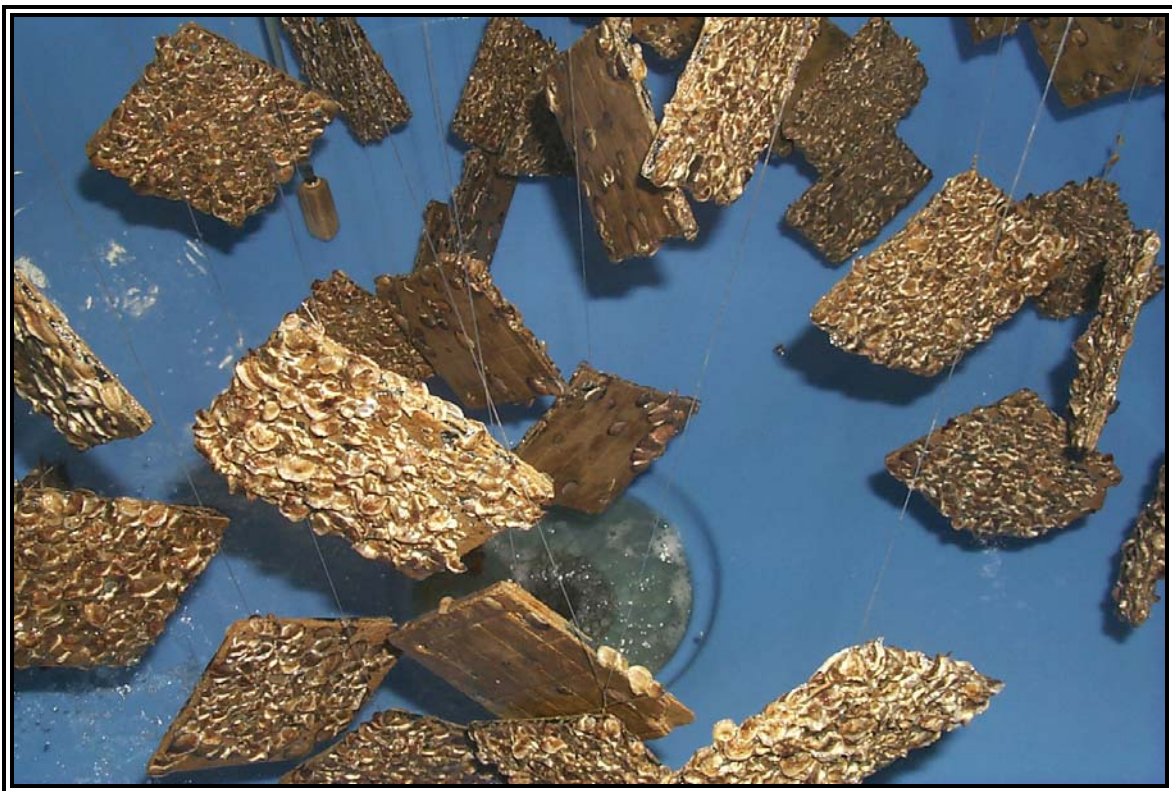


# Annual Report 2007

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## Imaginative Innovation



“Every great advance in science has issued from a new audacity of the imagination.”

~ *John Dewey*

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# 2007 Highlights

## Projects

- Tested the F<sub>2</sub> generation of oysters selected for tolerance to hypoxic environments.
- Completed field work investigating aspects of *Perkinsus marinus* (Dermo disease) infection in oyster reef restoration.
- Developed and analyzed an oyster depuration system to reduce or elimination *Vibrio vulnificus* bacteria.
- Contributed over 100,000 oysters for reef restoration to the Oyster Gardening Project in partnership with Mobile Bay National Estuary Program.
- Supported five graduate students and their research projects.
- Provided summer internship for a high school student selected from Alma Bryant High School's aquaculture program.
- Provided research facilities, oyster larvae, oyster seed, or adult oysters to eleven researchers at three institutions, and one private industry partner.
- Research conducted at AUSL was presented at the Alabama Fisheries Association Annual Meeting, the World Aquaculture Society Annual Meeting and the American Society for Microbiology General Meeting.

## Production

- Produced over 17 million larvae. Of those, 2.3 million were delivered as larvae, 2.95 million were set to produce single oysters, 4.46 million were set on whole shell, 2.5 million were set on heavy gage fencing wire, and 5 million were set on concrete tiles.
- Maintained 15 discrete groups of adult oysters in Mobile Bay for use as broodstock and research animals.

## Facilities

- Installed longline apparatus for growout and maintenance of adult oysters under the Dauphin Island Sea Lab boat dock.
- Constructed decks for storage of equipment and supplies.
- Stabilized intake pipeline exposed by beach erosion.
- Rebuilt two sump pumps and one intake pump.

## Tours and Meeting

- Hosted over 383 people from 13 groups through facility tours, lectures, and use of conference facilities.

## Introduction

Each year at the Auburn University Shellfish Laboratory (AUSL), there is an increasing demand for oysters from researchers, agencies and aquaculture interest. Early in the history of AUSL, requests for shellfish were usually simple orders for single oysters or spat set on whole shell. With the passing years, the requests get more unusual and elaborate with regards to setting substrate and delivery timing. Often this requires some imaginative innovations to meet the variety of needs that exists. The cover photo shows one of these innovations. Oysters were set on concrete tiles suspended in setting tanks by monofilament line. The tiles were then used by researchers to investigate predation rates on oysters at various locations in Mobile Bay. The hatchery was in production longer than any time in the past with the rearing of five groups of larvae and juvenile oysters from April through December.

The past year was a productive year graduate students affiliated with AUSL. Two students that used AUSL facilities and oysters for their projects graduated in 2007. Another student has completed his field research and is currently preparing his thesis while another is near completion of his field work. In the summer of 2007 a new student began investigation into a depuration system for oysters. In addition to supporting the research endeavors of students, AUSL continues to support other researchers and agencies with shellfish products and use of facilities. AUSL also provided tours and lectures on shellfish research and production for a record number of groups and individuals in 2007.

Research projects, requests for shellfish, and requests for tours and lectures are already coming in for 2008. With a little dose of imagination, AUSL will continue to strive to meet all the needs for shellfish research, production and outreach.

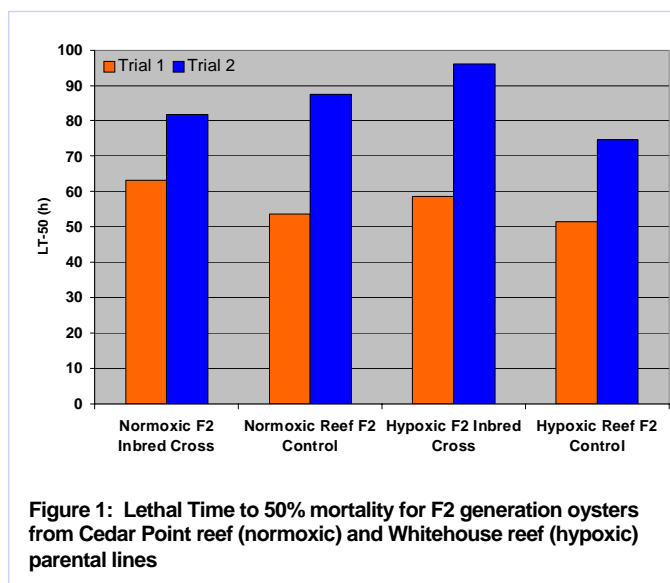
# Projects

## Breeding Tolerance to Hypoxia

AUSL began investigating the possibility of breeding oysters for increased tolerance to hypoxic conditions in 2004. Oysters from reefs that experience hypoxia were shown to survive significantly longer than oysters from normoxic reefs when exposed to hypoxic conditions in the laboratory. Ironically, offspring (F<sub>1</sub> generation) from the oysters that survived the hypoxia challenge indicated those from normoxic reef parents showed the most improvement in survival over control oysters. The results suggest natural selection pressure on the hypoxia-challenged reef may have reached some maximum limit.

The F<sub>1</sub> generation oysters were again challenged with anoxia in 2005. Surviving oysters were kept for brood stock and spawned to produce an F<sub>2</sub> generation in the summer of 2006. Though nine different crosses were produced, only inbred crosses of selected F<sub>1</sub> generation oysters from each of the two reef lines warranted further study after being challenged with anoxia. The two inbred crosses as well as F<sub>2</sub> control oysters from each reef line were grown to larger sizes and

challenged again with anoxia in the spring of 2007. The inbred crosses of the normoxic reef line did not fare as well as control oysters in this second trial. But inbred crosses from the hypoxic reef line sustained their advantage over control oysters from that reef line when challenged with anoxia (Fig. 1).

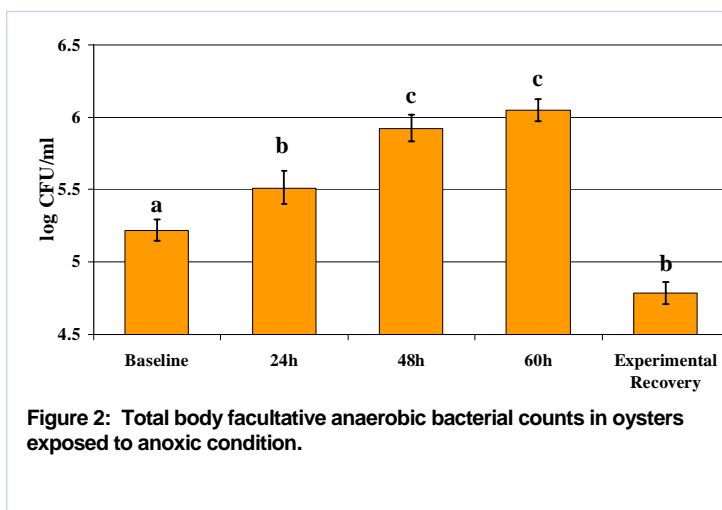


These results will be reviewed for further studies in the future. Dr. Richard Wallace with the Auburn University Marine Extension Research Center (AUMERC) is the principal investigator for the project.

### **Understanding Oyster Response to Hypoxia**

In 2007, graduate student Susan Fogelson completed her master's thesis investigating the mechanisms of oyster mortality under anoxic conditions at summer temperatures. Oysters were exposed to anoxia for varying lengths of time and then evaluated for changes in tissue structure, bacterial levels, condition index values, glycogen levels, and fecundity. Results indicated that glycogen reserves and oyster condition were not likely causes of mortality. Oysters stressed with anoxia did show an increase in total body facultative anaerobic bacterial counts, and bacteria were found at higher levels in certain tissues of the stressed oysters

(Fig. 2). There was also an inflammation of the mantle tissue and disintegration of some of the digestive tissues in the stressed oysters. The findings suggest that oysters may succumb to anoxic events through bacterial infection and tissue degradation rather than lack of energy stores.



Ms. Fogelson's presented her results at the 2007 Alabama Fisheries Association Annual Meeting and the 2007 World Aquaculture Meeting. This project was directed by Ms. Fogelson's major professor, Dr. Richard Wallace, (AUMERC).

**Dermo disease**

Field work concluded in August of 2007 on a two-year project analyzing the effect of dermo disease on oyster populations at unharvested and harvested reefs, and the associated implications for oyster reef restoration. Dermo disease is caused by the systemic protozoan parasite *Perkinsus marinus* and can lead to mortality in oysters after prolonged infection. The two reef types were compared for the density and size structure (proxy for age) of oyster populations, the prevalence and intensity of *P. marinus* infection, and mortality rates of existing oyster populations.

The project began in August of 2005 with the selection of six harvested and six unharvested reefs (Fig. 3). Oysters were collected for baseline population data and analysis of disease prevalence and intensity on each reef. Researchers constructed experimental arrays at each reef composed of three mesh bags each containing 30 oysters collected from the reef. These oysters were checked monthly for mortality from August 2005 through August of 2007. Three additional reefs with differing harvest pressures were

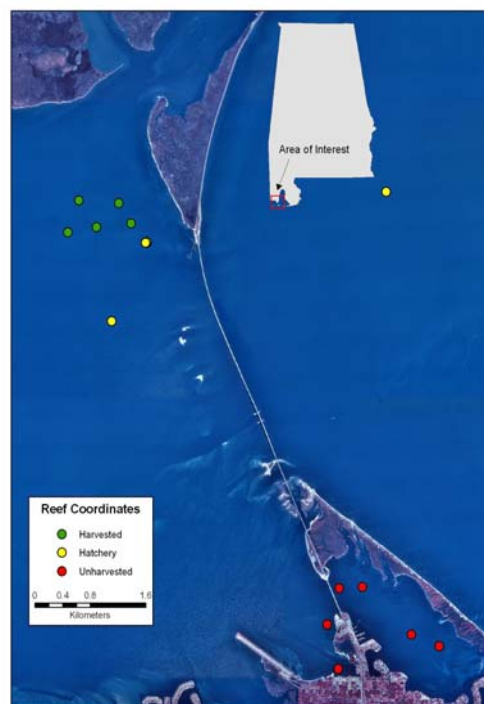


Figure 3: Location of study sites.

selected to track disease development in hatchery-reared oysters. The three reefs chosen had heavy harvest pressure, moderate harvest pressure, and no harvest pressure (a newly created reef). Bags containing hatchery-reared oysters were placed on these reefs and monitored monthly for mortality. Other hatchery-reared oysters were maintained to provide

samples for disease analysis. Mortality monitoring and disease analysis began in August 2005 and proceeded periodically through August of 2007.

A comprehensive analysis of the data is currently underway and preliminary results indicate oyster populations on the unharvested reefs have a higher density and contain larger, older oysters than on the harvested reefs. Oysters on the unharvested reefs also contain higher levels of *P. marinus* than oysters on harvested reefs (Fig. 4) and unharvested reefs may act as a reservoir of *P. marinus* that may influence neighboring reefs. Analysis of the project will conclude in 2008.

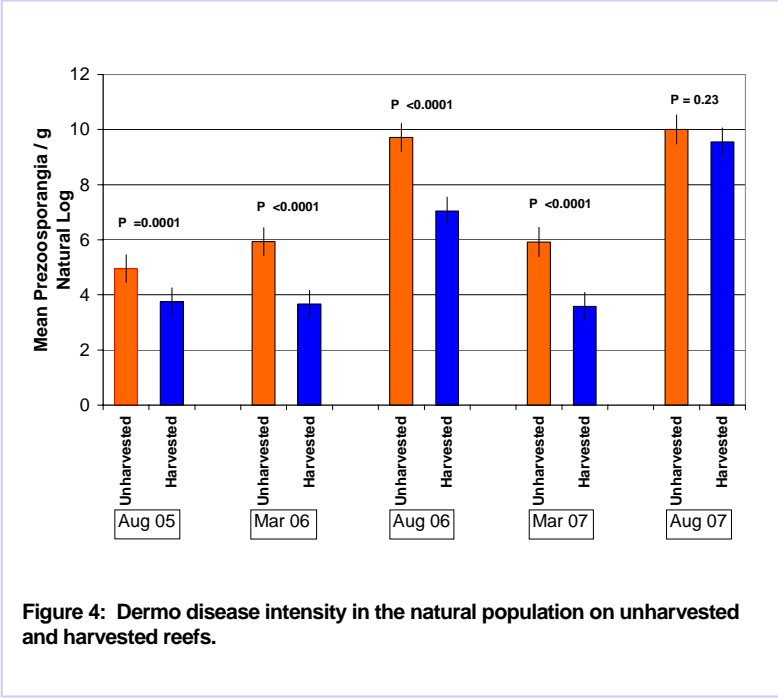


Figure 4: Dermo disease intensity in the natural population on unharvested and harvested reefs.

Graduate student Dennis Donegan has been working with AUSL and AUMERC personnel on this project. Mr. Donegan also works under the direction of the principal investigators for the project, Drs. Richard K. Wallace and Yolanda Brady. Dr. Brady also serves as Mr. Donegan’s major professor. Funding for the project is provided through the University of South Alabama’s (USA) Alabama Oyster Reef Restoration Program and NOAA. Mr. Donegan presented the first-year results at the 2007 Alabama Fisheries Association Annual Meeting and the 2007 World Aquaculture Meeting.

**Cold Shock Response in *Vibrio vulnificus***

Graduate student Suttinee Limthammahisorn received her PhD from the Fisheries and Allied Aquaculture department in the summer of 2007. Ms. Limthammahisorn conducted a study on the cold shock response of *Vibrio vulnificus* in oysters for her dissertation. *V. vulnificus* is a naturally occurring bacterium in the coastal waters of Alabama, and can be an opportunistic human pathogen associated with the consumption of raw oysters, primarily in immune compromised persons. Ms. Limthammahisorn's study evaluated the effect of oyster post-harvest time and temperature conditions on growth and survival of the bacteria.

AUSL provided one-year-old oysters for Ms. Limthammahisorn's experiments. A depuration system was set up at AUSL in an attempt to standardize bacteria. After a 7 day depuration period, the oysters were transported to Auburn for inoculation with *V. vulnificus* and cold shock experimentation.

Results suggest that cooling oysters to an intermediate level of 15°C and then to 4°C may result in cold adaptation by *V. vulnificus* compared to oysters that were cooled straight to 4°C. The adaptations at the intermediate temperature helped *V. vulnificus* remain in a culturable state when exposed to the lower temperature. These findings may have implications for the post-harvest treatment of oysters to reduce the potential threat of *V. vulnificus* infections.

Ms. Limthammahisorn worked under the direction of her major professor, Dr. Yolanda Brady and Dr. Cova Arias. She presented the results of her research at the 2007 World Aquaculture Meeting and the American Society for Microbiology General Meeting.

### Depuration of *Vibrio vulnificus* in oysters

The depuration system developed to standardize bacteria levels for Ms. Suttinee Limthammahisorn's research noted above showed the potential to eliminate *V. vulnificus* bacteria from oysters. Dr. Cova Arias worked through the details of obtaining a provisional patent for the system this past summer and brought in PhD candidate Ryan Wood to analyze the depuration system's potential for eliminating *Vibrio* bacteria. With Mr. Wood's assistance, AUSL ran several preliminary trials with the system using both hatchery-reared oysters and wild oysters. The preliminary results were encouraging and suggest the system merits further analysis. The depuration system has undergone several modifications during these preliminary trials and a full-scale analysis will be conducted in 2008. Preliminary results indicate the system is capable of reducing *V. vulnificus* to non-detectable levels. Mr. Wood hopes to work with the FDA lab on Dauphin Island in the summer of 2008 to learn PCR techniques that would be able to detect if *V. vulnificus* has been completely eliminated from oysters. System parameters of particular interest are oyster residence time in the system and handling prior to depuration, initial bacterial loads, flow rates, and salinities.

### Clam Culture

Graduate student Jonathan Jackson began field work in June 2007 on a project investigating the biological and production feasibility of culturing the clam, *Mercenaria mercenaria* (Fig. 5). The project analyzed two bivalve grow-out systems in the coastal waters of Grand Bay, Alabama. Clams were stocked into mesh bags at three densities in a belt



Figure 5: Northern hard clams, *Mercenaria mercenaria*.

system placed on the bottom and in bags suspended from an adjustable long-line system. The mesh bags placed on the bottom allow clams to burrow into the sediment as they would naturally. The clams placed in the long-line system were suspended in the water column approximately 0.5 m from the bottom. To date, clams in the belt system show a 25.0 % increase in size with 42.6 percent survival compared to only a 14.6 % increase in size for clams in the long-line system with a 24.3 percent survival. The field work for this project is slated to end in January 2008. This project is being conducted by Mr. Jackson under the direction of his major professor, Dr. LaDon Swann (AUSL and Mississippi/Alabama Seagrant Consortium).

### **Oyster Gardening**

AUSL is proud to have supported the Mobile Bay National Estuary Program's (MBNEP) Oyster Gardening Project since its inception in 2001. The program has restored over 311,000 oysters to reefs in Mobile Bay over the last seven of years. The success of the project would not be possible without the help of volunteers around the Bay raising oysters in protective cages on their waterfront property.

In 2007, AUSL set approximately 4 million eyed larvae on 78 bags of oyster shell in late May to provide oysters for the program. After two weeks of growth in the hatchery the shell bags were placed on commercially productive Cedar Point Reef in Mobile Bay on June 5<sup>th</sup> for further growth. Bags were retrieved from the reef on June 25<sup>th</sup> and held at AUSL until delivery to volunteers for grow-out. The spat set on the whole oyster shell were delivered to volunteers on July 2<sup>nd</sup> and 3<sup>rd</sup> by personnel from MBNEP and AUMERC. Volunteers tended the oysters for the next five months. The oysters were retrieved by MBNEP and AUMERC personnel in mid-November for planting in Mobile Bay. On November 13<sup>th</sup>, oysters from Mobile County volunteers were placed on Denton Reef just to the south of the mouth of Fowl

River. On November 14, oysters from Baldwin County volunteers were placed on a protected reef in Bon Secour Bay. Volunteers raised a total of 63,000 oysters for planting to these reefs in 2007. AUSL contributed another 46,000 oysters to the restoration efforts.



The number of volunteers in the 2007 program increased to 44 from 33 the previous year. More volunteers have returned to the program after recovering from the effects of Hurricane Ivan in 2004 and Hurricane Katrina in 2005. In 2006, a new group of volunteers for the Oyster Gardening Project came in the form of students from Alma Bryant High School. These students took an interest in the Oyster Gardening Project as part of the Second National Student Summit on Oceans and Coasts sponsored by Coastal America. Four students, Alex Callister, Gabriel Denton, Darrel Wright and Shaun Jenkins, established a precedent for students this past year. Students in the Marine Science class at ABHS under the direction of their teacher, Lynn Stewart, bagged the shell for the 2007 oyster gardening efforts. The students also helped with the retrieval of oysters from the oyster gardeners in November and subsequent planting on the reefs in the Bay. AUSL looks forward to continuing support of the Oyster Gardening Project for years to come.

### **Summer Internship**

As in past years, AUSL supported a summer internship for a student from Alma Bryant High School's (ABHS) aquaculture program. The student selected for the internship this year was Gabriel Denton. Mr. Denton came to our attention through ABHS's involvement in the Oyster Gardening Project and came highly recommended for his enthusiasm for his work in the aquaculture program at ABHS. He graduated in the spring of 2007 from ABHS and is continuing his education at the University of Mobile. AUSL plans to continue providing this summer intern ship in support of the ABHS aquaculture program.

### **Helping Industry**

AUSL entered into a cooperative relationship with a local shellfish producer, Roberson Seafood. Owner Michael Roberson provided AUSL with several batches of locally-harvested oysters to test in the *Vibrio* depuration system. In exchange for his assistance in obtaining oysters, AUSL provided several types of oysters for planting on private leases owned by Roberson Seafood. AUSL provided a total of 4000 oysters including single oysters, oysters set on whole shell, and oysters set on concrete tiles for planting on Roberson leases.

### **Assisting Other Researchers**

Over the last four years, AUSL has provided Dr. Stephen Kempf in the Department of Biological Sciences at Auburn University with oyster larvae. These larvae were used for research to develop a detailed description of the larval nervous system in *Crassostrea virginica* and examine the anatomy of neuronal circuitry. The research is focused on the larva's apical sensory ganglion in terms of its structure and possible functions. The larvae have also been used in the development of monoclonal antibodies to further aid in this

research. In 2007, AUSL provided Dr. Kempf with two shipments totaling 2.3 million oyster larvae.

AUSL has assisted USA graduate student Nobuo Ueda the past couple of years investigating heat shock proteins in oyster larvae and spat. After receiving his master's degree, Mr. Ueda took a research position with Dr. Kevin Fielman in the Department of Biological Sciences at Auburn University. Mr. Ueda used his contacts at AUSL to obtain use of two, 250-gallon troughs with flow-through seawater to leach plastic parts for a recirculation system being built for research on sea urchins. Dr. Fielman's lab is conducting investigations into gene expression in sea urchins in response to environmental stresses, with applications as an ecological forecasting tool to predict the effects of recent climate change on species distribution.

AUSL was able to support two other Auburn graduate students, Mac Martin from the Geology Department and Nhuong Tran from Agricultural Economics, who used AUSL as a base of operations for four days in August while they worked with the Alabama Working Waterfronts Coalition. The goal of the Working Waterfronts Coalition is to promote and provide leadership in maintaining a sustainable working waterfront. AUSL provided living quarters for the students as they surveyed waterfront businesses in Mobile County.

Since 2004, AUSL has provided oysters for projects in the University of South Alabama's (USA) Alabama Oyster Reef Restoration Program. AUSL's support continued in 2007 for a variety of field projects related to oyster reef restoration. Drs. Matt Johnson and Sean Powers received 2,250 spat on whole shell to investigate the elevation off the sea floor that enables oysters to survive anoxic events in Mobile Bay. This will help determine the optimum height to build reefs in anoxia prone areas. Spat were also used to analyze survival and growth in a variety of habitats on the western side of Mobile Bay.

Graduate student Jason Herrmann is also working on a project with Dr. Sean Powers analyzing predation on oysters in Mobile Bay. AUSL supported their project by conducting three separate spawns to produce larvae to set on 12x12 cm concrete tiles throughout the summer and fall of 2007. Spat were set on one side of the tiles and when they reached a size of 2 to 5 mm they were culled to 50 spat per tile. After obtaining the tiles from AUSL, Mr. Herrmann attached the tiles to moorings throughout lower Mobile Bay and Mississippi Sound to analyze predation. AUSL provided approximately 4,050 spat set on 81 tiles for the project.

Also receiving funding through USA's Alabama Oyster Reef Restoration Program is Dr. Ruth Carmichael, a new addition to the DISL team of researchers in 2007. Dr. Carmichael's research interests are in the area of marine ecosystem responses. Currently Dr. Carmichael is conducting research on the use of stable isotope ratios to link wastewater sources to effects on shellfish health and on human health from shellfish consumption. She is also investigating the effects of nutrient enrichment on oyster ecology in Mobile Bay. In support of her ongoing research, AUSL provided 2190 oysters, ranging from small single spat and spat on shell to larger adult oysters. The oysters were placed near wastewater treatment plants, monitored for growth and survival, and used for tissue analysis of stable isotopes and potential pathogens. Dr. Carmichael's current projects are slated to continue into 2009 with plans to receive oysters from AUSL for the next two years.

AUSL worked with private land owner Dr. Andy DePaola on setting oysters on a variety of fencing materials. Dr. DePaola is affiliated with the FDA lab on Dauphin Island and has collaborated on several projects with Auburn University in the past related to shellfish pathogens and human pathogens associated with shellfish. This collaboration was a private endeavor to investigate the possibility of using oysters set on fencing material as a installable living reef and possible future breakwater on bayfront property.

One of the by-products of AUSL's oyster research is a large quantity of shell. This by-product was helpful when AUSL receive a request for paired valves of oyster shell from the Discovery Hall Program at DISL. AUSL was able to meet the request with approximately 100 paired-valve oyster shells. The shells were used in a hands-on activity sponsored by the Discovery Hall Program at the National Science Teachers' Association Regional Conference.

## Production

### Oyster Spawning

AUSL conducted five separate spawns on the following dates in 2007 for the stated projects or purposes:

- |          |   |
|----------|---|
| April 24 | -Contaminated due to a hole in mechanical filter – Larvae discarded   |
| May 3    | - MBNEP Oyster Gardening Project<br>- AU apical sensory ganglion function (Dr. Steve Kempf)<br>- USA Alabama Oyster Reef Restoration Program – Stable isotope and ecosystem response projects (Dr. Ruth Carmichael)<br>- USA Alabama Oyster Reef Restoration Program – Survival of oysters relative to elevation in anoxia prone areas (Dr. Matt Johnson and Dr. Sean Powers)<br>- Single oyster production for stock maintenance |
| June 25  | - USA Alabama Oyster Reef Restoration Program – Predation studies (Jason Herrmann and Dr. Sean Powers)<br>- AU apical sensory ganglion function (Dr. Steve Kempf)<br>- Set on wire fencing material for oyster reef breakwater (Dr. Andy DePaola)<br>- Single oyster production for stock maintenance   |
| July 24  | - USA Alabama Oyster Reef Restoration Program - Predation studies (Jason  |

Herrmann and Dr. Sean Powers)

- Sept 17
- USA Alabama Oyster Reef Restoration Program - Predation studies (Jason Herrmann and Dr. Sean Powers)
  - USA Alabama Oyster Reef Restoration Program – Stable isotope and ecosystem response projects (Dr. Carmichael)

### **Oyster Larvae**

The 2007 oyster spawns resulted in over 17 million larvae raised for the following projects or purposes:

- 2.3 million - Apical sensory ganglion function (Dr. Steve Kempf – Auburn University)
- 5.07 million - Set on concrete plates – USA Alabama Oyster Reef Restoration Program – Predation studies (Jason Herrmann and Dr. Sean Powers)
- 2.5 million - Set on wire fencing material for oyster reef breakwater (Dr. Andy DePaola)
- 2.95 million - Set as singles on micro-cultch.
  - USA Alabama Oyster Reef Restoration Program – stable isotope and ecosystem response projects (Dr. Carmichael)
  - Single oyster production for stock maintenance
- 4.46 million - Set on whole shell for:
  - MBNEP Oyster Gardening Project
  - USA Alabama Oyster Reef Restoration Program – Stable isotope and ecosystem response projects (Dr. Ruth Carmichael)
  - USA Alabama Oyster Reef Restoration Program – Survival of anoxia relative to elevation (Matt Johnson and Dr. Sean Powers)

### **Oyster Seed**

Oysters set on whole shell, concrete plates, and micro-cultch were distributed for the following projects or purposes:

**Spat set on whole shell**

- 78 Bags - Approximately 120,000 spat set on whole shell (3-5mm) – MBNEP Oyster Gardening Project.
- 6 Bags - Approximately 2,250 spat set on whole shell (10-12mm) - USA Alabama Oyster Reef Restoration Program - Survival of anoxia relative to elevation (Dr. Matt Johnson and Dr. Sean Powers)
- 250 - Spat set on whole shell (10mm) – USA Alabama Oyster Reef Restoration Program – stable isotope and ecosystem response projects (Dr. Ruth Carmichael)
- 500 - Spat set on whole shell (25mm) - Private aquaculture interest (Michael Roberson- Roberson Seafood)

**Spat set on concrete tiles**

- 4,050 - Spat set on 81 concrete tiles (10mm) – USA Alabama Oyster Reef Restoration Program – Predation studies (Jason Herrmann and Dr. Sean Powers)
- 9,000 - Oysters set on concrete plates planted on Bon Secour Bay brood stock sanctuary reef in conjunction with MBNEP Oyster Gardening Project.
- 7,500 - Oysters set on concrete plates planted on Denton Reef in Mobile Bay in conjunction with MBNEP Oyster Gardening Project.
- 1,500 - Oysters set on concrete plates (25mm) - Private aquaculture interest (Michael Roberson – Roberson Seafood)

**Spat set on micro-cultch (Singles)**

- 1,000 - Single oyster (15mm) – USA Alabama Oyster Reef Restoration Program – Stable isotope and ecosystem response projects (Dr. Ruth Carmichael)

- 29,500 - Single oysters planted on Denton Reef in Mobile Bay in conjunction with MBNEP Oyster Gardening Project.
- 2,000 - Singles oysters 20-25mm – Private aquaculture interest (Michael Roberson-Roberson Seafood)
- 20,000 - Single oysters for future use are being maintained by AUSL in suspended bags on a longline system at the DISL boat dock.

### Large Oysters

In 2007 AUSL and AUMERC personnel maintained 13 different stocks of oysters on racks in Bon Secour Bay. Some of these oysters dated back to AUSL production from 2003. After a theft of oysters from the rack in April of 2007, the remaining oysters were moved into the AUSL facility until their relocation to suspended bags on a longline system under the DISL boat dock in December, 2007. Large oysters from maintained stocks were distributed for the following projects or purposes:

- 155 - Single oysters from 2005 production – AUSL *Vibrio vulnificus* depuration (Graduate student, Ryan Woods)
- 940 - Single oysters from 2005 production – USA Alabama Oyster Reef Restoration Program – Stable isotope and ecosystem response projects (Dr. Ruth Carmichael)
- 1200 - Single oysters from F2 generation oysters produced in 2006 from AUSL anoxia project. – AUSL anoxia project

## Facilities

AUSL has a long-standing agreement to use racks owned by Bon Secour Fisheries, Inc. for holding oysters. The racks are located in Bon Secour Bay and have been used by AUMERC and AUSL for approximately 18 years. AUSL has been holding several brood stock lines and production oysters for projects on these racks since opening its doors in 2003. In April of 2007, there was a theft targeting the largest oysters from these racks. Some of the

oysters stolen dated back to AUSL's first production year. The silver lining to this cloud is that most of the smaller oysters were left behind, probably because they were too small to sell or consume. This is fortunate because these oysters represent the most recent generations of our brood stock lines.

The remaining small oysters were temporarily relocated to the AUSL facility. Ideas were considered for making the rack system more secure, but on a return visit to assess the rack site, it was discovered that the racks themselves had been stolen, probably to be sold for scrap metal. This necessitated the consideration of alternate sites and methods for holding oysters. In December 2007, a longline system was installed under the DISL boat dock to

hold oyster stocks. Two heavy gauge monofilament lines were stretched between pilings that support the boat dock. All oysters housed at AUSL were moved to suspended bags attached to the longline in December, 2007. Approximately 20,000 oysters are currently being held in the longline system. The nearshore location should



Figure 7: Longline system for holding adult oysters located a the DISL boat dock.

be substantially more secure.

As more tanks are installed in the AUSL hatchery to meet the increasing demand for shellfish products, space for storing equipment has become limited. To address this need, a series of decks have been built under the existing overhead decks of the AUSL facility. This additional space should completely clear the concrete areas of the hatchery for production only. Also installed were racks for PVC pipes that replaced existing storage racks and made more efficient use of vertical space. Racks for PVC fittings will be installed in 2008.

Beach erosion over the last several years has caused the AUSL intake pipeline to become exposed at the beach/sea interface. The pipelines below water level that had become exposed were weighted with steel railroad rail to secure them in place. Above-water portions that were exposed have been secured with pilings. These are temporary solutions to a long-term problem. To that end, AUMERC and AUSL hired Thompson Engineering to draw up specifications for a bid package to directionally drill and install two new pipelines and remove the existing pipelines. The specifications should be completed in early 2008 with the bid process to commence shortly thereafter. Directional drilling will enable the pipelines to be buried much deeper.

The saltwater environment takes quite a toll on hatchery equipment. In 2007, both discharge sump pumps and one intake pump were rebuilt. In this harsh environment, this kind of equipment maintenance is to be expected.

The flow-through depuration system established in 2006 for graduate student Suttinee Limathammahisorn's research with *V. vulnificus* bacteria was extensively modified in 2007. The original system was developed to standardize bacteria levels using water filtration and sterilization. The system showed the potential to eliminate *Vibrio* bacteria from oysters. In 2007, graduate student Ryan Wood was brought in to conduct a thorough analysis of the system. Preliminary trials have led to several modifications. The latest version of the system is installed on a 250-gallon round tank as opposed to the original 90 gallon trough style tank. This will greatly aid in collection and removal of solid oyster waste. A new drain was also incorporated into the system for efficient solids removal and flow rates have been optimized. Further modifications and refinements are anticipated as the research on the depuration system progresses.

## Instruction

AUSL was not directly involved in summer courses this year at the DISL. Marine Aquaculture is scheduled to be offered in the summer of 2008, taught by Dr. Hugh Hammer from Gasden State University. AUSL plans an active role in providing facility use and guest lectures for this course. The status of the Marine Fish Disease course for summer 2008 is undetermined at this time. AUSL also provides instruction through facility tours and lectures as described below.

## Facility Tours and Lectures

In 2007, AUSL provided tours to several groups and allowed use of conference room facilities for a variety of meetings.

- The marine biology teacher at Alma Bryant High School, Lynn Stewart, brought fifteen junior and senior students to AUSL on February 17<sup>th</sup> for a tour of the facility.
- Twenty-four interns with the Environmental Protection Agency from around the country toured AUSL on February 28<sup>th</sup> as part of an EPA workshop in Gulf Breeze, Florida.
- Twenty-five state and regional aquaculture coordinators toured the AUSL facility as part of the National Association of State Aquaculture Coordinators conference. The tour was coordinated by Mr. Jimmy Carlyle.
- Members of the Louisiana Natural Resource Conservation Service met with AUSL personnel and individuals from Coastal Restoration Inc. and Varazo and Associates on May 23<sup>rd</sup> at the AUSL conference room to discuss the potential to use Wave Attenuating Devices for shoreline protection in Louisiana. There were six individuals in attendance outside of AUSL personnel.
- Seven students from the DISL Research Experience for Undergraduates Program visited AUSL for a presentation on oyster hatchery production and a tour of the facility on June 19<sup>th</sup>.

- As part of their Marine Application of Science and Technology Workshop, DISL brought sixteen individuals to AUSL for a tour of the facility on June 20<sup>th</sup>.
- On June 21<sup>st</sup> seventy-five individuals attending the Natural Resource Conservation Society Workshop toured the AUSL facility and the site of Dr. LaDon Swann's Wave Attenuating Device Project at Alonzo Landing.
- The DISL summer Discovery Hall Program brought twenty-five high school students from around the country to AUSL for a lecture and tour on June 26<sup>th</sup>.
- As part of the Marine Application of Science and Technology Workshop, DISL brought twenty-five individuals to AUSL for a tour of the facility on June 27<sup>th</sup>.
- Ten undergraduate students from the AU Department of Fisheries and Allied Aquaculture came to AUSL for a tour and lecture on July 26<sup>th</sup> as part of Dr. Jeff Terhune's Introduction to Fisheries Science course.
- Mitt Walker with ALFA brought 85 individuals attending the Alabama Farmers Federation 35<sup>th</sup> Annual Commodity Producers Conference to AUSL for a tour of the facility.
- AUSL hosted a tour on September 19<sup>th</sup> for approximately 50 3<sup>rd</sup> graders from Council Traditional School. Teacher Sally Barns coordinated the tour.
- Jonathan Bearden, a teacher at Davidson High School, brought 20 juniors and seniors to AUSL for a tour of the facility.

## Media and Presentations

In 2007 several articles were written and presentations given about AUSL and research conducted at the facility.

Donegan, Dennis J., Yolanda J. Brady, F. Scott Rikard and Richard K. Wallace. 2007. Population structure and dermo disease at harvested and unharvested reefs in Mobile Bay, Alabama. Alabama Fisheries Association Annual Meeting, Orange Beach, AL. February, 2007.

Fogelson, Susan, Scott Rikard, and Richard Wallace. 2007. Effects of anoxia on histology, bacteriology, condition index, glycogen levels, and fecundity in the eastern oyster, *Crassostrea virginica*. Alabama Fisheries Association Annual Meeting, Orange Beach, AL. February, 2007.

Donegan, Dennis J., Yolanda J. Brady, F. Scott Rikard and Richard K. Wallace. 2007. "Population structure and dermo disease at harvested and unharvested reefs in Mobile Bay, Alabama". World Aquaculture Society Annual Meeting, San Antonio, TX. February-March, 2007.

Fogelson, Susan, Scott Rikard, and Richard Wallace. 2007. "Effects of anoxia on the eastern oyster, *Crassostrea virginica*, with respect to condition index, glycogen levels, bacteriology and histology. World Aquaculture Society Annual Meeting, San Antonio, TX. February-March, 2007.

Limthammahisorn, Suttinee, Yolanda J. Brady, and Covadonga R. Arias. 2007. *Vibrio vulnificus* growth and in vitro expression of genes encoding cold shock proteins and other related genes under shellstock harvest time to temperature control conditions. World Aquaculture Society Annual Meeting, San Antonio, TX. February-March, 2007.

Swann, LaDon, Jody Thompson, and Scott Rikard. 2007. Development of CD-ROM and web versions of an interactive oyster hatchery teaching module. World Aquaculture Society Annual Meeting, San Antonio, TX. February-March, 2007.

Limthammahisorn, S., C. Arias, and Y. Brady. 2007. *In Vivo* Cold Shock response in *Vibrio vulnificus*. American Society for Microbiology, General Meeting, Toronto, ON., Canada. May, 2007.

Young, Jene. September 12, 2007. Oyster Gardening. WKRG News 5 and on the web at: [http://wkrg.com/weather/article/oyster\\_gardening/5132/](http://wkrg.com/weather/article/oyster_gardening/5132/)

Young, Jene. November 13, 2007. Oyster Gardening Reef Restoration. WKRG News 5 and on the web at: [http://wkrg.com/news/article/oyster\\_garden\\_reef\\_restoration/6883/](http://wkrg.com/news/article/oyster_garden_reef_restoration/6883/)

Herder, Tom. 2007. MBNEP oyster gardening program releases 63,000 juvenile oysters. Alabama Current Connections. Winter 2007-2008, Vol. II, Issue 4.

## A glimpse at 2008

In 2008, Dr. Richard Wallace, the director of the Auburn University Marine Extension and Research Center will be retiring. Dr. Wallace has been the guiding force for much of the research and outreach efforts at AUSL. His day to day involvement with AUSL will truly be

missed but we look forward to continuing to work with Dr. Wallace for years to come. AUSL also looks forward to the hiring of a new shellfish researcher in 2008. The search for this position will begin in early 2008 with a tentative start date of January 2009.

Though the field work for the dermo project wrapped up in 2007, reporting for this project will be finalized in early 2008. Analysis of the most recent results from F<sub>2</sub> generation oysters from the hypoxia-tolerance project will be reviewed to determine if further selection work is warranted. The field work for the project investigating the feasibility of clam culture is due to come to a close in late January 2008 with anticipated completion of the master's thesis for this project by summer 2008. Preliminary work in 2007 on depuration of *V. vulnificus* from oysters will lead to system enhancements and further in-depth analysis in 2008 by graduate student, Ryan Woods. Early in the year, graduate students will present the results from ongoing research at AUSL at local and national meetings.

AUSL will continue to support the MBNEP Oyster Gardening Project through oyster production, personnel involvement, and contribution of oysters for planting from excess production. The MBNEP hopes to increase the number of volunteers participating in the program by expanding the participation area in Mobile Bay and opening the program to the Orange Beach area of Baldwin County. Volunteer numbers are also expected to increase as more past participants re-enter the program after recovering from recent hurricanes.

AUSL will continue to look for ways to increase hatchery production to meet the ever-increasing demand for shellfish. We anticipate that the city of Fort Walton Beach, Florida will be requesting a large number of oysters as they establish an oyster gardening program in their area. We also have lined up shellfish orders for a variety of Auburn University projects as well as for researchers at the Dauphin Island Sea Lab.

Dr. Hugh Hammer from Gasden State University will be back at DISL this summer to teach Marine Aquaculture. AUSL plans to assist Dr. Hammer with guest lectures and facility

use as part of this course. As in past years, we anticipate providing lectures on shellfish production and facility tours to a variety of groups visiting AUSL including our yearly commitment to the Discovery Hall program and the REU program at DISL. The coming year looks to be another action packed year that will require a lot of cooperation and maybe a little dose of imagination!

## Acknowledgements

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