands-on" laboratory sessions conducted at the Department of Fisheries and Aquatic Sciences provided samples of shellfish for program participants to dissect and initiate diagnostic procedures. Also provided a presentation on the current status of clam farming and a tour of commercial clam operations in Cedar Key. Public and private aquatic veterinarians gained expertise on current conditions and diagnostic techniques appropriate for support of the clam industry. Prior to this program, there were few trained shellfish

pathologists in the state available to assist the industry. Through these efforts, a better understanding was also gained by the industry of ongoing diagnostic support as well as the development of a preliminary health monitoring program for Florida clams.

Provided aquatic veterinarians at the College of Veterinary Medicine (Francis-Floyd and Riggs) with samples of cultured clams from 3 growing areas in the state during February for a "winter" sample and during August for a "summer" sample. Baseline information on the presence and absence of important shellfish pathogens in Florida is being determined.

- S.12 Develop and coordinate at least four water quality monitoring workshops for the clam farming industry. (Sturmer)

Although water quality monitoring workshops were not conducted this year, continued to work with clam growers in 7 counties in an effort to make them aware of the CLAMMRS water quality monitoring stations. About 30%, or 49 out of 170, of the active clam growers in east central Florida, southwest Florida and the Florida panhandle were kept informed of the latest information on the water quality monitoring equipment and weather stations deployed at their lease areas. Growers viewing water quality data are able to make immediate decisions on whether to plant seed or transfer nursery seed based on current salinity and water temperature readings. Further, the weather information recorded at the lease areas allows growers to decide if conditions are favorable to work on their farm site.

Met with growers in Charlotte and Lee Counties and the county marine agent (Novak) to set up a volunteer team to assist in the efforts of the Department of Agriculture and Consumer Services field personnel in maintaining CLAMMRS stations at their lease areas and in collecting water samples for validation of the chlorophyll probes. Engaged four growers from southwest Florida, or about 5% of the industry located in this area, to participate. High fouling of the probes in this area requires timely changing of the sondes in order to obtain valid measurements of dissolved oxygen and other parameters.

- S.13 Conduct six crop record keeping workshops for clam farmers. (Adams, Sturmer)

Reported as part of S.4.

- S.14 Provide technical assistance to the UF Whitney Lab to establish an experimental shellfish laboratory and initiate investigations of alternative molluscan species for possible aquaculture production. (Sturmer, Creswell)

This work has not been done. However, Leslie Sturmer continues to address questions by industry with respect to crop insurance programs in Florida.

Continued to assist Nunez with the Department of Fisheries and Aquatic Sciences and Creswell with Florida Sea Grant in conducting spawning, larval rearing and nursery rearing trials for ark clams at an experimental molluscan shellfish hatchery located at the UF Whitney Laboratory in a USDA-funded project. Further, continued to collect live ponderous and blood ark clams from several wholesalers across the state and hold for use as brood stock. These species, both promising aquaculture candidates, naturally set in clam bags at selected lease areas. Preliminary results were obtained by about 20%, or 5 out of 27, of the clam seed suppliers in the state. In addition, 3 growers are participating in the study by providing a portion of their lease and time in growing out the ark clam seed produced during these trials.

Utilizing skills learned from the St. Lucie County Agent, project staff collected broodstock of blood ark, *Anadara ovalis*, and ponderous ark, *Noetia ponderosa*, from clam leases in St. Augustine and Cedar Key, Florida, and successfully spawned them in the hatchery. The spawning process and larval development were videotaped to be used in the preparation of educational materials. Post-set juvenile arks were cultured in nursery tanks located at the hatchery. In the fall of 2003 seed arks were distributed to clam farmers on the Gulf of Mexico and Atlantic coast of Florida to evaluate growth and survival in hard clam growout areas.

S.15 Continue development of workshops and materials to shellfish growers who are participating in the USDA pilot crop insurance program. (Sturmer, Adams)

On 56 occasions met with growers, insurance providers, field supervisors and loss adjusters to review various crop losses and policy provisions. Information provided included water quality data from the CLAMMRS monitoring stations or meteorological data from the NOAA buoy stations. At the request of the USDA Risk Management Agency met with their staff and representatives from reinsured companies who service the clam policy in Florida to 1) discuss problems with the policy in the state, 2) consider how to deal with insurance claims, and 3) review risk factors and risk avoidance factors. Provided input on the identified issues of concern as well as issues identified by growers participating in the pilot program. Provided information at the request of RMA insurance specialists on current pricing information to use in adjusting actuarial values. Reviewed proposed policy revisions, additions and endorsements drafted by RMA staff. Suggested provisions to RMA staff, for example grower experience and increased reporting requirements, that may assist in redirecting the program back to what it was intended to be. Informed all eligible growers of the significant changes to the pilot clam crop program for crop year 2004 through newsletter articles. Further, requested RMA staff to review policy changes at the 2003 Hard Clam Industry Meeting. Over 55 growers and 5 reinsured company representatives were provided with this information. Through technical support and serving as a liaison for clam growers involved in the pilot crop insurance program was able to assist the USDA RMA in making significant changes to the policy and actuarials. These will be under evaluation during 2004. The continuation of a sound program is necessary to assist

clam growers in the event of catastrophic losses and ultimate adoption of a permanent program to benefit U.S. aquaculture.

- S.16 Develop a shellfish aquaculture research and demonstration center in Cedar Key. This will be the first salt-water running laboratory on Florida's Gulf of Mexico that will allow UF faculty to address the research needs of the clam farmers. (Sturmer)

The construction of a shellfish aquaculture research and demonstration facility in Cedar Key was completed. Installation and fine-tuning the operation of a saltwater delivery system, an effluent discharge system, aeration system, and fiberglass tanks were also completed. The facility became operational this year, providing educational opportunities to tour groups, students, and others. In addition, the facility was used by university faculty and students as a remote field station. Research efforts underway are evaluation of genetic diversity in clam strains and development of alternative molluscan shellfish species for culture.

- S.17 Conduct workshops and tours on the fundamentals of shrimp farming and specific technical and economic criteria established from data collected at the Ft. Pierce shrimp demonstration farm. Also present and publish results from demonstration project at professional association conference and publication. (Creswell)

Construction of the demonstration shrimp farm met with delays in construction engineering, permitting, and administration during 2003 so that stocking of the ponds has been delayed until spring 2004 (stocking later than July would not have provided a realistic representation of a shrimp production cycle at the site). Despite the delays, the demonstration aquaculture farm has made significant progress, and indeed, is being expanded for potential future use, including a nursery greenhouse and additional pond construction. Construction to date includes: 1) land clearing of approximately 15 acres; 2) construction of 5 acres of ponds; 3) pond interiors lined and berms sodded; 4) electrical systems and backup generator in place; 5) storage facility for equipment and feeds; 6) signage; and 7) 1,000 ft. artesian well. In-kind contributions to the project during 2003 exceed \$100,000. With completion of the nursery greenhouse, stocking of the ponds was scheduled for February 2004. Inquiries about shrimp aquaculture and the project have been sent materials, and a mailing list has been compiled for distribution at workshops scheduled in spring 2004.

- S.18 Conduct annual Oyster Industry Workshop for oyster dealers, providing them with latest technology, products and regulations. (Otwell, Mahan).

The Franklin County agent helped coordinate and teach this year's FL Oyster Industry Meeting with Dr. Steve Otwell and Victor Garrido at the Hut Restaurant in Apalachicola in July. The focus of the meeting was post harvest treatment options that the industry can use to help reduce the illness rate of *Vibrio vulnificus* in Florida and the upcoming Interstate Shellfish Sanitation Conference. Fourteen oyster dealers from around the state attended the meeting.

- S.19 Conduct workshops for new clam farmers who are developing their farms on new clam lease sites in the Apalachicola Bay. (Mahan, Sturmer)

The Franklin County Agent worked with Leslie Sturmer (UF/IFAS Shellfish Aquaculture Agent) to plan, organize and teach a series of three educational workshops for the 46 clam farming families in Franklin County and one workshop for the certified shellfish dealers in the county to introduce them to clams. An average of 14 farmers attended each of the workshop sessions. As a result of the dealer's marketing clams workshop, three of the dealers agreed to begin marketing Alligator Harbor clams.

Organized and taught 2 workshops on "The Basics of Handling and Harvesting Clams" in June at the FSU Marine Laboratory. 15 growers were introduced to the "rules of the road" that must be followed in these activities. Information on aquaculture certification requirements, shellfish harvesting classification and management plan for Alligator Harbor, boat and vehicle requirements, and other state and federal rules pertaining to molluscan shellfish was provided. Organized and taught 2 workshops on "The Basics of Processing and Marketing Farm-raised Clams" in August. Thirteen growers and 3 wholesalers were advised about current marketing efforts for cultured clams by staff from the Department of Agriculture and Consumer Services (DACS), Bureau of Seafood and Aquaculture Marketing and the regulations pertaining to harvesting, processing and distribution of clams by staff from the DACS Division of Aquaculture. The county marine agent (Mahan) hosted these workshops. About a third of the clam growers in Franklin County participated in these workshops. In doing so, the industry in this new growing area gained a better understanding of these activities.

- S.20 Continue to provide local workshops and technical for potential and existing clam farmers. (Sturmer, Mahan, Novak, Combs)

(See S.19 also.)

A forum held with clam growers, researchers and resource managers in southwest Florida during March opened up a dialogue among these groups to determine what information is available to clam growers, and discuss what clam growers may need to assist them in their business operations. It is anticipated that cooperation between growers and representatives of these institutions, universities and agencies in this area will continue as a result of this meeting in an effort to address the clam aquaculture industry's needs. As a way of follow-up to the March meeting, a written synopsis of each participant's program areas and activities was compiled and provided to 43 clam growers in Charlotte and Lee Counties. The report provides information on 12 universities, institutions, and agencies, specifically pertaining to whom to contact, what activities are being conducted, and how to access additional information via web sites. Further, through this forum created an awareness of research needs to address summer-related mortality problems and development of

alternative management practices that can be applied to improve clam production in subtropical conditions.

The Brevard County agent coordinated Clam-industry tour and Clam-disease Workshop with Leslie Sturmer and Dr. Smolowitz (MIT) (38 participants), participated in clam aquaculture management seminars with Sea Grant Clam Specialist, Leslie Sturmer, in Micco and Cocoa (25 clam farmers). Continue working with local clam farmers, clam hatcheries/nurseries.

- S.21 Continue to participate in regional and national Interstate Shellfish Sanitation Conference committee meetings to provide technical support to the industry. (Mahan)

The Franklin County Agent attended the Interstate Shellfish Sanitation Conference's Biennial Meeting in Portland, Oregon. During the meeting the agent provided technical information to Gulf of Mexico oyster industry representatives and participated in committee assignments (Biotoxin, Post-Harvest treatment, Education, and *Vibrio vulnificus* Education Subcommittee). A total of 175 people from the ISSC's 28-member states in addition to members representing shellfish producers, regulators and scientists for Canada, Japan, Korea, New Zealand, and Taiwan attended the conference.

### Finfish

- F.1 Participate in the World Aquaculture Association 2003 meetings in Salvador, Brazil, and co-present a paper that describes the Florida Sea Grant-funded study that assessed the market potential for culture sturgeon products. (Adams)

A presentation was co-authored (given by former student Marco Palma) on the market potential for cultured sturgeon in the southeast U.S. This presentation was adapted into an article that was published in the popular journal Global Aquaculture Advocate.

- F.2 Provide technical assistance that includes startup considerations to new and existing aquaculturalists in Florida and South Alabama. (S. Jackson)

Seventeen participants registered for the Growing into the Fish Business Aquaculture program in Crestview. Financial sponsorship for the event was provided by Three Rivers Rural Conservation and Development Inc. and the Yellow River Soil and Water Conservation District. Programming for this event was provided by Sea Grant Extension, Florida Division of Agriculture, and University of West Florida Small Business Support Center. Thirteen participants evaluated the program. All reported knowledge gained and overall satisfaction with the program quality.

## General

- G.1 The 30<sup>th</sup> Joint Meeting of the U.S.- Japan Natural Resources (UJNR) Aquaculture Panel was held in Fall 2001 in Florida. The proceedings of the symposium on stock enhancement and marine fish aquaculture will be published. (Leber: PD-01-3)

The volume “Ecology of Aquaculture Species and Enhancement of Stocks: Proceedings of the Thirtieth U.S. – Japan Meeting on Aquaculture” was published in 2003 in the UJNR TP-128 series.

- G.2 Provide educational programs on aquaculture to local k-12 teachers. (Creswell, Mahan, Stevely, Sturmer)

This program was not conducted due to a change in science teachers at Apalachicola High School. The new science teachers at the school were not interested in doing aquaculture education.

The Aquaculture Agent assisted the Fish and Wildlife Conservation Commission staff, the Suwannee River Water Management District staff, and the City of Cedar Key by providing educational materials and displays on clam farming for various school groups touring Cedar Key. Continued to assist the Cedar Key High School Marine Biology class in maintaining small plots within the Levy County management lease agreement in the Gulf of Mexico for farming clams. Participated in Career Fair at the Hilltop Alternative School in Bronson. Provided a 1-page description about the occupation of clam farmer with information on educational requirements, skills level, related jobs, and salary range to 35 high school juniors and seniors. Finally, introduced 20 juniors and seniors from the Alle High School to clam farming by giving a presentation and a tour of several shore-based commercial facilities in Cedar Key.

The St. Lucie County Agent did not complete this objective due to lack of funds for teacher in-service training.

## 2004 Planned Work

This section contains those items planned for completion in 2004 and beyond. The estimated date of completion is shown, along with the person responsible and a research project number where appropriate.

### Marine Ornamental Species

- MO.1 Suitable food for early life stages of cultured fish is a bottleneck for raising them for the ornamental fish hobby-based market. The goal of this project is to scale-up production of copepod species as food for rearing tropical ornamentals. (Marcus: R/LR-A-36).

- MO.2 Many marine ornamental species are collected from coral reef areas. Aquaculture is recognized as one solution to minimize the wild collection, while sustaining the aquarium industry and creating new commercial opportunities. This Sea Grant Industrial Fellow will continue former Sea Grant research to develop protocols to cultivate high value and popular marine ornamental shrimp. (Lin/Rhyne/Calman: E/INDST-2)
- MO.3 The aquaculture of marine ornamental fish is one way to reduce the collection of the fish from coral reef areas. A major problem is diseases contracted by the fish in culture situation or while on display in aquariums. Longer-lived fish mean fewer must be collected or cultured. This Sea Grant Industrial Fellow will examine the causes of head and lateral line erosion syndrome of the popular surgeonfish and attempt to find the solution to the problem. (Francis-Floyd/Tilghman/Stamper: E/INDST-3)
- MO.4 Most marine organisms marketed in the aquarium trade industry are collected from the wild, particularly from coral reef ecosystems. Some destructive harvesting techniques have dramatic impacts on the health and biodiversity of coral reef ecosystems. Developing aquaculture technology for marine ornamental species is urgently needed to guarantee a sustainable supply for the industry while minimizing the negative impacts on the natural environment. The goal is to develop and improve larviculture protocols for marine ornamental crabs and lobsters. (Lin: PD-03-09)
- MO.5 High mortality during larviculture remains a major obstacle to successful rearing of a large number of marine ornamental fish species. In particular, catastrophic mortality is associated with first-feeding or the “critical period” during which larvae switch from endogenous to exogenous feeding. This phenomenon creates a need for research aimed at determining the causes of mass mortality during the early stages of exogenous feeding in hatchery-reared marine ornamental fish larvae. (2006) (Turingen/Creswell/Gaines: R/LR-A-41PD)

### Shellfish

- S.1 Florida has approximately 350 active clam growers producing a crop worth \$18.2 million in 2001. Recently, the need for a hardier clam strain has become evident as clam culturists in Florida report below average survivals or total losses during the prolonged hot summers. Triploid clams may be a solution to this problem as they are virtually sterile, thereby spawning does not occur and energy is available during this stressful period for basic metabolism. (2006) (Scarpa/Baker/Sturmer/Adams: R/LR-A-39)
- S.2 Production will be enhanced, costs minimized, and opportunities improved for aquaculture businesses. (Creswell)

- S.2.1 At least four one-half day workshops will be presented at the Shrimp Aquaculture Demonstration Site at the University of Florida Research and Education Center related to shrimp aquaculture.
- S.2.2 Continue to instruct fish farmers in Puerto Rico to aspects of collection, handling and growout of spiny lobster and provide information regarding development of formulated feeds for spiny lobsters.
- S.2.3 Conduct at least one workshop on the potential of baitfish aquaculture in Florida.
- S.3 Enhance the clam farming industry in Franklin County. (Mahan)
  - S.3.1 Continue to provide one-on-one consultations and technical support to individuals interested in marine aquaculture.
  - S.3.2 Continue membership and work on FL DACS Statewide farm-raised Clam Marketing Advisory Committee.
- S.4 In a collaborative project with Florida Gulf Coast University, a series of workshops will be set-up to work towards making local clam farmers more efficient with current stocks and to implement a plan to create an oyster growing facility to supplement income. (Wasno)
- S.5 Complete the assessment of the economic feasibility of small-scale freshwater, penaeid shrimp culture in Florida. This study will provide guidelines for prospective culturists regarding investing in inland shrimp culture in Florida. (Adams/Sweat)
- S.6 Establish, coordinate and provide training in counties where clam farming is ongoing. Counties involved include Levy, Dixie, Charlotte, Lee, Brevard, St. Lucie, Indian River and Franklin. (Sturmer)
  - S.6.1 Continue to conduct workshops in support of the new clam farmers who are developing their farms on lease sites in Franklin County. Topics to be addressed include marketing, clam physiology, land-based nursery technology and systems, and rules and regulations. In addition, will also educate local chefs and restaurants owners in the area on the new farm-raised, seafood product available to them. (Mahan/Sturmer)
  - S.6.2 Continue cooperative programming with Sea Grant Clam Aquaculture Specialist, Leslie Sturmer, in two workshops assisting clam aquaculture enterprises, in efforts to improve their economic efficiencies. (Combs/Sturmer)
  - S.6.3 Continue to provide local workshops and technical assistance for potential and existing clam farmers. (Sturmer/Wasno)
  - S.6.4 Continue to provide individual consultations to clam growers on how to use a computerized spreadsheet program to enhance their record keeping and inventory management activities for a commercial clam culture operation. (Sturmer)

- S.6.5 Develop educational program and materials, update financial feasibility analysis for a small-scale clam culture operation, and provide technical assistance and educational support where clam farming operations are being considered in the state, in particular Collier County. (Sturmer/Adams)
  - S.6.6 Continue development of workshops and materials to shellfish growers who are participating in the USDA pilot crop insurance program. (Sturmer)
- S.7 Continue a coordinated effort to enhance hard clam farming in Florida through a series of USDA funded projects. (Sturmer)
- S.7.1 Initiate field trials to compare the performance of multiple Florida strains of hard clams under aquaculture conditions and to assist researchers in collecting field data to correlate this performance with genetic diversity.
  - S.7.2 Continue to provide technical assistance to the 5-year Clam Lease Assessment, Management, and Modeling using Remote Sensing (CLAMMRS) project. Provide “farmer friendly” graphs of monthly archived water quality data, as well as post to a web site, and compare two years of continuous water quality data at 10 aquaculture lease sites in the state with clam production. This project allows for adoption of remote sensing technology for the clam aquaculture industry.
  - S.7.3 Provide technical assistance on the Expert Assistance and Distance Identification Network (EADIN), a project that establishes protocol and implementation procedures for the rapid distance identification of biological samples, specially focused on phytoplankton.
  - S.7.4 Assist in completing a study that is providing baseline information on the presence and absence of shellfish pathogens in aquaculture lease areas. The final report of this study, which established a health monitoring program for the hard clam culture industry, will allow growers to increase their awareness of potential health problems for their stocks.

## Finfish

- F.1 The main objective is to develop innovative, reliable and environmentally sustainable hatchery technology for larval rearing and production of cobia fingerlings. This will be achieved by developing proactive health management methods aiming to reduce the input of microbes from major sources of contamination during the culture cycle (eggs/hatching/live food) and to increase survival and yield of fingerlings through the addition of probiotic bacteria to the larval culture tanks and to live feeds prior to feeding the larvae. A quantitative microbial management technology, using selected strains of probiotic bacteria will be adapted to cobia fingerling production. (2006) (Benetti/Orhun: R/LR-A-40)

## General

- G.1 Students enrolled in the St. Lucie County School District will increase their general knowledge of aquaculture through classroom instruction. The general public will be more aware of aquaculture as a potential industry in Florida through seminars, exhibits and mass media presentations. (Creswell)
  - G.1.1 At least 100 students will learn more about aquaculture through classroom and distant learning programs.
  - G.1.2 Compile an informational packet for individuals interested in shrimp aquaculture.
  - G.1.3 Develop a series of two-page fact sheets on potential aquaculture species in Florida.
  - G.1.4 Conduct at least six radio broadcasts (30 minutes each) dedicated to aquaculture topics.
- G.2 Provide technical assistance that includes startup considerations to new and existing aquaculturists in Florida and South Alabama. (S. Jackson)
- G.3 Educate aquaculturally interested public with aquaculture information and consultation. Provide water quality workshops to existing aquaculture ventures. Serve as aquaculture consultant to public schools in Citrus County. (Sweat)
- G.4 Increase the scientific, industry and agency knowledge about Florida aquaculture through participation at regional and national conferences.
  - G.4.1 Participate in the World Aquaculture Society 2004 conference in Hawaii. Invited to present a paper on structures and strategies for successful agricultural and aquacultural organizations at the East Meets West session for shellfish aquaculture industry members. This paper is the result of a study completed in the previous year with funding from the USDA Risk Management Agency. (Sturmer/Adams)
  - G.4.2 Participate in the Gulf and South Atlantic States Shellfish Conference in Georgia, and provide an overview of the Florida hard clam aquaculture industry highlighting certain projects, such as the CLAMMRS water quality monitoring program, genetics research projects, and the ark clam diversification study. (Sturmer)
  - G.4.3 Invited to give a presentation on extension activities in support of the Florida clam aquaculture industry at the National Agriculture County Agents Association's Annual Conference to be held in Orlando. (Sturmer)

Office of Trade, Tourism and Economic Development

*No report submitted.*



# UNIVERSITY OF FLORIDA

Institute of Food and Agricultural Sciences

UF/IFAS Tropical Aquaculture Laboratory  
Ruskin, FL

## Program Activities for July 1, 2003 – June 30, 2004

### **General:**

The research and extension programs continue to focus on the development of the state's ornamental aquaculture industry. Infrastructure additions included adding six additional offices to the main building using funds in a residual grant account and from USDA/Wildlife Services. A 72' X 30' greenhouse was also constructed and now houses facilities for marine ornamental research.

### **Workshops/Demonstrations:**

- Fish Health Management Workshop – August 7 – 8, 2003
- Fish Health Management Afternoon Seminar Series: Water Quality in Ponds and Tanks – September 18, 2003
- Fish Health Management Afternoon Seminar Series: Parasites Identification and Treatment – October 16, 2003
- Intensive Production of Live Bearers Workshop – October 24, 2003
- Florida Producer Information Workshop: Emerging Diseases of Koi – October 21, 2003 (Ruskin, FL), October 22, 2003 (Tallahassee, FL), October 27, 2003 (Homestead, FL), October 28, 2003 (Fort Pierce, FL), October 30, 2003 (Gainesville, FL)
- Fish Health Management Afternoon Seminar Series: Bacterial Diseases in Fish and Antibiotic Use – November 13, 2003
- Fish Health Management Afternoon Seminar Series: Common Bacterial and Parasite Treatments and Calculations – December 11, 2003
- Expression of Interest to Participate in University of Florida Tropical Aquaculture Laboratory-Sponsored 17-Alpha Methyltestosterone Efficacy Feed Experiment (as an Investigational New Animal Drug – January 21, 2004; January 28, 2004
- Marine Baitfish Workshop – February 2 – 3, 2004
- Induced Spawning Workshop – February 26 – 27, 2004
- Induced Spawning Workshop – March 11 – 12, 2004
- Pesticide Applicator Training and Testing – March 25, 2004
- Aquatic Animal Health Workshop – March 29, 2004
- Fish Health Management Workshop – May 5 – 6, 2004
- Diseases of Warmwater Fish – June 7 – 18, 2004
- Pesticide Labels: Review & Discussion of Restricted-Use Pesticides Labeled for Tropical Fish Farms – June 12, 2004
- Recirculating Systems Workshop – June 24, 2004

## Projects:

- **Use of Methyltestosterone for Masculinization of *Xiphophorus helleri*** – USDA/CSREES-funded project working with the FDA on an Investigational New Animal Drug (INAD) application for methyltestosterone as a masculinization agent for swordtail, *Xiphophorus helleri*, an important ornamental species. Initial results support labeling based on efficacy, but work remains to show environmental safety and manufacturing procedures.
- **Diet of Asian Swamp Eels Found in Commercial, Tropical Fish Production Ponds** – USDA/CSREES-funded project collecting Asian swamp eels, *Monopterus albus*, from tropical fish production ponds and examining their gut contents. The Asian swamp eel has appeared as an introduced species in commercial tropical fish production ponds in Hillsborough County. Based on initial information from federal agencies, great concern was expressed regarding their impact on fish populations in these ponds. Initial results of gut contents examinations indicate that fish may play a minor role in diet of Asian swamp eels in these ponds.
- **Design Criteria for Recirculating Ornamental Fish Production Systems** – USDA/CSREES-funded project developing design criteria for various ornamental species, using swordtails, *Xiphophorus helleri*, as the initial study animal. Ornamental species can be divided into major groups based on water quality, nutrition, and trophic-level parameters. A pilot scale system was built and a one year study of growth, survival, and economics was conducted. An extension publication is expected before the end of 2004.
- **Topical and Immersion Application of GnRH $\alpha$  to Selected Characins** - USDA/CSREES-funded project investigating alternatives to injection application of GnRH $\alpha$ , an important spawning aid, to a species of characin with economic importance. Results presenting a novel method of hormone application (i.e., gill application) accepted for publication in the North American Journal of Aquaculture.
- **Improvement of Harvesting, Grading, and Transportation Technologies for Ornamental Finfish** – USDA/Southern Regional Aquaculture Center-funded project in its third and final year. This project investigated current practices and new technologies, and extended results for this key portion of ornamental production. Four University of Florida EDIS extension publications are in preparation.
- **Water Quality Analysis of Ground and Surface Water Discharge from Commercial Ornamental Fish Farms in Florida** – USDA/CSREES- and FDACS-funded project which analyzed one year of data from monthly samples taken from five tropical fish farms in the state, concentrating on total nitrogen, total phosphorus, and total suspended solids. Results support the efficacy of state BMPs for tropical fish producers.
- **Special Local Need Label for Dylox 80** - project which resulted in the obtainment of a Special Local Need (SLN) label for Dylox 80 for use in ornamental fish and plant production systems on farms holding a Florida Department of Agriculture and Consumer Services aquaculture certificate.
- **Examination of Immune System Development in Juvenile Redtail Black Sharks** -- USDA/CSREES funded project investigating the ontogenesis of the immune system in an economically important ornamental fish, the Redtail Black Shark *Epalzeorhynchus bicolor*.
- **Pyceze Research Study** – Novartis Animal Vaccines Limited funded study of the potential toxicity and water stability of Pyceze, an anti-fungal therapeutant.

- **Use of Chemical Antibacterial Agents in Tropical Ornamental Fish Shipping Bags** – Florida Tropical Fish Farms Association funded project examining the efficacy of common shipping additives on reducing the bacteria loads in ornamental fish shipping bags.
- **Use of Sedatives to Reduce Handling Stress in Three Spot Gourami *Trichogaster trichopterus*** – Project testing the efficacy of anesthetics for sedation of Three Spot Gourami as measured by behavior and the efficacy of several commonly-used shipping chemicals, including anesthetics, in reducing blood plasma cortisol levels. Results suggest that some anesthetics are effective at reducing stress hormone levels in Three Spot Gourami. Two journal articles are in preparation.

#### **Exhibits:**

- Setup of 300 gallon aquarium of Florida farm-raised tropical fish at the University of Florida Bookstore, Gainesville, Florida

#### **Presentations:**

- *Commercial Shrimp Farming in Florida Status*, World Aquaculture Society Conference 2004, Honolulu, HI (Carlos Martinez)
- *Recent Perspectives on Opposite Ends of the Shrimp Culture Investment Spectrum*, World Aquaculture Society Conference 2004, Honolulu, HI (Carlos Martinez)
- Hillsborough County AgVenture – Fall 2003
- Hillsborough County AgVenture – April 12 – 15, 2004

#### **Facility Tours:**

- BMP Tour – October 2, 2003
- 14 clientele tours

#### **Publications:**

- Watson, C.A., J.E. Hill, and D.B. Pouder. 2004. Species profile: koi and goldfish. SRAC Publication 7201.
- Hill, J. E., J. D. Baldwin, J. S. Graves, R. Leonard, J. F. F. Powell, and C. A. Watson. In press. Preliminary Observations of Topical Gill Application of Reproductive Hormones for Induced Spawning of a Tropical Ornamental Fish. *North American Journal of Aquaculture*.

#### **Diagnostic Lab:**

- Conducted 204 fish disease cases with:
  - 31 water chemistry tests
  - 146 necropsies and bacterial cultures
  - 15 live exams or necropsies without bacterial cultures
  - 16 bacterial culture identifications
  - 99 histology slides
  - 18 virology (electron microscopy and/or cell culture)—outsourced
  - 47 health certificates
- Hosted three six-week and one two-week fish health extern
- Began hosting a two-year fish medicine veterinary intern

**Extension Contacts (Carlos Martinez, Assistant-In Extension):**

- 6,318 telephone calls
- 254 site visits
- 69 one-on-one office visits
- 41 facility tours to clientele
- 41 aquaculture packages mailed out (40 publications/pack)
- 20 aquaculture packages
- 1,560 e-mails

Leslie N. Sturmer, Multi-county Aquaculture Extension Agent III

*UF/IFAS Shellfish Aquaculture Extension Program*

FWC/Senator George G. Kirkpatrick Marine Lab, Cedar Key, FL

**Program Activities for July 1, 2003 – June 30, 2004**

**General:**

- Participated in over 1500 office visits, on-site visits, telephone conversations, and e-mail discussions with clam farmers for the purpose of providing current information on industry-related matters.
- Provided packages on clam farming, including biological, economical, marketing and regulatory information to about 55 individuals interested in entering the business.
- Provided individual assistance and appropriate forms to growers on over 90 occasions, assisting them in completing aquaculture certificate applications, authorized user agreements, lease transfers, or lease audits.
- Involved in 38 group-learning events with 818 participants for an estimated 650 instructional hours.
- Prepared about 60 instructional materials with distribution, including direct mailings, handouts, and other means, exceeding 5,500.
- Conducted tours of the shellfish aquaculture industry to various groups including school groups, cabinet aides, reporters, researchers, state agency representatives, federal and state elected officials, legislators, equipment suppliers, and other interested people.
- Provided support to the Dixie County Aquaculture Task Force and to the Boards of Directors of the Florida Aquaculture Association, Hidden Coast Shellfish Producers Association, Cedar Key Aquaculture Association, and East Coast Shellfish Growers Association

**Website:**

- Launched website - <http://shellfish.ifas.ufl.edu>

**Workshops:**

- The Basics of Processing and Marketing Farm-Raised Clams - August 21, Carrabelle; August 22, Apalachicola (Franklin County)
- Training in C.L.A.M. Software – October 2, Carrabelle (Franklin County); October 21, Sebastian (Indian River County); October 22, Cocoa (Brevard County); December 3, Cedar Key (Levy County); December 11, Cross City (Dixie County)
- Annual Hard Clam Culture Industry Meeting, November 5, Ocala
- Collier County Aquaculture Workshops, January 7, Goodland and Everglades City
- Aquaculture workshop to apply for clam leases, May 26, Goodland (Collier County)
- *Gulf Awareness: The Marine Resources of Cedar Key* Seminar Series (Host), January through April, FWC Marine Laboratory, Cedar Key (Levy County)

**Projects:**

- Complete survey and report on organizational structures and strategies for the clam industry
- Produced and posted clam lease informational signs for lease markers, public boat ramps and marinas in Franklin County
- Continuation of CLAMMRS Project / Providing monthly and annual graphs of archived water quality data and posting to web site
- Continue training in the use of CLAM Software Program through workshops and individual consultations
- Continue providing technical assistance to the USDA Risk Management Agency in the cultured clam pilot crop insurance program
- Obtain seasonal samples for clam health monitoring program from 3 growing areas
- Continue field growout trials with ark clams, UF Whitney Lab, St. Augustine
- Shipped live ark clam samples to interested shellfish dealers nationwide for product evaluation / Conduct shelf life studies and nutritional analyses for ark clams to be included in marketing study
- Initiate performance trials of clam hatchery stocks to evaluate genetic diversity, UF Shellfish Aquaculture Research and Education Facility, Cedar Key
- Initiate field nursery and growout trials with industry partners evaluating triploid clams, Charlotte, Lee and Levy Counties
- Identify partners and resources for the Oyster and Clam Shell Recover and Recycling Project, Cedar Key (Levy County)

**Exhibits/Posters:**

- Clam Farming Exhibit, 2<sup>nd</sup> Annual Clam Bake, September 5-7, Sebastian (Indian River County)
- Clam Farming Exhibit, Seafood Festival, October 18-19, Cedar Key (Levy County)
- Clam Farming Exhibit, Open House at FSU Marine Laboratory, April 24, Carrabelle (Franklin County)
- Planning committee for CLAMERICA Celebration, 4<sup>th</sup> of July (2004), Cedar Key (Levy County)
- *Genetic Issues in Florida Hard Clam Aquaculture*, Poster for Open House of the UF Shellfish Aquaculture Research and Education Facility, June 4, Cedar Key

**Demonstrations:**

- “A Day in a Clam Farmer’s Life”, 2004 4-H Youth Congress, July 23, Cedar Key (Levy County)
- Best Management Practices for Marine Bivalve Facilities, October 8, UF Shellfish Aquaculture Research and Education Facility, Cedar Key (Levy County)
- Original Florida Agritourism Media Press Tour – Clam Farming, April 30, Cedar Key (Levy County)
- Open House, UF Shellfish Aquaculture Research and Education Facility, June 4, Cedar Key

**Presentations:**

- *Organizational Strategies and Structures* Session, Hard Clam Culture Industry Meeting, November 5, Ocala

- *Clam Farming in Levy County*, FL Association for Family and Community Education, District II Annual Meeting, January 15, Chiefland (Levy County)
- *Clamalot: One brief shining moment or happy everlasting?* Gulf Awareness Seminar Series, February 23, Cedar Key (Levy County)
- *Organizational Structures and Strategies for the Florida Clam Aquaculture Industry*, East Meets West Industry Session, Aquaculture 2004, March 4, Honolulu, Hawaii
- *Hard Clam Aquaculture in Florida: Industry Initiatives*, 2004 Gulf and South Atlantic States Conference, April 20, Jekyll Island, Georgia

#### **Publications:**

- *Bivalve Bulletin Newsletter*, Vol. VII, No. 3, September, 6 pp.
- *Bivalve Bulletin Newsletter*, Vol. VIII, No. 1, January, 6 pp.
- *2003 Seed Suppliers List*, January, 2 pp.
- *2003 Clam Bag Suppliers List*, January, 1 pp.
- *Tagging Methods for Clam Bag Identification*, November, 2 pp.
- *Enhancing Seed Availability for the Hard Clam (*Mercenaria mercenaria*) Aquaculture Industry by Applying Remote Setting Techniques* (Sturmer, Adams, Supan), Florida Sea Grant Technical Report (TP-125), 37 pp.
- *Organizational Structures and Strategies for the Hard Clam Aquaculture Industry in Florida* (Ruth, Sturmer, Adams), Final project report for USDA Risk Management Agency, 59 pp.
- *The Economic Impact of the Florida Cultured Hard Clam Industry* (Adams, Hodges, Mulkey, Sturmer), *Journal of Applied Aquaculture* (15)1/2: 85-99
- *Reproductive pattern of the blood ark from the Northeast coast of Florida* (Power, Nunez, Mitchell, Walker, Sturmer), *Journal of Shellfish Research* 23(1):173-178

#### **Funded Projects/Grants:**

- Organizational Structures and Strategies for the Hard Clam Aquaculture Industry in Florida, USDA Risk Management Agency, 2002-3
- CLAMMRS: Clam Lease Assessment, Monitoring, and Modeling Using Remote Sensing, USDA Cooperative State Research, Education, and Extension Service, 2000-2005
- Diversification for the Hard Clam Aquaculture Industry through Investigation of Blood Ark and Ponderous Ark Culture and Marketability, USDA Cooperative State Research, Education, and Extension Service, 2002-2005
- CLAMMRS: Clam Lease Assessment, Monitoring, and Modeling Using Remote Sensing, for Franklin County, USDA Cooperative State Research, Education, and Extension Service, 2002-2005
- Genetic Analysis of Hard Clam Performance in Commercial Culture, USDA Cooperative State Research, Education, and Extension Service, 2002-2005
- Improving Stress Resistance of Cultured Hard Clams, USDA Agriculture Research Service, 2003-4
- Enhancing Stress Resistance of Cultured Hard Clams in Florida by Triploidy, Florida Sea Grant College Program, 2004-6

#### **Ongoing Programs and Plans for 2004-5:**

- Assist clam farming industry in their hurricane recovery efforts by providing information on

crop and financial assistance programs, developing a clam seed loan program, and evaluating the use of community land-based nurseries for rebuilding infrastructure.

- Update and expand information on shellfish aquaculture extension website.
- Complete studies (ark clams diversification, genetics, CLAMMRS, EADIN) and write up final reports for several USDA-CSREES projects.

Ferdinand F. Wirth, Associate Professor  
UF/IFAS Food and Resource Economics Department  
Indian River Research & Education Center, Fort Pierce, FL

**Program Activities for July 1, 2003 – June 30, 2004**

**General:**

The research focus has been investigating the feasibility of developing a food-species aquaculture industry in central and south Florida, where farmers are faced with redefining and changing agricultural practices due to regulations related to environmental restoration efforts, crop diseases (citrus canker and tristeza virus), and low market prices for citrus. There is strong interest in aquaculture among Florida citrus growers, especially in the Indian River area.

**Research Projects:**

- Conducted commercial scale penaeid shrimp demonstration in inland freshwater systems, FAES Project FTP-04100. This ongoing applied research project is a small scale production demonstration trial designed to show and evaluate the feasibility (production and economics) of farming marine shrimp in lined, freshwater ponds.

**Major Achievements:**

- Constructed a nursery greenhouse (36' x 96' with four tanks) and four 76' x 220' lined ponds
- Stocked the nursery greenhouse in early April 2004 with 300,000 Pacific White (*Litopenaeus vannamei*) shrimp PL12s distributed into two tanks
- On May 11, 2004, transferred the 300,000 juvenile shrimp (0.1 gm average weight) from the nursery tanks into two of the ponds for growout. This first crop should be ready to harvest in September or October 2004, depending on weather.
- Stocked second crop of 500,000 PL12s into three nursery tanks on June 10, 2004.

**Publications:**

- Adams, Chuck, Marco Palma, and Ferdinand Wirth. 2003. "Buying Cultured Sturgeon - Study Asks: Who Wants What, When?" *Global Aquaculture Advocate*, 6(6): 31-32.
- Wirth, Ferdinand F. and Kathy J. Davis. 2003. "Seafood Dealers' Shrimp Purchasing Behavior and Preferences." *Journal of Shellfish Research*, 22(2), August: 581-588.
- Wirth, Ferdinand F. and Kathy J. Davis. 2003. "Survey: U.S. Consumers Willing to Buy Farm-Raised Shrimp." *Global Aquaculture Advocate*, 6(5): 82-84.

**Presentations:**

- Wirth, Ferdinand F. and Kathy J. Davis. 2003. "Market Assessment: A Recommended First Step in Species Development." *International Sustainable Marine Fish Culture Conference & Workshop*, Harbor Branch Oceanographic Institution, Fort Pierce, Florida, October 9-10, 2003.
- Wirth, Ferdinand F. and Kathy J. Davis. 2004. "Assessing the U.S. Market for a Cultured

Flounder Industry.” Selected paper presented at Aquaculture 2004, the International Triennial Meeting of the World Aquaculture Society, Honolulu, Hawaii, March 1-5, 2004.

- Wirth, Ferdinand F. and Kathy J. Davis. 2004. “Seafood Dealers’ Shrimp Purchasing Behavior and Preferences.” Selected paper presented at Aquaculture 2004, the International Triennial Meeting of the World Aquaculture Society, Honolulu, Hawaii, March 1-5, 2004.
- Dasgupta, Siddhartha, Ferdinand F. Wirth, and Kathy J. Davis. 2004. “Consumer Perceptions of Freshwater Prawns Sold in Food Festivals.” Selected paper presented at Aquaculture 2004, the International Triennial Meeting of the World Aquaculture Society, Honolulu, Hawaii, March 1-5, 2004.