“If you wish to advance into the infinite, explore the finite in all directions.”

— Johann Wolfgang von Goethe
2008 Highlights

Projects

- Completed final report for a project investigating aspects of Perkinsus marinus (Dermo disease) infection related to oyster reef restoration.
- Conducted a pilot study investigating a more efficient protocol for the use of algae paste in feeding oyster larvae.
- Completed a project investigating the feasibility of clam culture in coastal Alabama waters.
- Continued to evaluate an oyster depuration system to reduce or eliminate Vibrio vulnificus bacteria.
- Produced oysters for Mobile Bay Oyster Gardening Program and city of Fort Walton Oyster Gardening Program.
- Donated 23,000 oysters to the Mississippi Department of Marine Resources. Donations are also planned for Alabama waters in January 2009.
- Supported three graduate students and their research projects.
- Provided summer internships for a high school student selected from Alma Bryant High School’s aquaculture program and an Auburn University undergraduate student from the Marine Biology program.
- Provided oyster larvae, oyster seed, or adult oysters to seven researchers at two institutions, two educational entities, the Seafood Branch of the Mobile County Health Department, and one private industry partner.
- Research conducted at AUSL or Auburn research conducted with AUSL support was presented at the Alabama Fisheries Association Annual Meeting, the World Aquaculture Society Annual Meeting and the American Society for Microbiology General Meeting.
- Housed and reared “refugee” oyster spat from Louisiana in the wake of Hurricane Gustav.

Production

- Produced over 22 million larvae. Of those, 9.24 million were used in a larval feed study, 2.72 million were delivered as larvae, 3.83 million were set to produce single oysters, and 6.21 million were set on whole shell.
- Distributed 160 bags of spat set on whole shell for Oyster Gardening projects, over 4000 single oysters for research projects, and over 24,000 single oysters for restoration.
- Maintained 14 discrete groups of adult and juvenile oysters in Mobile Bay for use as broodstock and research animals.

Facilities

- Expanded adjustable longline apparatus for growout and maintenance of adult and juvenile oysters under the Dauphin Island Sea Lab (DISL) boat dock.

Tours and Meeting

- Hosted 226 people from 9 groups through facility tours, lectures, and use of conference facilities.
Introduction

The Auburn University Shellfish Laboratory (AUSL) is always looking for ways to expand the scope of research capabilities and the people and projects we support through hatchery operations. In 2008, AUSL supported numerous research projects here in Alabama and also spread its support to our neighboring states by providing oysters for a new oyster gardening program in Fort Walton, Florida, by donating oysters to the Mississippi Department of Marine Resources to aid in recovery of oyster population in coastal waters, and by accepting “refugee” oysters from a hatchery in Louisiana that was rendered inoperable by Hurricane Gustav. AUSL will continue look for ways to expand its horizons to meet the needs of shellfish research, production, and outreach.

The past year also saw the retirement of Dr. Rick Wallace, who 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 in the future in his new role of Professor Emeritus. And we anticipate new faculty member Dr. Bill Walton joining us here at AUSL in 2009 with new ideas for shellfish research and extension.

In 2008, AUSL supported multiple research projects, the research of several graduate students, and other institutions, researchers, and agencies with shellfish products. AUSL continued its outreach and instructional activities by providing facility tours and lectures on shellfish research and production to a variety of groups.
Projects

Dermo Disease

A final report was completed in 2008 for a two-year (Aug. 2005 – Aug. 2007) field study investigating the influence of *Perkinsus marinus* prevalence and infection intensity on oyster population size structure and mortality rates at six established harvested reef sites and six unharvested reef sites in Mobile Bay, Alabama. Oyster population size structure was analyzed from oysters collected semi-annually from five 1m² samples at each reef site. Prevalence and infection intensity of *P. marinus* was determined from 5 oysters collected from the same sample area at each collection. Mortality was monitored monthly with replicate bags of natural reef oysters deployed at each site.

Throughout the study, all size classes of oysters on unharvested reefs had consistently higher densities than harvested reefs. Oyster populations on both harvested and unharvested reefs experienced notable shifts in size structure over the two year period. These shifts in size structure were attributed to several factors including recruitment, harvesting,
and mortality associated with disease and predation (Fig. 1). Prevalence of *P. marinus* in the natural population was not significantly different between reef types but infection intensity was significantly higher on unharvested reefs during four of the five sampling periods (Fig. 2). There was a significant effect of reef type on the mortality of adult oysters held in the bag arrays that can be associated with *P. marinus* intensity. Drought conditions established in late 2005 that persisted through the end of the study in August of 2007 led to an increase in salinity and provided optimal conditions for the oyster drill, *Stramonita haemastoma*. The increased numbers of oyster drills also played a significant role in the population densities and size class distribution of oysters on both reef types.

**Figure 2.** Comparison of *Perkinsus marinus* infection intensity at harvested and unharvested sites. Paired bars indicated by * are significantly different.

Data suggest that in the absence of significant predation, oyster populations on unharvested reefs are sustained at high density levels where there is good recruitment, with only the largest oysters succumbing to *P. marinus* infection. Harvesting of the larger oysters may reduce *P. marinus* disease intensity but will also reduce available substrate for larval setting unless cultch material is added through regular shell planting programs.
Larval Feeding Protocol

In shellfish hatchery operations, production of microalgae to feed larvae can be labor-intensive and require significant equipment and space. In small-scale hatcheries this can be a significant expense. The use of commercially-available microalgae concentrates can be a cost savings to hatchery operations by alleviating the demands on staff, equipment, and space dedicated to microalgae production. The concentrates themselves can be expensive, necessitating efficient use. Microalgae are typically fed by cell counts, with the number of cells per milliliter of culture water increasing as larvae grow.

AUSL conducted a pilot study in the summer of 2008 to refine techniques for the efficient use of commercial microalgae concentrates. AUSL investigated feeding shellfish larvae based on a computed dry weight of microalgae concentrate as a percentage of total larval weight. Larval weight can be related to size to simplify calculations. It is hoped that this method will allow more efficient use of microalgae concentrates especially as larvae are harvested from culture systems, diminishing feed requirements. Plans are being formulated to continue this research and refine techniques in the 2009 spawning season.
**Clam Culture**

Graduate student Jonathan Jackson received a Master of Science degree in 2008 upon completion of his research on the potential for hard clam, Mercenaria *mercenaria*, aquaculture in the coastal waters of Alabama. The biological and production feasibilities of clam culture were analyzed using two bivalve grow-out systems. Clams were stocked into mesh bags in a belt system placed on the bottom, and in bags suspended from an adjustable long-line system. Four stocking densities, 188/m², 375/m², 750/m², and 938/m², were analyzed for each culture system.

The mesh bags placed on the bottom allowed clams to burrow into the sediment as they would naturally. The clams in the adjustable long-line system were suspended in the water column approximately 0.5 m from the bottom. Over a period of five months clams in the belt system showed a 25.0% increase in size with 42.6% survival compared to only a 14.6% increase in size for clams in the long-line system with a 24.3% survival.

Further research to investigate more traditional bottom culture methods will be needed before ruling out clam culture in coastal Alabama waters. This project was conducted by Mr. Jackson under the direction of his major professor, Dr. LaDon Swann (AUSL and Mississippi/Alabama Seagrant Consortium).

**Depuration of *Vibrio vulnificus* in oysters**

A depuration system was developed at AUSL in 2006 to standardize *Vibrio vulnificus* levels in oysters but showed the potential to eliminate the bacteria. *Vibrio vulnificus* is a
human health concern associated with the consumption of raw shellfish. Dr. Cova Arias obtained a provisional patent for the system in 2007 and with the assistance of PhD candidate Ryan Wood began to standardize procedures for analysis of the system’s potential for eliminating *Vibrio* bacteria. The preliminary results were encouraging and suggested the system merited further analysis. Graduate student Matt Lewis has joined the project in 2008 and continued to develop the sampling protocol with the goal of more intense investigation of the system in 2009.

Preliminary results indicate the system is capable of significantly reducing *V. vulnificus* levels in oysters. System parameters of particular interest are oyster residence time in the system, handling prior to depuration, initial bacterial loads, flow rates, and salinities.

**Oyster Gardening**

AUSL is proud to have supported the Mobile Bay Oyster Gardening Program in cooperation with the Auburn University Marine Extension and Research Center (AUMERC) and the Mobile Bay National Estuary Program (MBNEP) since its inception in 2001. The program has restored over 370,000 oysters to reefs in Mobile Bay in the last eight 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 2008, AUSL provided 80 bags of spat set on whole shell for the project. Forty volunteers raised and returned 59,000 oysters for restoration to reefs in Mobile Bay. AUSL was also able to help the city of Fort Walton, Florida initiate its own oyster gardening program by providing 80 bags of spat set on whole shell.

Figure 5. Volunteers checking oysters in cages in the inaugural year of oyster gardening in Fort Walton, Florida.

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 Alex Mayfield. Mr. Mayfield will graduate in the spring of 2009 from ABHS. AUSL plans to continue providing this summer internship in support of the ABHS aquaculture program.

This year AUSL also provided a summer internship for Auburn University marine biology student Mike Bolger. Mr. Bolger worked alongside AUSL personnel to gain experience in shellfish production and research. He also completed a directed research
project investigating the use of a spawning funnel for egg production of *Fundulus* minnows to broaden his experience.

**Helping Industry**

AUSL donated 23,000 single oysters to the Mississippi Department of Marine Resources in November of 2008. The oysters were reared in AUSL’s adjustable longline system and represented excess production from the 2007 and 2008 spawning seasons. Sizes of the oysters ranged from 15mm up to large adult oysters. The oysters were loaded aboard the Mississippi Department of Marine Resources vessel “Reef Keeper” and transported to Biloxi Bay for planting. The donation was made to aid oyster reef recovery efforts in the wake of the Hurricane Katrina in 2005. AUSL plans similar plantings in early 2009 on Alabama oyster reefs that have been decimated by oyster drills flourishing in high salinity conditions brought about by the drought that has persisted since 2006.

AUSL again used the resources of local shellfish producer Roberson Seafood. Owner Michael Roberson has continued to provide AUSL with several batches of locally-harvested oysters to use in the *Vibrio* depuration system and also provided some unique broodstock from Portersville bay to expand AUSL’s breeding lines. In exchange for his assistance, AUSL provided single oysters for planting on private leases owned by Roberson Seafood.

**Assisting Other Researchers**

Over the last five 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 to examine the anatomy of neuronal circuitry. The research is focused on the
structure and possible function of the larva’s apical sensory ganglion. These larvae have also been used in the development of monoclonal antibodies to further aid in this research. In 2008, AUSL provided Dr. Kempf with two shipments totaling 2.72 million oyster larvae.

AUSL was able to support graduate student Mac Martin from the Geology Department, who periodically used AUSL as a base of operations while working in Bayou La Batre with the Alabama Working Waterfronts Coalition. The goal of the Working Waterfronts Coalition is to promote maintaining a sustainable working waterfront.

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 2008 for projects with Dr. Ruth Carmichael. Dr. Carmichael’s research centers on marine ecosystem responses. She is directing the research of two graduate students using AUSL oysters for their thesis research. Graduate student Heather Patterson used 950 AUSL oysters for her research investigating hypoxia effects on oysters in both lab and field settings. Stable isotope analysis and biochemical techniques are being used to discern stress responses, and several tissue types are being analyzed for stress response. Graduate student Peter Biancani received 1070 AUSL oysters for research investigating the effects of waste water treatment plant effluent on oysters and how those effects varied with distance from water treatment plant outfalls.

AUSL provided 130 oysters of varying sizes to Dr. Tina Miller-Way with DISL. The oysters were to be embedded in acrylic to be used as a teaching aid in DISL’s K-12 Discovery Hall Program.

The Seafood Branch of the Mobile County Health Department received 24 large adult oysters from AUSL. These oysters were used in the Departments red tide sampling program.

Dr. John Supan’s Louisiana Seagrant oyster hatchery on Grand Isle suffered serious damage from Hurricane Gustav. In the spirit of cooperation, AUSL was able to provide a
refuge for oyster spat from Dr. Supan's hatchery in the aftermath of the hurricane. AUSL
plans to work with Dr. Supan in 2009 on hatchery production of single oysters for his program
until he can return his hatchery to operation.

Production

Oyster Spawning

AUSL conducted two spawns on the following dates in 2008 for the stated projects or
purposes:

April 30  - Mobile Bay Oyster Gardening Program
          - Fort Walton Oyster Gardening Program
          - Single oyster production for stock maintenance

June 13  - Pilot algae paste feed study
          - Apical sensory ganglion function and development of monoclonal
            antibodies (Dr. Steve Kempf - Auburn University)
          - Single oyster production for stock maintenance

Oyster Larvae

The 2008 oyster spawns resulted in over 22 million larvae raised for the following
projects or purposes:

6.21 million  - Set on whole shell for:
              - Mobile Bay Oyster Gardening Program
              - Fort Walton Oyster Gardening Program

3.83 million  - Set on microculch for single oyster production for stock maintenance

9.24 million  - Pilot larval feed study

2.72 million  - Apical sensory ganglion function and development of monoclonal
              antibodies (Dr. Steve Kempf - Auburn University)
Oyster Seed

Oysters set on whole shell and microcultch were distributed for the following projects or purposes:

Spat set on whole shell
80 Bags - Approximately 120,000 spat set on whole shell (3-5mm) – Mobile Bay Oyster Gardening Program
80 Bags - Approximately 120,000 spat set on whole shell (3-5mm) – City of Fort Walton, Florida Oyster Gardening Program

Spat set on microcultch (Singles)
250,000 - Single oysters produced for stock maintenance

Large Oysters

In 2008 AUSL maintained 14 different stocks of oysters in suspended bags on a longline system under the DISL boat dock. Large oysters from maintained stocks were distributed for the following projects or purposes:

24 - Single adult oysters for red tide sampling – Mobile County Health Department, Seafood Branch
525 - Single adult oysters - USA Alabama Oyster Reef Restoration Program – Stable isotope and ecosystem response projects (Dr. Ruth Carmichael)
322 - Single adult oysters - *Vibrio vulnificus* depuration (Dr. Cova Arias; graduate students Ryan Woods and Matt Lewis)
1990 - Juvenile and adult single oysters – USA Alabama Oyster Reef Restoration Program – Stress response in oysters (Dr. Ruth Carmichael; graduate student Heather Patterson)
1070 - Juvenile and adult single oysters – USA Alabama Oyster Reef Restoration Program – Waste water effects on oysters (Dr. Ruth
Facilities

In April of 2007, AUSL established two adjustable longline systems under the DISL boat dock to hold AUSL oyster stocks. We expanded that capacity to 4 lines in 2008. At the end of 2008, the system held approximately 60,000 oysters.

The AUSL hatchery was reconfigured prior to the 2008 spawning season. A series of 180 gallon tanks were added to the larval rearing capacity of the facility. Spat rearing tanks were also reconfigured to better use all the hatchery space. These changes have greatly expanded the ability of the hatchery to produce oyster larvae and spat.

In 2007, beach erosion had caused the AUSL intake pipeline to become exposed at the beach/sea interface. Exposed above-water portions of the intake pipeline were secured with pilings. A beach renourishment project has since covered the pipelines. AUSL is considering more permanent solutions to the intake pipeline structure. In 2009, we will look
at a cooperative arrangement with DISL to install new pipelines to serve AUSL as well as a new mesocosm facility at DISL.

Air handling equipment for the HVAC systems at AUSL was originally located in the attic and has suffered from exposure to salt air in that unconditioned environment. The entire HVAC system is being overhauled and the air handlers are being moved into the conditioned space of the building. This work began in December 2008 and should be completed in early 2009.

**Instruction**

Dr. Hugh Hammer of Gadsen State University taught Marine Aquaculture in the summer of 2008. AUSL provided facility tours and guest lectures for his course. AUSL also provides instruction through facility tours and lectures as described below.

**Facility Tours and Lectures**

In 2008, AUSL provided tours and lectures to several groups.

- Dr. Rick Wallace and Bob Becker with AUMERC brought a group of nine Chinese nationals to AUSL for a facility tour on January 9th as a part of a tour of seafood and aquaculture facilities in the area.

- Twelve undergraduates from the University of West Florida toured AUSL on February 11th as part of an Introduction to Aquaculture course.

- The Alabama Association of County Agricultural Agents and Specialists held their 60th Annual Meeting and Professional Improvement Conference in Mobile. As part of the conference, seventy-six participants toured the AUSL facility.

- As part of the Marine Application of Science and Technology Workshop, DISL brought thirty-three individuals to AUSL for a tour of the facility on June 26th.
AUSL – ANNUAL REPORT 2008

- Fifteen teachers toured AUSL on July 15 as part of P. J. Water’s (AUMERC) aquaculture workshop.

- Eleven undergraduate students from the Dr. Hugh Hammer’s Marine Aquaculture course at DISL toured AUSL on July 16th.

- Scott Rikard with AUSL also provided a lecture on Bullminnow Aquiculture to the same Marine Aquaculture class on July 30th.

Publications

Publication regarding AUSL-related research in 2008:


Presentations

Presentations and published abstracts regarding AUSL-related research in 2008:


Media

Articles and news regarding AUSL or related research in 2008:


Glimpse at 2009

In 2009, AUSL will continue to support the oyster industry by donating a large number of oysters to be planted on Alabama oyster reefs for restoration and recovery purposes similar to those donated to Mississippi in late 2008. We hope that these efforts will help the
recovery of oyster reefs and oyster harvest that have been decimated by hurricanes, drought, and predators.

We will also be welcoming a new faculty member to AUSL and the Auburn family. Dr. Bill Walton will be a full-time faculty and extension presence at AUSL starting in January, 2009. Dr. Walton comes to us from Woods Hole Oceanographic Institution Sea Grant and Cape Cod Cooperative Extension in Massachusetts. We look forward to working with Dr. Walton and the new ideas for shellfish research and extension he will bring with him.

Research into the development of an oyster depuration system targeting *Vibrio vulnificus* will continue with Dr. Arias and her graduate students in 2009. There will also be a new research and extension initiative aimed at establishing oyster farming in Alabama as part of Dr. Walton’s focus. AUSL will continue to look for more shellfish restoration possibilities in the coastal waters of Alabama.

AUSL will continue to support the Mobile Bay Oyster Gardening Program through oyster production and personnel involvement. Plans for the program in the coming year include the development of an Master Oyster Gardener Program and potential expansion of the Oyster Gardening Program into other coastal waters of Alabama. AUSL will also produce oysters for the city of Fort Walton, Florida if they continue their oyster gardening program.

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, facility tours, 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 annual commitment to the Discovery Hall program and the MAST program at DISL.
Acknowledgements

The 2008 report was prepared by:

Scott Rikard,
Ag & Natural Resources Program Manager
Auburn University Shellfish Laboratory (AUSL)
150 Agassiz Street
Dauphin Island, Alabama 36528
Ph: (251) 861-3018
rikarfs@auburn.edu

Contributors:
Blan Page, Glen Chaplin, Phillip Waters (AUMERC), Dr. LaDon Swann (AUMERC, Mississippi-Alabama Sea Grant Consortium), Dr. Cova Arias (Auburn University, Department of Fisheries and Allied Aquaculture), Dr. Steven Kempf (Auburn University, Department of Biological Sciences), Dr. Ruth Carmichael (DISL) and students, Jonathan Jackson, Ryan Woods, Matt Lewis (Auburn University Department of Fisheries and Allied Aquaculture), Heather Patterson, Peter Biancami (DISL)

Thank you:
George Crozier and the faculty and staff of the Dauphin Island Sea Lab