Auburn University
Shellfish Laboratory

Annual Report 2004

On The Rise

2004 Highlights

Projects

- Seven groups of oysters from two sites were tested for tolerance to low oxygen. Initial findings suggest differential tolerance between sites but inheritance of tolerance is not confirmed.
- Optimum size of micro-cultch for more efficient production of single oysters determined.
- Outline and images developed for an instructional CD, “Oyster hatchery methods”.
- Oyster gardening supported in partnership with Mobile Bay NEP and 26,000 oyster planted for reef restoration.
- Aquaculture Network Information Center (AquaNIC) website coordinated and maintained.
- Hosted Marine Aquaculture Course (Dr. La Don Swann, instructor).

Other Projects Supported

- Eight researchers at five institutions were provided assistance in the form of lab space, oyster larvae, oyster seed or large oysters.
- Fifty five thousand oysters donated to public reef in wake of Hurricane Ivan.
- One hundred ten thousand seed oysters donated to a recently established broodstock reserve area in Bon Secour Bay.

Production

- Over 12 million larvae and 375,000 seed oysters produced
- Maintained 100,000 large oysters in Mobile Bay for broodstock, anticipated experiments, and use by other researchers.

Facilities

- Two additional pumps installed improving intake and discharge capabilities.
- Water filtration and oyster nursery systems improved for increased efficiency and production.
- Advance preparation for Hurricane Ivan and hard work post-hurricane returned the AU Shellfish Lab to full functional capacity within a week.

Tours and Meeting

- Over 150 people from 10 groups visited the AU Shellfish Lab as part of tours or use of conference room facilities for meetings.

Introduction

The past year was a period of growth for the Auburn University Shellfish Laboratory (AUSL). In 2004, AUSL made tremendous strides in expanding efforts in all areas of its mission of instruction, research and outreach. These efforts were reflected through facility enhancements, increased production and research output, and an expanded cooperative effort with other researchers, agencies and public interests.

Refinements and enhancements to the AUSL seawater system in 2004 moved shellfish through the facility in a more timely fashion. The resulting increase in production capabilities had a dramatic effect on the research potential of the laboratory. The facility served as the base for several Auburn research projects as well as various cooperative projects with researchers from other agencies and universities. As part of AUSL's outreach program, work continued with a volunteer-based program for oyster reef restoration. AUSL expanded its outreach efforts by working closely with local interests in oyster aquaculture and providing oyster larvae, oyster spat, and operational advice. In addition, several diverse groups visited the facility for tours and lectures. The lab provided instruction through course offerings from the Dauphin Island Sea Lab (DISL) and by serving as a support base for graduate student research.

AUSL will continually look for ways to get the full potential out of the laboratory in all phases of its mission. The coming year will be even more challenging with a larger production

effort, more research projects, additional graduate students, and more cooperative efforts with other researchers, agencies and public interest.

Projects

Low Oxygen

One of the major projects at AUSL in 2004 focused on hypoxia tolerance in oysters and the potential for developing oysters more tolerant to low dissolved oxygen. Oysters with low oxygen tolerance would aid restoration efforts in areas where low dissolved oxygen is a limiting factor. In late winter and early spring 2004, adult oysters were subjected to anoxic conditions in the laboratory to determine if oysters from areas known to experience low oxygen have an increased tolerance relative to control oysters (Fig. 1). Survivors from these challenges, as well as control oysters, were spawned in May 2004 to produce the F_1 generation. Two additional groups were spawned in June 2004. The resulting larvae were reared in the hatchery and set on micro-cultch to produce single oysters (Fig. 2). In August 2004, the F_1 generation oysters were subjected to anoxic conditions in the laboratory and compared for tolerance. The offspring groups were moved out to racks in Bon Secour Bay where they are being maintained in anticipation of further breeding studies in 2005. Dr. Richard Wallace, Auburn University

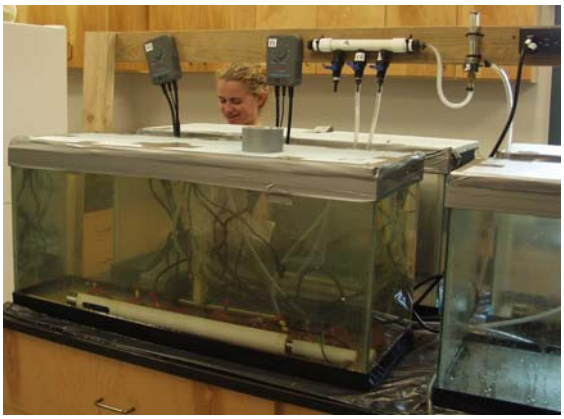

Figure 1. Hypoxia experimental setup.

Figure 2. F_1 generation oysters.

Marine Extension Research Center, (AUMERC) is the principle investigator for the project. Funding for the project was provided by Mississippi-Alabama Seagrant Consortium and supported Master's student Courtney Ford. Results of this project to date will be presented in 2005 at the Alabama Fisheries Association meeting in Auburn, AL and the National Shellfish Association meeting in Philadelphia, PA.

Cultch Size

In an effort to improve our efficiency in getting research oysters through the hatchery phase, AUSL undertook a project to investigate the optimal size cultch material to use when setting larvae for the production of single oysters. In the past, ground oyster shell sieved to a size range of 250-300 microns was used with good success producing single oysters. In this project, larger cultch sizes, 600-1000 microns and 1500-2000 microns, were compared with the smaller cultch (Fig. 3). If larger cultch material can be used and still generate

Figure 3. Ground oyster shell cultch material in three size ranges.

predominantly singles, oysters can move up to large screen size upwellers faster. With the larger screen upwellers, water flow can be increased leading to faster oyster growth and a decrease in hatchery rearing time. The 600–1000 micron cultch provided the best combination of single oysters and fast growth. This project was conducted in conjunction and

with larvae from the low oxygen tolerant oyster project. Scott Rikard was responsible for experimental design and Glen Chaplin from AUMERC, carried out the data collection.

Educational CD

Dr. LaDon Swann is the principle investigator on a project to develop an educational CD on the hatchery production of oysters. Graduate student, Melanie Rhodes, took the initial steps of outlining the material and creating storyboards as part of a directed study under Dr. Swann. Jody Scanlan with AUMERC is working with Dr. Swann on the programming development of the CD. Scott Rikard with AUSL and Rick Wallace with AUMERC are reviewing material for accuracy. Mr. Rikard also worked on digital photography of oyster larval developmental stages (Fig. 4). Larvae used for the photography were from the low oxygen tolerant oyster project. Development of the CD will continue into 2005.

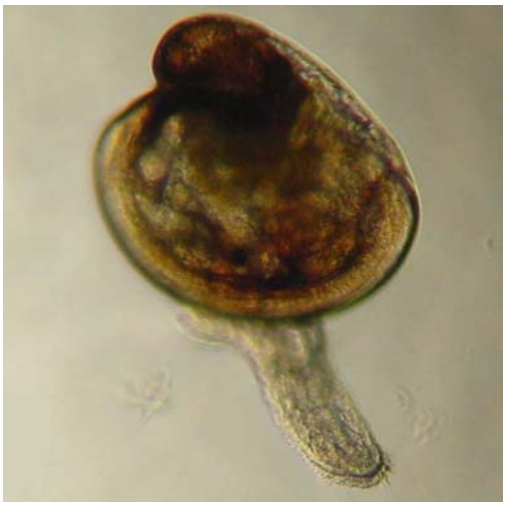

Figure 4. Pediveliger oyster larvae.

AquaNIC

As in 2003, the Aquaculture Network Information Center (AquaNIC) website is coordinated and maintained at AUSL. AquaNIC is a gateway to the world's electronic aquaculture resources. AquaNIC is coordinated by Dr. Swann with the Mississippi-Alabama Sea Grant Consortium and is hosted by Purdue University and the University of Illinois through the Illinois-Indiana Sea Grant Program. AquaNIC is a member of the National Sea Grant College Program's Network of Aquaculture Information Services along with the DOC/NOAA Aquaculture Information Center, National Sea Grant Library, Delaware

Aquaculture Resource Center, and the Maryland Sea Grant Program. AquaNIC supported a summer undergraduate intern, Jonathan Jackson, from Mississippi State University.

Oyster Gardening

AUSL continued its support of the Mobile Bay National Estuary Program's (MBNEP) Oyster Gardening Project. The project consists of volunteers around Mobile Bay raising oysters on waterfront property for restoration of oyster reefs. The program expanded to greater than 60 volunteers this past year. AUSL's role is to provide the oyster spat for the volunteers. AUSL set approximately 1 million eyed larvae on 20 bags of whole oyster shell for the project. Another 60 bags of shell were placed on commercially productive Cedar Point reef in Mobile Bay to catch a natural set of oysters. After spat set, bags were held in flow-through tanks at AUSL until delivery to volunteers for growout. Volunteers grew the oysters for five months. The oysters were then collected by Kara Lankford with MBNEP and P. J. Waters with AUMERC and placed in flow-through tanks at AUSL awaiting restoration to reefs in the bay. On November 5 2004, MBNEP, AUMERC and AUSL personnel restored approximately 26,600 oysters to Whitehouse Reef in Mobile Bay (Fig. 5). Numbers of oyster restored this year were down from previous years due to the devastating effects from Hurricane Ivan. More than half the volunteers lost their oysters during the storm. AUMERC and AUSL personnel

Figure 5. Restoration of oyster gardening oysters to Whitehouse Reef.

returned to Whitehouse reef on December 2, 2004, to scuba dive on the reef and assess oysters planted in 2001 and 2003.

Helping Industry

Hurricane Ivan also took its toll on Cedar Point Reef, the largest publicly harvested reef in Alabama. The Alabama Department of Conservation estimated that approximately 80% of the reef was damaged. In an effort to support Alabama's oyster industry and help replenish the damaged reef, AUSL in cooperation with the Alabama Department of Conservation and Natural Resources Marine Resources Division planted 55,000 fingernail-size oysters on Cedar Point Reef. Input was gathered from local oyster harvesters about the best place to plant the oysters. These oysters were surplus oysters from the low-oxygen tolerance project.

AUMERC and AUSL have been working with a novice oyster farmer, for the past two years in establishing an oyster aquaculture operation. Scott Rikard (AUSL) and P. J. Waters (AUMERC) worked with the farmer's employees to establish an oyster larvae setting system and upweller nursery system for post-set oyster. In addition, AUSL provided the farmer with both larvae and post-set spat from excess production from the AUSL hatchery

Since 2002, AUMERC has worked in partnership with Bon Secour Fisheries, Inc. to create a broodstock sanctuary in Bon Secour Bay, Alabama. The program originated from a grant by the Ocean Trust and the National Fisheries Institute in conjunction with the NOAA Restoration Center. An area of existing hard bottom was built up with oyster shell and then planted with seed oysters grown by AUMERC on racks in Bon Secour Bay and oyster gardening oysters from MBNEP in 2002. In 2004, AUSL was able to donate two batches of seed oysters, totaling 110,000 oyster, for planting on the reef. These were excess oysters from the low oxygen tolerant oyster project.

Assisting Other Researchers

AUSL has been working closely with several researchers from the University of South Alabama (USA) investigating various aspects of oyster reef restoration. Dr. Ann Boettcher and graduate student Nobuo Ueda are conducting research on the affects of temperature, salinity, and dissolved oxygen concentrations on larval settlement and metamorphosis. In addition, they looked at the relationship between these environmental stresses and the expression of heat shock proteins. AUSL has provided both larvae and spat for this project. As a cooperative project, AUSL ran spat from our low oxygen tolerant oyster project through the anoxia experimental setup, then USA ran heat shock protein analysis on them. AUSL also provided large oysters from our 2003 production as well as spat from 2004 production to Dr. Sean Powers and Dr. Ken Heck from USA for field projects investigating oyster reef restoration.

USA graduate student Matt Johnson used AUSL wet lab space in 2003 and requested use again in the spring of 2004 for his research on community structure in seagrass beds. AUSL granted Mr. Johnson use of six 1,000-gallon tanks, space in the wet lab for the tanks, and flow through water for the tanks. At AUSL, Matt manipulated patch size and shape of artificial grass units in the 1,000-gallon tanks to investigate their influence on community structure of macrofaunal organisms in seagrass beds. He used these mesocosms to examine the effect on multiple predator-prey combinations to delineate between the consequences of shifts in patch size/shape and the threat of predation in these systems. The tertiary predator used in these experiments was juvenile red drum, while pinfish act as both a predator to lower trophic levels and a prey item to the red drum. Grass shrimp and amphipods were prey items for both higher order trophic levels.

Production

Large Oysters

Over 100,000 oysters from the 2003 production year were being held on racks in Bon Secour Bay. In January 2004, 98,000 oysters (25 to 35mm size range) were sold to the Drs. Sean Powers and Ken Heck with USA for reef restoration research. In October 2004, AUSL gave Dr. Heck another 1,100 oysters from the 2003 production. These were to help replace oysters lost due to hurricane Ivan.

In April 2004, 200 oysters (35 to 40mm size range) from the 2003 production were shipped to Majbrit Bolton-Warberg, a graduate student at the College of Charleston. Another 400 were shipped to her in July 2004. Mrs. Bolton-Warberg is working with Dr. Loren Coen at the South Carolina Department of Natural Resources, looking at the effects of pesticides used in mosquito control on oyster populations.

Another 1,000 oysters from 2003 production were taken in July to a shrimp farm in Greene County, Alabama. Oysters were used to reduce algal blooms in of shrimp pond effluent.

Larvae and Seed Oysters

The first spawn of 2004 took place on May 11 and 12, with the spawning of broodstock selected for the low oxygen tolerance project. Seven different broodstock groups were spawned resulting in 115 million fertilized eggs. These eggs were used to stock larval rearing tanks with 12 million eggs from each of the seven broodstock groups. The larval rearing cycle produced 2.55 million eyed-larvae.

From the eyed larvae, one-half million were set on bags of whole shell for the MBNEP oyster gardening project. The others were set on micro-cultch to produce single oysters for the F1 generation of the low oxygen tolerance project. In conjunction with this setting, 900,000 larvae were used to conduct a preliminary analysis of optimal cultch size to use for setting single oysters. The larvae set on micro-cultch from this first spawn resulted in approximately 123,000 spat.

In an effort to produce additional control oysters for the low oxygen tolerance project and oysters for other projects, a second spawn was conducted on June 21 and 22, 2004. The spawn resulted in the production of 86 million fertilized eggs from two different sets of broodstock. Larval rearing tanks were stocked with approximately 60 million eggs. The larval rearing cycle produced over 10 million eyed-larvae

From the second batch of eyed-larvae, 2.7 million were set on micro-cultch for production of control oysters for the low oxygen tolerance project. These larvae were set on three different cultch sizes for analysis of optimal cultch size to use for setting single oysters. The resulting spat set was analyzed for percent single oysters. The set resulted in approximately 250,000 single oysters.

Forty bags of oyster shell were set with 4.5 million eyed-larvae for Dr. Sean Powers from USA. The spat set on whole shell were raised for two weeks at AUSL and then turned over to Dr. Powers for reef restoration projects. Dr. Ann Boettcher and graduate student Nobuo Ueda from USA received one-half million larvae for heat shock protein research. A local oyster farmer was given 1.3 million larvae to test a larval setting system at his oyster aquaculture operation.

From the oysters set as singles, 110,000 were planted on the Bon Secour Bay broodstock sanctuary. A local oyster farmer bought 77,000 for use in his oyster aquaculture

operation. Dr. Ann Boettcher and graduate student Nobuo Ueda received three batches of 1,000 oysters each in July, August, and November for use in heat-shock protein research. In a cooperative project between AUSL and Dr. Boettcher, 1,200 oysters were subjected to hypoxic conditions and then tested for heat shock protein expression. In cooperation with the Alabama Department of Conservation and Natural Resources, Marine Resources Division, 55,000 seed oysters were planted on Cedar Point Reef to aid reef recovery in the aftermath of Hurricane Ivan.

The remaining oysters were used for the low oxygen tolerance project. As part of the project, 1500 oysters were subjected to hypoxic conditions to determine if tolerance had been increased in the F1 generation. Currently 23,000 oysters are being maintained on racks in Bon Secour Bay for further hypoxia testing and spawning in 2005 and for use in other projects.

AUSL received a request for larvae in October, from Dr. Steve Kempf in the Department of Biological Sciences at Auburn University. Though this was very late in the spawning season, a small spawn was produced and 50,000 d-hinge larvae were shipped to Dr. Kempf. The larvae were used for his research on the structure and possible function of the larva's apical sensory ganglion (ASG). The ASG is thought to be what senses the inductive cue for metamorphosis. We anticipate providing Dr. Kempf with larvae of all stages in the spring of 2005.

Facilities

Pumps

Improvements to the infrastructure of the facility began with adding redundant pumping systems. Personnel from AUSL and AUMERC installed an additional 7.5 HP intake-pump

and additional 10 HP discharge pump. The duplicate systems will not only serve as backups in case of pump failure but will also allow us to alternate between systems to perform maintenance without disrupting our production capabilities. The additional pumps double our pumping capacity in case of a need for larger volume of water for a short period. Though there would rarely be a need to run both systems simultaneously, it does provide the ability to bring seawater in at a rate of 500 gpm (Fig. 6,7).

Figure 6. Dual intake pumping system.

Figure 7. Dual discharge pumping system.

Sump

Strong storms (tropical storms) encountered in 2003 caused ground water to reach such a high level that the liner in the facility's 12,000-gallon sump floated up when pumped to near empty. This led to tearing of the liner around the hatchery discharge pipe from. A modification to the discharge protocol ensures the sump retains enough water to prevent the liner from floating and dictates that the sump remains full when large storms are anticipated.

Modifications to reinforce the liner around the discharge pipe penetration included doubling the thickness and installing a large retaining ring to provide additional support.

Filtration

The filtration system used in conditioning water for larval production was modified to run at higher pressure, increased capacity, and ease of use. The new configuration makes the process of sieving larvae considerably faster and increases the number of larval tanks that can run at any given time (Fig. 8).

Upwellers

Modifications to the upweller system for raising post-set juvenile shellfish also increased production capacity. A new plumbing arrangement increased flow to the system, reduced the frequency of upweller cleaning, and increased spat production capacity (Fig. 9).

Figure 8. Filter system.

Figure 9. Tank plumbing.

Hurricane Ivan

September brought a new challenge for AUSL in the form of Hurricane Ivan. Ivan came ashore just to the east of Dauphin Island causing considerable damage, especially on the west end of the island. Following established procedures, AUSL and AUMERC personnel were able to complete pre-hurricane preparations in three days. As the storm entered the Gulf of Mexico, the installation of hurricane shutters over all the windows became the first priority. When it became apparent that the storm would head toward the north-central Gulf Coast, personnel began removing the secondary intake pump, sump pump, and blower. Removal of the remaining pumps took place the day before the storm was to make landfall. All pumps were transported to Mobile, Alabama for safe storage. Equipment and small tanks under the building that could blow away or float away were moved upstairs to the interior of the building. The larger tanks in the hatchery were filled with water to prevent them from blowing over or floating. In anticipation of the power being out for an extended period, bottled oxygen was strapped to pilings under the building to provide oxygen to oysters in the hatchery systems. There was a mandatory evacuation ordered for the island on Tuesday, September 14.

After the storm, roads to the island were closed or impassable for two days. Dr. LaDon Swann (AUSL) returned to the island by boat on Thursday September 16 and reported minimal damage to the facility relative to other parts of the island. Blan Page (AUMERC) was able to get to the island by truck on Saturday, September 18 and conduct a further assessment of oysters in the hatchery. Facility manager Scott Rikard (AUSL)

returned to the island on Sunday September 19 and began oxygen flow to the oyster rearing tanks.

On Monday, September 20, recovery from the hurricane began. A generator powered air blowers for the oyster rearing tanks until restoration of power to the facility. AUSL and AUMERC personnel removed by hand approximately five cubic yards of debris from underneath the building. Reinstallation of intake pumps, sump pumps and blowers took place on Tuesday, September 21 and Wednesday, September 22. On Thursday, September 23, a survey of the pipeline found it to be in good shape. Restoration of power also occurred that day followed by water service on Friday, September 24. With fresh water to run on the pump seal, the intake and discharge pumps were restarted and flow-through initiated back on oyster rearing tanks.

The security fence at the rear of the property collapsed due to a build up of debris and battering by large floating objects. Replacement of the fence occurred in late October. The main laboratory building and the cistern building lost several shingles from the roof. The interior of the building suffered some minor water damage to walls in the front hall and microbiology lab from water blowing in through the roof vents. AUSL and AUMERC personnel completed repairs to the building by the first week of November.

Instruction

Dr. LaDon Swann taught Marine Aquaculture through the DISL summer school program. This course introduced students to techniques in marine aquaculture with emphasis in the areas of nutrition and feeding, reproductive biology, production techniques, water quality requirements, processing, marketing, and economics of commercially important marine aquaculture species. AUSL facility manager, Scott Rikard provided assistance with

lab work related to oyster culture as well as providing a guest lecture on Bullminnow Aquaculture.

Tours and Conference Facility Use

In 2004, AUSL provided tours to several groups and allowed use of conference room facilities for various meetings.

- On February 8, six students from St. Joseph's University dropped in for an impromptu tour of the shellfish lab. The students were visiting Dauphin Island as part of a Marine Biology Class field trip.

- Dr. Andy Danulchuk, Director of Research at the Island School in Cape Eluthera, Bahamas, visited the lab on April 19 and discussed ideas for a hatchery facility at his school. Several weeks later AUSL personnel worked with Dr. Danylchuck on estimating power usage for pumps and blowers that would be used to run a hatchery facility at the school.

- Beginning in April the local Cub Scout pack from Dauphin Island was allowed use of the conference room at AUSL for their pack meetings after working hours.

- The Clark School of Math and Science brought 11 students to AUSL for a facility tour on May 6.

- Chazz Hesselein with Mobile County Ornamental Horticulture Substation used the AUSL conference facility for an Ornamental Entomologist Workshop on May 13 and 14. In conjunction with the workshop AUSL provided a facility tour and a discussion of AUSL's rainwater recovery system that is integrated with the landscaping to create a migratory bird habitat.

- AUSL provided a facility tour for approximately 60 individuals from all over the country on June 15 as part of the National Agriculture Alumni Development Association Annual Meeting in Mobile and hosted by Auburn University.

- The Mississippi Department of Natural Resources brought 13 individuals to tour AUSL on June 22. Discussions were held concerning possible future cooperative efforts with oysters and the possibility of spawning clams.

- As part of their Center of Ocean Science Education Excellence Workshop, DISL brought twelve individuals to AUSL for a tour of the facility on July 1.

- DISL also sent five students from their Research Experience for Undergraduates program to the AUSL for a presentation on oyster hatchery production and a tour of the facility on July 14.

- Dr. Jesse Chappell, with the Department of Fisheries, brought approximately 25 individuals, primarily Chinese nationals, for a tour of AUSL on August 3 as part of an American Soybean Association Training course.

Media

In the aftermath of Hurricane Ivan, AUSL donated 55,000 oysters to be planted on damaged reefs in Mobile Bay. The following is a list of media coverage of that event:

Newspapers and Publications:

"Oysters planted on damaged reef" Mobile Register, Mobile, AL, October 7, 2004.

"Auburn oysters replenish reefs in Mobile Bay" The Auburn Plainsman, Auburn, AL, November 4, 2004.

"The great oyster drop" Impact: Research News from the Alabama Agricultural Experiment Station, Auburn University, AL, December 2004.

An article written by Associated Press writer Garry Mitchell contained information about the planting done by AUSL. The article was printed in the following newspapers and web sites under the various titles listed:

Newspapers:

"Gulf States tally oyster losses" Naples Daily News, Naples, FL, October 25, 2004.

"Alabama oyster reefs suffer 80 percent loss" Sun Herald, Biloxi/Gulfport, MS, October 25, 2004.

"Alabama oyster reefs hard-hit by Ivan" Shreveport Times, Shreveport, LA, October 26, 2004.

"Gulf States tally oyster losses" Tampa Bay Tribune, Tampa, FL, October 29, 2004.

Websites:

"Gulf States tally oyster losses" WPMI.com, Mobile, AL, October 25, 2004.

"States hit by hurricane see oyster losses" ABCNews.com, November 13, 2004.

"States hit by hurricane see oyster losses" APNews.myway.com, November 13, 2004.

"States hit by hurricane see oyster losses" premier-isp.net, November 13, 2004.

"Gulf Coast oyster beds battered by hurricanes" Ron's Oyster News, oysterweb.dnr.state.la.us, November 13,2004

"States hit by hurricane see oyster losses", RedNova.com, November 14, 2004.

"States hit by hurricane see oyster losses" Environmental News Network, enn.com, November 15, 2004.

"States hit by hurricane see oyster losses" Science and Technology News, onlypunjab.com, November 16, 2004.

"Oysters washed away by storm", boston.com, November 26, 2004.

A Look Forward to 2005

AUSL will continue to enhance its production systems in 2005. Plans are currently under way to modify piping from the pumphouse to the hatchery to provide two completely

independent pumping systems. The current system allows a build up of bio-fouling on the interior of the pipes in the hatchery. The two systems can be alternated to allow the idle system to go anoxic and kill fouling organisms before they become large enough to restrict water flow. Reduced fouling will allow for a steady flow of water and reduced maintenance. Better filter systems will also be investigated that will further reduce the need for cleaning tanks and oysters which can lead to increased capacity of the system.

Work will continue this year on development of a low oxygen tolerant oyster. The F_1 generation produced in 2004 will be bred to see if further enhancements to low oxygen tolerance can be obtained. AUSL will continue to work with Dr. Ann Boettcher at USA on heat-shock protein research by providing oysters and possible cooperative field research on this topic. A cooperative project is also in the works with Dr. Sean Powers with USA and the Dauphin Island Sea lab looking in to the potential that unharvested oyster sanctuaries might serve as sinks for oyster diseases. As in 2004, AUSL will be providing oysters for many other researchers as well as continuing to work with individuals interested in oyster aquaculture.

AUSL will again supply oysters for the MBNEP oyster gardening project. The number of volunteers participating in this project continues to grow and it is anticipated that the number of oysters provided by AUSL will increase this year.

Summer school courses will be taught in conjunction with DISL. Again, Marine Fish Diseases and Marine Aquaculture will both be offered. In the coming year, AUSL will continue to provide tours and lectures to various groups visiting the Lab. Already on the schedule is a group from the Mobile School of Math and Science, visiting in April. As we have for the past two years, tours and lectures will be provided for the Discovery Hall program and the REU program at DISL.

Acknowledgements

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