Summary of the Northeast Regional Aquaculture Point of Contact 2009 Site Visits

David Alves
National Marine Fisheries Service
Northeast Regional Office
Gloucester, Massachusetts
&
NOAA Aquaculture Program

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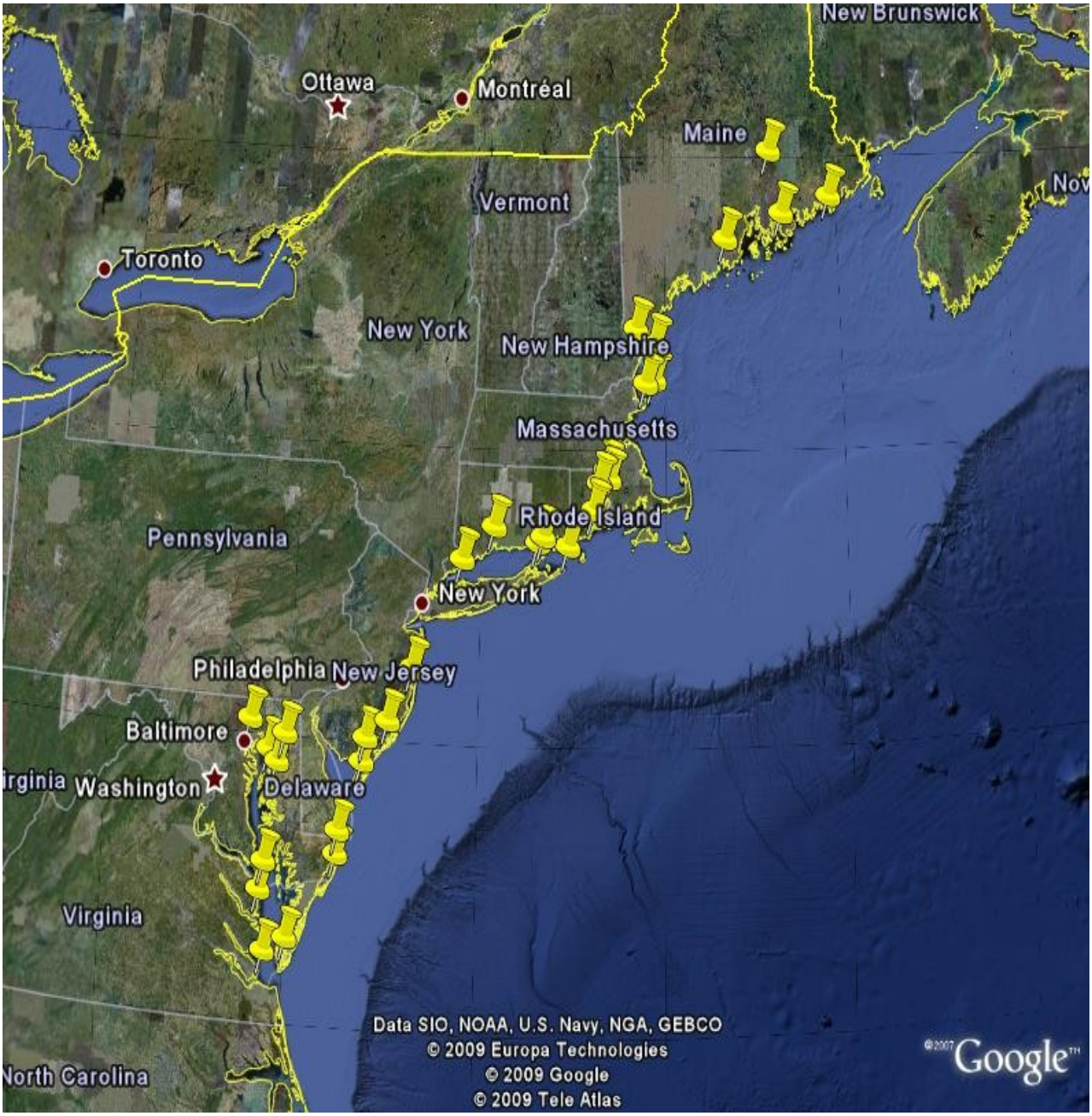


Map 1. This map shows the locations of the sites visited during 2009. They range from the University of Maine, Orono, Maine, the point furthest north; to The Virginia Institute of Marine Science, Gloucester Point, Virginia, the point furthest south. Please refer to site visit reports for specific locations visited.

Summary of the
NOAA Northeast Aquaculture Point of Contact
2009 Site Visits

By David Alves
NOAA Aquaculture Program and
NOAA Fisheries Northeast Regional Office

In 2009, the Northeast Regional Office (NER) of the National Marine Fisheries Service in conjunction with the NOAA Aquaculture Program supported a series of site visits by staff in the coastal states from Maine to Virginia. The purpose of these visits was to learn about all aspects of the region's marine aquaculture industry. In this context, 'the industry' includes commercial aquaculture companies as well as federal and state regulatory agencies, academic and private research facilities and extension contacts from NOAA Sea Grant and the U.S. Department of Agriculture.

Background

I came on board as the newly established NOAA Northeast Region's aquaculture point of contact in January 2009. My background includes aquaculture by way of a stint as Aquaculture Coordinator for the State of Rhode Island, working for a small biotech firm designing research systems for zebra fish and a period as the aquaculture extension person for a university. Of course, a short visit to the states in the region is only sufficient to give a flavor of the aquaculture industry in that state. I continue to plan more visits to meet people out in the field to keep up with ongoing developments in industry and research. I learned much on these visits, but a few things stand out. This summary will highlight those experiences.

Highlights of the Tour

To me, the most surprising aspect of the site visits conducted 2009 was the extent of the industry in the region. The range of culture from oysters, cod, urchins, halibut and other species in Maine to the wide extent of oyster culture in Virginia was eye opening. I had experience with the shellfish culture in southern New England but was unaware of the extent of activity in the rest of the region. In my personal travels along the coast you never even see many of the farms and remain unaware of the extent of the industry unless you are talking to some one with local knowledge of the industry.

For all intents and purposes, the industry has grown to this point while being under the radar of most federal regulators. Of course, the fact that all of the marine industry in the region is in state waters explains that. However all of the industry's growth has been reviewed at one point or another by federal regulators, i.e. the U.S. Army Corps of Engineers in consultation with NOAA's National Marine Fisheries Service, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and other agencies.

Note – the views and observations expressed in this summary are those of the author. They do not necessarily represent the views or official positions of the agency.

Another highlight of these visits was learning about the long history of aquaculture in the region. It is one thing to learn about the history of aquaculture in the world (first written work on aquaculture in 500 BC, etc.) and in the U.S. (first salmonid culture in the 1860's, etc.), but visiting a shellfish farm that was started in the 1880's in Connecticut, or a shellfish farm in Virginia that is owned by a seafood company that was established in the 1860's really made history come alive. It was clear that the people involved with aquaculture in this region are aware of their farms' and industry's history and are committed to keep them alive and going well into the future.

The people running the commercial operations I met on my travels were very open to having me visit their facilities and did not restrict my access in any way. Before I stared the tour, I was concerned that being visited by a government official would be considered an imposition. After all, commercial operators have a business to run. But, wherever I went, the farmers, lab directors, and others were more than willing to talk with me. Their insights on everything from business practices, to the market, to research challenges were valuable. After the visits, many of the commercial operators thanked me for taking the time to meet with them and learn about their facility. I appreciated that.

The people I met who were involved in the industry generally had a high level of education. Many of the folks I met had been to graduate school and then went into the business. It was not unusual to find a Ph.D. running a small farm. In the academic realm it was surprising how many of the researchers had business experience. They realized that the research they were conducting was ultimately directed at making the industry more competitive and economically viable.

As I look back over the year, I realized that these site visits were invaluable for me as a way to see firsthand the extent of the industry in the region, the jobs it provides, the research and technical innovations that grow out of it, and the seafood it produces. The visits also proved valuable to the agency since the information I gleaned from the tour enabled me to assist other divisions within my office and to increase the visibility of NOAA among those in the aquaculture industry. I think this kind of personal interaction is important especially since one of the focus areas for NOAA is to educate the public about the role of sustainable aquaculture in the U.S. seafood supply.

Quick Tour

A quick review of the 2009 site visits, in chronological order beginning in January, starts at a small educational facility in Gloucester, Massachusetts. This hatchery is operated by the Massachusetts Institute of Technology Sea Grant. This facility is quite small and at the time of my visit held a few winter flounder. The emphasis of the facility was education efforts in the local high schools.

In February 2009, I visited the Salem State College's Cat Cove Laboratory in Salem, Massachusetts. This lab conducts research in the Cape Ann area working with commercial lobster industry participants growing mussels, as well working with the towns on the North Shore in enhancement of clam beds and clam aquaculture. The principal investigators here are enthusiastic educators. The 2009 NER summer interns

made a trip to the lab and I was very impressed by the ability of the professor to engage the interns.

In March 2009, I visited the Great Bay Aquaculture marine finfish hatchery in Portsmouth, New Hampshire. This facility has been producing marine finfish juveniles since 1995. The company is also involved in cod grow-out in marine cages in Maine. The operator of the facility is very knowledgeable and it was an interesting discussion and tour. One major point is that the majority of the production from this facility is exported out of the country. The operator found it ironic that the expertise to raise the fish in his hatchery was in the US but since the industry is more advanced in other countries most of his production goes there.

In April 2009, I visited New Jersey. This trip provided some of my biggest surprises. I hadn't suspected there was as much aquaculture activity in the state as I found. It shouldn't have surprised me to find this; after all, there is a town named Bivalve where I found mountains of oyster shells and old wooden oyster boats still engaged in the fishery. But, I was still surprised. One interesting fact is that much of the aquaculture industry in the state is operated by folks from the commercial fishing industry who have made a transition to farming. In many other states there has been conflict between wild harvesters and aquaculture as the transition takes place. Later in the process many of the farms end up being started by progressive wild harvesters. As it was explained to me, they saw the decline of the wild harvest fishery coming and made the transition in order to stay employed.

In May 2009, I visited NOAA's Northeast Fisheries Science Center laboratory in Milford, Connecticut. Here I visited with researchers in the lab. The Milford lab was one of the pioneers in shellfish aquaculture starting in the 1930's and the effort continues today with world class researchers working here. The research conducted ranges from shellfish disease and physiology to ecosystem services and effects of aquaculture on the environment. Many shellfish culture innovations that allows us to culture shellfish today grew out of the research conducted there. This cutting edge research continues. I also visited the State of Connecticut Aquaculture Coordinator whose offices are in the same location.

In June 2009, I visited the State of Maine in the company of the NOAA Sea Grant Aquaculture Program Manager and the NOAA Aquaculture Program's Southeast Regional Aquaculture Coordinator. This was a 5-day tour that covered operations and facilities from Southern Maine to Downeast Maine to Central Maine. Maine has the most diverse and productive aquaculture industry on the East Coast and is supported by the state. Academic support for the industry is also very active here. The state university system supports a varied research program that works hand-in-glove with the industry on animal health, environmental effects, business incubation, new species cultured and more.

Later in June I visited Rhode Island. Although it's one of the smallest states in the country, Rhode Island has a significant aquaculture industry. Here we visited shellfish farms, a shellfish distribution facility, a shellfish farmer who was in the midst of opening a shellfish restaurant (as a side note since this visit, I have had a chance to eat at the restaurant, and the food was excellent), a university conducting investigations on shellfish and ornamental fishes, and a private company that was spun off from this research.

In September 2009, I made a visit to Maryland and Virginia. In the company of personnel from the NOAA Chesapeake Bay Office in Annapolis, Maryland, and the NOAA Aquaculture Program in Silver Spring, Maryland. For this tour we traveled from a marine biotech facility that cultures finfish and crabs in Baltimore, Maryland, across the Bay to a state hatchery in Maryland that produces 5 billion oyster larvae a year. Then we headed down the Eastern Shore to tour shellfish farms in Maryland and a clam farm in Virginia that sells 60 – 100 million hard clams a year into the national and international market. We continued back to the Western Shore of Virginia and visited a research hatchery at the Virginia Institute of Marine Science and continued up the shore visiting shellfish farms along the way. We ended up driving almost 600 miles and visiting 10 facilities. The stark contrast between the two states is amazing. Virginia has been leasing submerged lands in and around the Chesapeake Bay and its costal areas for decades for aquaculture and, as a result, has a vibrant industry which is growing. Historically, Maryland has not been open to private leasing and as a result there is almost no private shellfish aquaculture in its tidal waters. Wild populations of oysters in both states are at all time historic lows.

In November 2009, I visited Long Island, New York. The aquaculture industry here ranges from small boutique oyster farms to a large production facility located 25 miles from New York City. There is a dormant marine finfish farm on the eastern end of the north fork which is in the process of being revitalized. The farm was initiated in the mid 1990's, grew summer flounder for a few years, then when the economics did not work was mothballed. All of the equipment was removed from the water, but the leases were kept up. An underground shellfish hatchery rounds out the range of facilities I visited on Long Island. This hatchery was built in the 1950's and is certainly one-of-a-kind in my experience. The property is currently a preserve with the organization that operates it leasing the hatchery and associated infrastructure to a local shellfish culturist. The aquaculture industry is small but growing in this area.

All-in-all, it was an interesting series of site visits. I've learned a bit about the width and breadth of the marine aquaculture industry in the Northeast Region. I would say that's it's categorized by hard working, intelligent operators supported by first-rate researchers and supportive extension agents in each state. I was surprised at the amount of marine aquaculture that is in existence and the plans for expansion that are out there. It was not surprising that the people in the industry care deeply for the environment they work in. They want to keep the long rich aquaculture tradition going for the foreseeable future.

Map 2. This shows the location of the MIT Sea Grant Hatchery on the Harbor Loop in downtown Gloucester, MA. The facility is located in the basement of the Heritage Harbor Museum.

STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: **STATE:** Massachusetts **DATE: 2/4/09**

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: MIT Sea Grant fish hatchery

PERSONS CONTACTED: Sarah Olivio

ACCOMPLISHMENTS:

Massachusetts Institute of Technology (MIT) Sea Grant moved their fish hatchery from the Constitution Pier in Boston to the Heritage Harbor Museum in Gloucester 4-5 years ago. The facility is located in the back of the museum on the ground floor. Currently there is one part time employee. They are a few winter flounder in 3-4 tanks on one recirculation system. There is another recirculation system with another 4-5 tanks that is currently unused. They have some artemia and algal production tanks that are also currently unused. The general state of the facility is one of benign neglect by MIT Sea Grant.

The young woman who runs the facility is very enthusiastic and a go-getter, but has only been there a short while. When asked about the winter flounder there she stated they came from UNH, but didn't know whose lab they came from. The general focus of the effort seems to be education of elementary school students. The staff did not know of any plans MIT Sea Grant had for expansion into federal waters or any realistic research goals for this facility. The research program seems to be nonexistent. The staff member did state that during the summer there was a research program focused on feeding trials. This seems very unlikely considering the number of tanks available versus the reality that feeding trials need a large number of replicates to have any statistical power. It would seem that if there is any research being conducted it is geared towards engaging elementary students not towards any scientific research goals.

The Research Associate who built the facility and has been running the facility for the past 6-7 years has spent the summer out on maternity leave and has recently moved to upstate New York. She has continued working a few days a month on a part time basis. I suspect once she completely severs her ties to this facility it will die a quiet death.

Map 3. This shows the location of the Salem State College Cat Cove Laboratory in Salem Massachusetts. You can see the long shadows cast by the smoke stacks on the power point to the south of the lab.

STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: **STATE:** Massachusetts **DATE: 2/13/09**

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Salem State College, Cat Cove Marine Laboratory, Northeastern Massachusetts Aquaculture Center

PERSONS CONTACTED: Dr. Joseph Buttner

ACCOMPLISHMENTS:

The Northeastern Massachusetts Aquaculture Center is housed at the Cat Cove Laboratory in Salem Massachusetts (Picture 1). It is affiliated with the Biology Department at Salem State College. The site was part of the Massachusetts Division of Marine Fisheries until the college acquired it in 1995. The lab is situated on a tidal cove, Smith Pool, which has tidal flow controlled by a dam (Pictures 2, 3).

Picture 1. Cat Cove Marine Laboratory at Salem State College, Salem, Massachusetts.

Picture 2. Cat Cove Marine Laboratory; picture taken from dam showing hatchery, garage, auxiliary hatchery and dock to the right.

Picture 3. Dam across tidal cove; Smith Pool to left and Salem Sound proper to right

Between 1995-1997 the College renovated the lab adding an aquaculture system capable of hold organisms under various temperature and photoperiod regimes. There is the capability to hold both fresh and salt water organisms. Currently, the facility is holding various fishes and mollusks. There were summer flounder (*Paralichthys dentatus*), striped bass (*Morone saxitis*), tilapia (*Oreochromis nilotica*), trout (*Onchorynchus mykis*),

hard clams (*Mercenaria mercenaria*) and softshell clams (*Mya arenaria*) being held on the day of my visit (also blue mussels (*Mytilus edulis*) and American oysters (*Crassostrea virginica*). In excess of 16 million softshell clams have been spawned, grown and released to two dozen communities in Massachusetts, from Cape Ann to Cape Cod and the Islands. The facility has the capability to raise algae for mollusk culture (Picture 4). Tanks are used to culture both finfish and shellfish (Pictures 5-8).

Picture 4. Dr. Buttner with algal cultures.

Picture 5. Dr. Buttner showing juvenile softshell clams being cultured.

Picture 6. Culture tanks used for shellfish production.

Picture 7. A separate room of culture tanks for finfish.

Picture 8. Juvenile clams being cultured in downweller silos.

The lab has conducted projects in conjunction with the Massachusetts Division of Marine Fisheries, the Northeastern Regional Aquaculture Center. Researchers here have been successful in grant competitions. They have recently (2007-2008) been working with the fishing community around Cape Ann Massachusetts experimenting with mussel culture (please see attached newsletter). Since 2006 the lab has been working with the Massachusetts Division of Marine Fisheries to enhance soft shell clam populations in Boston Harbor (Towns of Hingham, Hull, Quincy, Winthrop and Weymouth). Previous studies include experiments working with participants in the lobster fishery to determine if oysters could be a profitable addition to their fishing activity, various hard and soft clam aquaculture experiments in the northeastern Massachusetts area, and published studies on marine finfish (e.g., striped bass, summer flounder, red hake, *Urophycus chus*).

The lab is well set up for small scale experiments or holding of fishes. The main focus of the lab is teaching, but experiments can be conducted with the help of student participation, which is a plus for the students and the investigators. Lab Co-director, Dr. Joseph Buttner, expressed willingness to work with NOAA fisheries in whatever capacity that will further common interests. The lab does have space in the Smith Pool to conduct small scale experiments (Picture 9).

In conclusion, there is a core of competent researchers with connections to other researchers' through-out the New England area, coupled with enthusiastic student participation and suitable laboratory space.

Picture 9. Small scale clam experiment being conducted in the cove.

NEMAC NEWS

Salem State College
Educating you for life

Northeastern Massachusetts Aquaculture Center
Salem State College/Department of Biology
Salem, Massachusetts 01970

Volume 10 (1) FALL 2008

NEMAC personnel spent much of 2007-2008 mussels around the coastal waters off Cape Ann. They installed and deployed mussels on experimental long-line set-ups off Cape Ann to evaluate the potential for growing blue mussels (*Mytilus edulis*) in nearshore waters.

Dr. Mark Fregeau readies floats and buoys for deployment.

Mussel seed (mean size 6.2mm) was collected and stocked onto six dropper lines. Each line was 2m long and stocked at a density of ~ 1000 mussels/m using standard cotton socking and core "fuzzy" rope. In July 2006, these lines were deployed in 10 m of water off Hodgkins Cove in Gloucester. Lines were suspended from floats 6 m below the surface to avoid interfering with boat traffic. The set-up was designed to keep mussel lines 5m off the bottom to limit exposure to potential predators, especially crabs and sea stars. Mussels were monitored monthly for a period of 15 months. Inspections were conducted by divers and video recordings.

Monitoring of mussels documented good growth and survival.

Mussels survived and grew well, attaining a mean size of 61.1 mm during the 15 month study. In 2007-2008, juvenile mussels were again deployed off Hodgkins Cove and at a second, deep water location, in Rockport. On-going monitoring has confirmed the good survival and rapid growth observed for mussels stocked in 2006. Efficacy of long-line, mussel culture was shared with North Shore fishers on 18 June 2008 at a hands-on workshop, by Dr. Fregeau and Francois Bourque, from Quebec.

Francois Bourque, Evan Parker and Tony Marzuski (L to R) visit mussel culture site off Gloucester.

Collaborative efforts between NEMAC and the Massachusetts Division of Marine Fisheries to restore and enhance softshell clams in Boston Harbor continue. Since 2006, over 2.5 million clams have been spawned and grown to a suitable size (preferably ≥ 10

mm Shell Length) at the Cat Cove Marine Laboratory for release at selected sites approved by DMF personnel and Town officials in Hingham, Hull, Quincy, Weymouth and Winthrop. Survival and growth of stocked clams has been good, but perhaps more germane, reproduction and recruitment of clams has been enhanced. Stocked clams, protected by predator exclusion netting, apparently function as a broodstock reservoir that can reseed tidal flats (figure 1). Note the bimodal distribution of clams collected from Snake Island in Winthrop; individual clams less than 25mm SL represent natural recruitment and a 10-fold increased density (from 0.41 clams/ft^2 to 4.43 clams/ft^2). Monitoring will continue to assess how increased juvenile survival translates into adult survival.

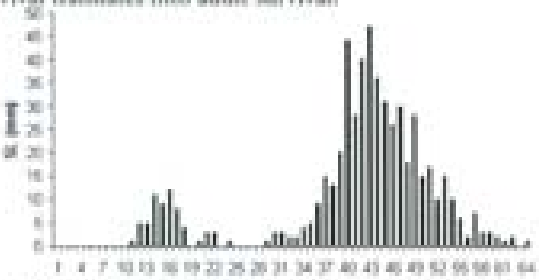


Figure 1. Size distribution of clams (n = 561) from Snake Island in Winthrop sampled on 3 June 2008; clams (avg = 11.3; SD = 1.4 mm SL) were stocked on 1 July 2007.

Educational offerings at the Cat Cove Marine Laboratory expanded during the 2007-2008 academic year. In fall 2007, nine students gained a hands-on and practical introduction to aquaculture through *Introduction to Aquaculture* (Bio 203) and *Aquaculture Methods* (BIO 205). In spring 2008, 13 aspiring aquatic scientists enrolled in *Fish Biology* (Bio 323). Drs. Alan Young and Joe Buttner co-instructed *Estuarine Ecology* (BIO 706), which has been offered on alternate years as a summer institute since 2003. Eight local teachers participated in the summer experience.

Scott Bachen, Marsha Turin, Mary Hinkson, KristHarrison and Steve Grace (l to r) monitor water quality from brackish portion of Forest River as part of their experience in Estuarine Ecology.

Aquatic experiences were also shared directly with local youth; two high school students with vocational aspirations in marine biology, Christine Francios and Grant Kokernak, worked at the Cat Cove Marine Laboratory. Christine was an intern from Girls Inc. in Lynn, MA. Grant, a senior at Berwick Academy in NH, earned college credit for his experience. *Explorations in Biology* (BIO 137) is a variable credit course developed and offered for nontraditional students interested in obtaining a focused experience in biology. In addition, several dozen youth "got wet" at the Cat Cove Marine Laboratory as they learned about marine biology by doing "marine biology" as part of several locally sponsored summer programs.

High school students participating in Northeastern University's Coastal Science Ocean Academy beach seine Smith Pool, adjacent the Cat Cove Marine Laboratory.

In summer 2007 an auxiliary laboratory was added; this summer realized installation of an access ramp. Collectively, the new lab and ramp greatly facilitate production of softshell clams grown at the Cat Cove Marine Laboratory. Nearly 4 million clams were spawned and settled this year.

Dr. Joe (L) and Grant Kokernak traverse the newly installed ramp to FLUPSY in Smith Pool, located below and behind the auxiliary lab used to grow clams from 0.5 to 2.0 mm SL.

Student Perspective by Dana Monteira

I began my college career in the fall of 2005 as an Environmental Science major at the University of Vermont. Unfortunately, my educational expectations and needs weren't realized and out-of-state tuition had skyrocketed. During my sophomore year I decided to take some time off and left UVM.

I worked full-time delivering pizza. I didn't want to do that for the rest of my life, so I started looking at colleges around my hometown of Stoneham. Knowing that I had an interest in marine biology, a close friend of mine, who was also a student at Salem State College, suggested that I check out the biology program at SSC. After a quick look, I immediately knew that I wanted to go here. I completed my application that day and began taking classes in the fall of 2007.

Dana assists condition of a female dogfish shark.

My first semester at Salem State was far different than my experience at UVM. Although it took me a few weeks to readjust to college life, I knew that I had made the right decision. With smaller classes, friendly and accessible professors, I looked forward to getting up every morning and going to class. During my second semester, I decided to take Fish Biology, taught by Dr. Joe at the Cat Cove Marine Laboratory. After a few weeks, Dr. Joe offered me a summer job at the Lab, which I gladly accepted.

Working at the Lab has provided invaluable hands-on experience. I gained more knowledge about marine biology and aquaculture than I could inside a classroom. At the lab, I monitor water quality, care for fresh and salt water fish, grow algae and assist in the culture of soft-shell clams. In the field, I help monitor growth of soft-shell clams at several locations in Boston Harbor. The work that I do at Cat Cove gives me tools needed to further my career in marine biology; working also enhances my college experience and gives me the opportunity to positively impact our coastal ecosystem.

Cat Cove Alumni

Cat Cove Alumni report good news Jamie Coffran (2004) relocated from Vermont to the Upper Peninsula of Michigan, still growing salmonids in a federal hatchery. **Mac Taylor** (2007) has completed her first year as a M.Sc. student at Nova Southeastern University in Florida and reports her first peer reviewed publication is in press. **Matt Lotti** (2007) is pursuing a M.Sc. at the University of Rhode Island, receiving financial support as a Teaching Assistant. **Veronica Wade** (2008) writes us from Africa, where she and other SSC alumni spent the summer working in the bush where they encountered hyenas, a herd of 30 elephants and a recent leopard kill; all in one week!

Mac Taylor (B.Sc. 07) moments before her first open water dive

A BIG thank you to our summer crew, without whose assistance NEMAC would be unable to function at the capacity realized over the last half decade.

Photo on left.
NEMAC summer 2008 crew (L-R): Dana Monteiro, Ted Maney, Ashley London, Scott Wixon, Heather Tierney, Mark Pregan, Christine Fiancois, Dr. Joe, Julie Greenwood (& so is). Not pictured is Grant Kobernuh.

Professional contributions take many forms including publications, professional and technical presentations. During the 2007-2008 academic year nearly a dozen presentations were made by Laboratory personnel before varied audiences. Recent publications and reports include:

Buttner, J.K. K.G. Pikos (**student**), and D. Leavitt. 2007. Augmenting the Lobster Catch: Oyster Aquaculture in Modified Lobster Traps. World Aquaculture 38 (3): 26-29.

Buttner, J.K., W. Burts, W. Walton, B. Wilbur, C. Hollingsworth, D. Murphy, and C. Gooley. 2007. Aquaculture Situation and Outlook Report 2007: Massachusetts. Northeastern Regional Aquaculture Center No. 103-2007, University of Maryland, College Park, MD. 11pp.

Webster, D., J. Buttner, and G. Flimlin. 2008. Planning for Success in Your Aquaculture Business. NRAC Publication No. 101-2008, University of Maryland, College Park. 8 pp.

Buttner, J., G. Flimlin, D. Webster. 2008. Freshwater Aquaculture Species for Northeast. NARC Publication No. 102-2008, University of Maryland, College Park. 7 pp.

Buttner, J., G. Flimlin, and D. Webster. 2008. Marine Aquaculture Species for the Northeast. NRAC Publication No. 1003-2008, University of Maryland, College Park. 6 pp.

Flimlin, G., J. Buttner, and D. Webster. 2008. Aquaculture Systems for the Northeast. NRAC Publication No. 104-2008, University of Maryland, College Park. 7 pp.

Fregan, M., J.K. Buttner and S. Wixon. Potential Commercial and Ecological Benefits of Mussel Culture in Coastal Waters. Journal of Shellfish Biology. 27(4):949-950.

Getchis, T., D. Alves, R. Barnaby, C. Bartley, W. Burt, J. Buttner and 24 others. Northeast Aquaculture Extension Network. Journal of Shellfish Biology. 27(4):951-952.

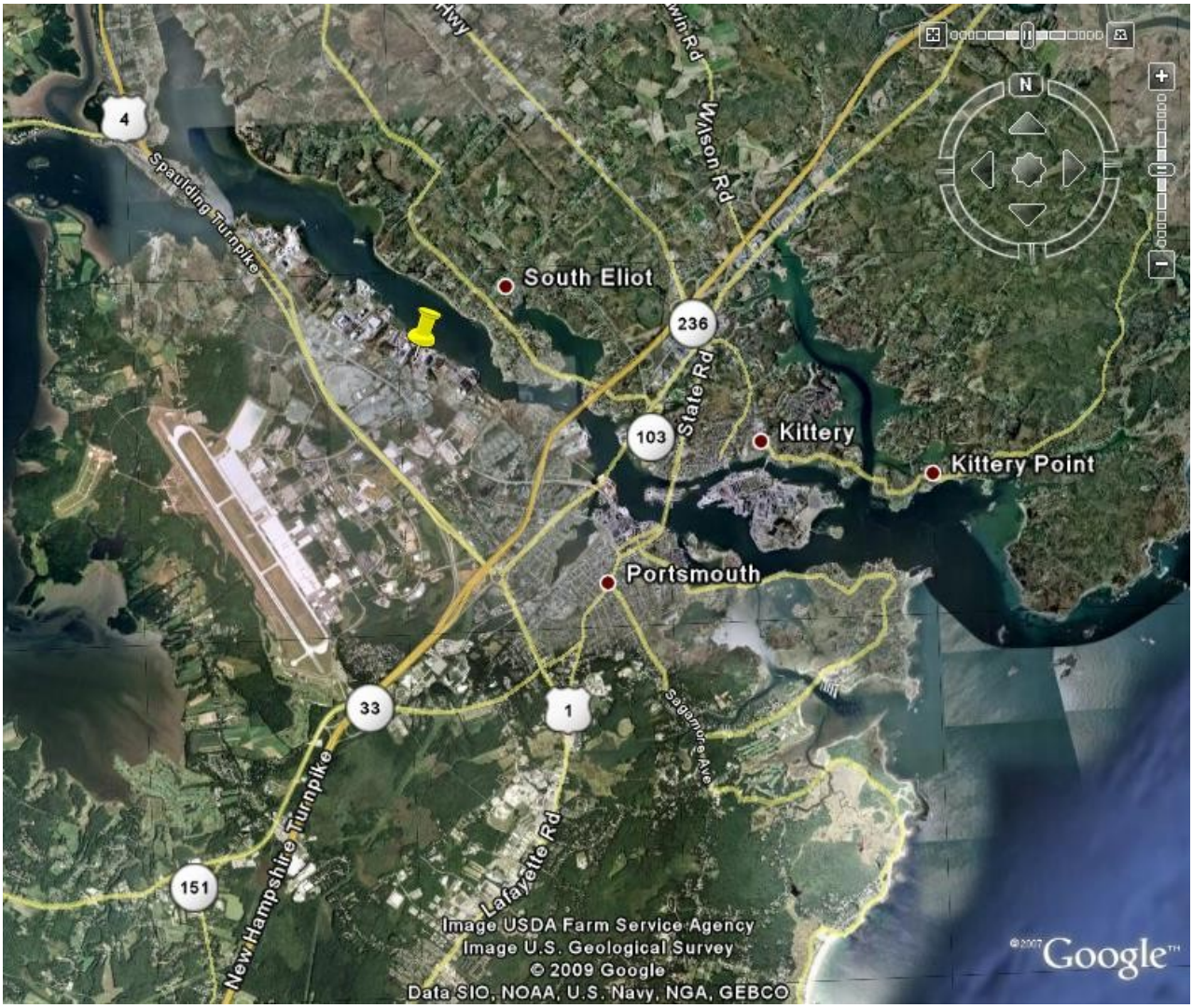
Buttner, J.K. G. Kurz. Hawaiian Culture and Aquaculture. Journal of Shellfish Biology. 27 (4):945-946.

Calendar

3-5 December 2008 Northeast Aquaculture Conference and Exposition, Portland, ME. (contact: Dana Morse, dana.morse@maine.edu, 207-563-3146; www.northeastaquaculture.org)

23-25 February 2009. 29th Milford Shellfish Seminar, Meridan, CT. (contact: Walter Blogoslawski, walter.blogoslawski@noaa.gov, 203-883-6535; mi.nefsc.noaa.gov/seminarworkshop)

NEMAC News is published by the Northeastern Massachusetts Aquaculture Center, housed at the Cat Cove Marine Laboratory operated by Salem State College. The Cat Cove Marine Laboratory physically includes a 5,500 ft² laboratory and an 8 acre, tidal pool, Smith Pool. For more information regarding aquaculture initiatives by NEMAC and Salem State College or to be added to our Newsletter mailing list contact the Cat Cove Marine Laboratory at 978-542-6824 or Dr. Joe (jbuttner@salemstate.edu) or Dr. Fregan (mfregan@salemstate.edu) or visit our website www.salemstate.edu/biology/aquaculture.



Map 4. This map shows the location of the Great Bay Aquaculture marine finfish hatchery. The facility is located on the grounds of the Public Service Company of New Hampshire electric generating plant. Water for both facilities is taken from the Piscataqua River.

STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: **STATE:** New Hampshire **DATE:** 3/24/09

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Great Bay Aquaculture hatchery

PERSONS CONTACTED: George Nardi

ACCOMPLISHMENTS:

On March 24th I visited the Great bay Aquaculture facility in Portsmouth N.H. The facility is located on a Public Service Company of New Hampshire (PSCNH) generation facility in Newington, New Hampshire. The facility was established in 1995 in an unused storage warehouse on the power company facility site.

Great Bay Aquaculture (GBA) produces summer flounder (*paralichthys dentatus*), cod (*Gadus morhua*), Black Sea Bass (*Centropristis striata*) and cobia (*Rachycentron canadum*). In the beginning the company was focus on land based culture and grow out of marine species. The lack of existing infrastructure, customers, led to a refocusing on sea based culture. Currently the company is self supporting without grant monies. It is interesting to note that as a result of the lack of existing aquaculture enterprises in the US 95% of all current production from the facility is exported.

Illustration 1: the Great Bay Aquaculture facility on PSCNH power company land. The office and a major portion of the hatchery is located in the building on the right. The greenhouse was utilized for a NOAA funded research project on using marine algae to filter effluent and then be made into marine fish feed. The building on the left houses the broodstock holding and conditioning systems. All systems are recirculating systems where the water is filtered and reused.

Illustration 2: summer flounder (*Paralichthys dentatus*) adults in a holding tank.

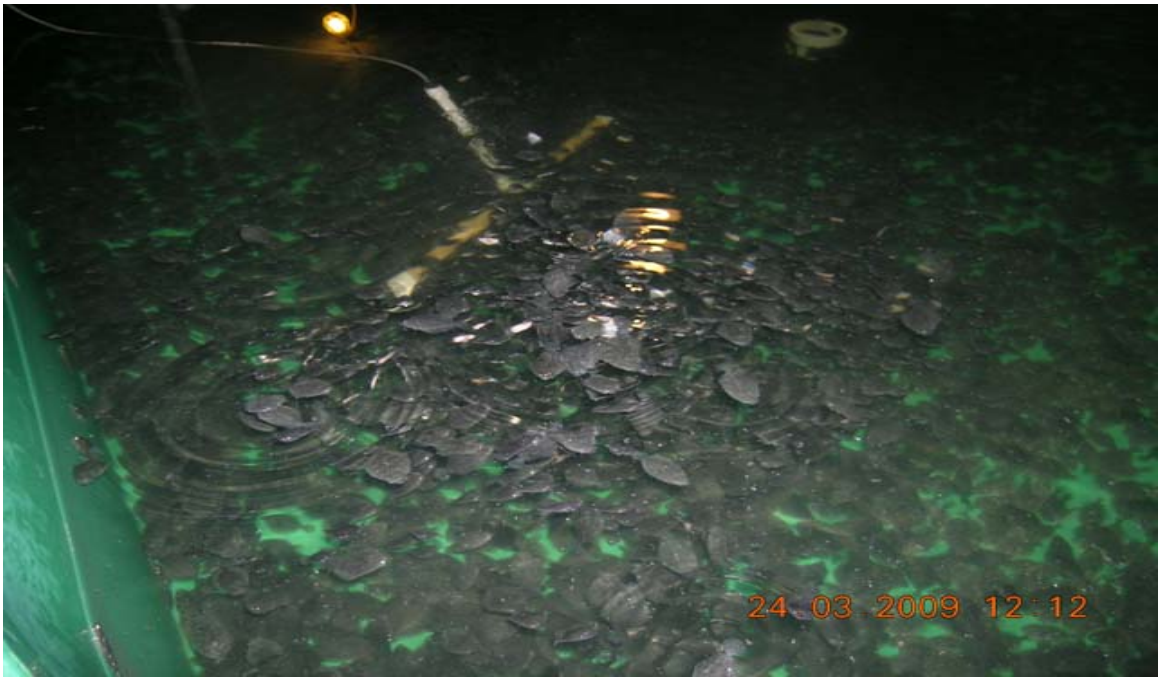


Illustration 3: summer flounder juveniles. These fish will be exported to Israel in the next few weeks.

Illustration 4: Cod (*Gadus morhua*) broodstock in a temperature and photoperiod controlled holding tank. The fish spawn freely once conditioned, fertilized eggs are captured in an egg catching device hung off the side of the tank.

Illustration 5: Cod (*Gadus morhua*) broodstock are used to humans and upon seeing any come up to look for food. These fish had just spawned in the preceding week.

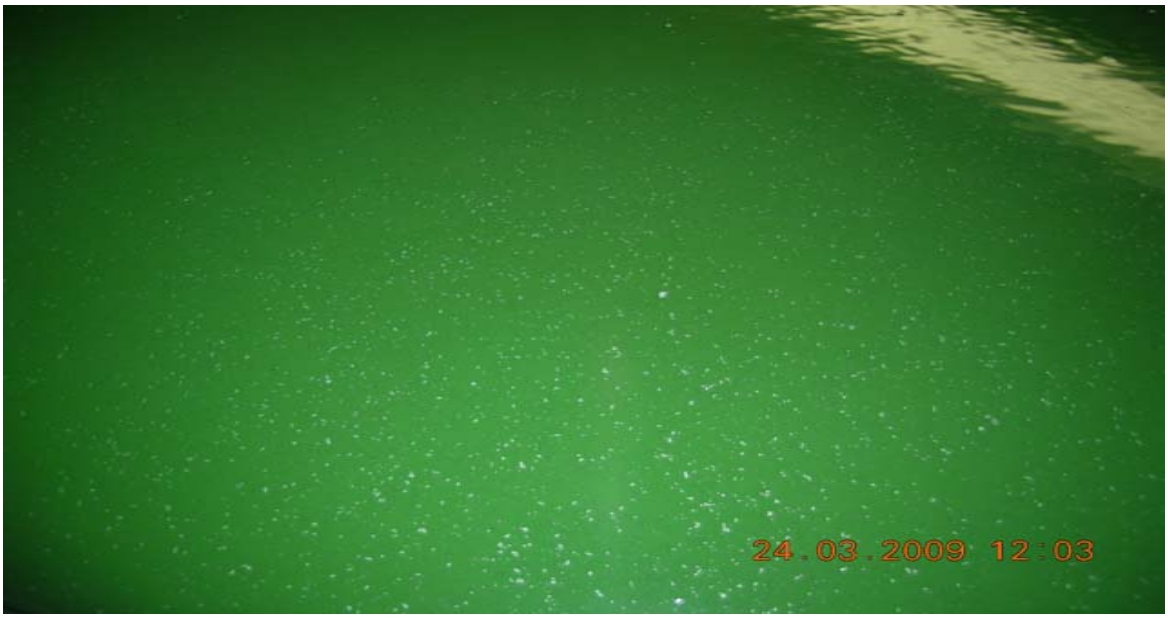


Illustration 6: Cod (*Gadus morhua*) larvae. Cultured in "green water" this tank is full of very difficult to see cod larvae. The larvae are fed rotifers at this stage. Later they will be weaned to a manufactured starter diet. These cod will be in the hatchery for 6-10 months and then in a net pen for two years before harvest.

Illustration 7: Black Sea Bass (*Centropristis striata*) juveniles. These fish are destined for a research project at UNH. The fish are being held in relatively cool water for them.

Illustration 8: Black Sea Bass (*Centropristis striata*) juveniles move about after feed is offered.

Illustration 9: These Black Sea Bass (*Centropristis striata*) juveniles are a larger cohort from the same spawn as those shown in illustration 7 & 8.

Illustration 10: the facility has a lab that is capable of performing the required testing and counting encountered in operating a marine fish hatchery.

Illustration 11: these are the rotifer (*Brachionus* spp.) culture tanks. Rotifers are cultured as a first feed for larval fishes. Rotifers are cultured using algae and enrichments to ensure complete nutrition for the larval fish.

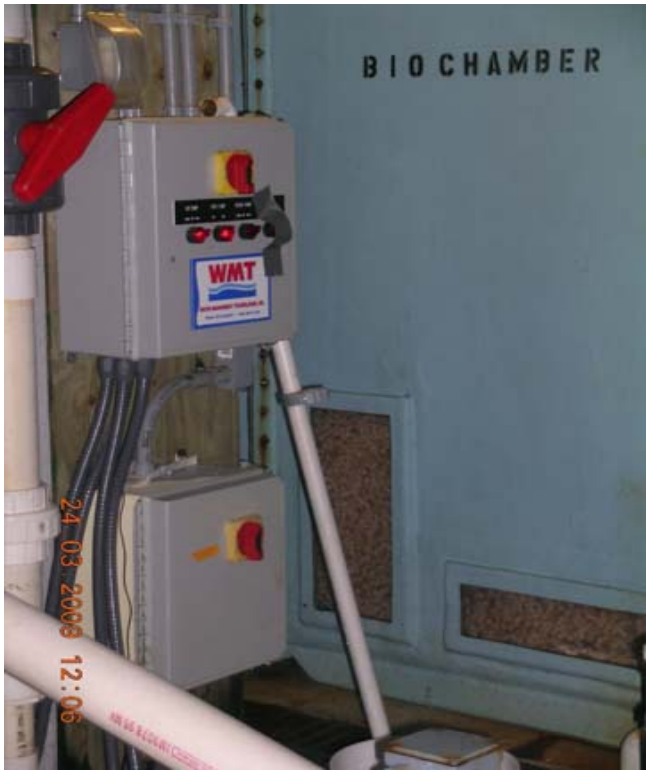


Illustration 12: part of the biofiltration system for the culture tanks. The small windows in the tank marked biochamber show the substrate for the bacteria (*Nitrosomonas* and *Nitrobacter* spp.) which convert ammonia wastes to nitrite and nitrate.

Illustration 13: the stripper strips gasses (nitrogen, CO2, etc) from the waste stream. A super saturation of gasses in the culture water would result in gas bubble symptoms in the larval fishes and reduce the O2 carrying capacity of the water.

Illustration 14: drum filters carry out the first step in the filtration process by removing the solid wastes from the filtration stream. The stream then goes to the biofilter before going through the gas stripper. The water then goes through UV filtration and oxygen injection before returning to the fish culture tanks.

Illustration 15: Liquid oxygen is stored on site to be injected into the culture water.

I sat down with Mr. George Nardi, co-founder of GBA and chief operating officer, for a wide ranging discussion on the history of GBA, their plans for the future and how the US can still be competitive in the international fish farming arena. GBA is currently looking at expansion into cod grow out in Maine to complement their hatchery operations.

The company currently has one net pen operation in the waters of Frenchman Bay near Sorrento Maine. The effort to expand into harvestable fish production is being carried out in a judicious manner without the need to raise venture capitol. There is currently an expansion of this facility under way. The first net pen with cod in it has been in operation for a year. Thus far the local communities have been supportive of the venture. The Maine Department of Marine Fisheries has been satisfied thus far with the operation of a cod grow out facility and is supportive of the industry as long as it is conducted on a sustainable basis. A local company in the region, Ocean Farm Technologies makers of the Aquapod, will be providing a small cage for the facility to test with in their grid. This type of submersible cage is suitable for off shore aquaculture. This addition will benefit the cage company, they will have a cage in use near by their company, and GBA will benefit by gaining experience with this type of equipment.

The issues currently under consideration are diseases and site availability. Site availability is always an issue in the crowed inshore waters of the northeast United States. However as the wild capture fishing industry continues to experience difficulties many communities and industry participants see aquaculture as a way to keep existing working waterfronts active in support of the communities they are located in.

Disease issues are always a concern in culture operations. The fish leaving the hatchery's controlled environment are healthy. The introduction of these fish to the open environment allows the transfer of disease from the environment to the relatively crowded conditions of the fish culture operation. There are currently two diseases of concern: atypical *furunculosis* and vibriosis, from *Listonella anguillarum*. There is a vaccine for this disease and so as long as the fish are vaccinated it should not be an issue. The second disease of concern is *Francisella philomiragia*. This is a bacterial disease that has been seen mostly in southern Norway. The current thinking is that because of the colder water found in Maine compared to southern Norway it won't be an issue. It is less of an issue in the cooler waters of northern Norway which have a temperature regime similar to Maine's. However the fish being cultured are being closely monitored for these diseases and others know to occur in fish. Currently there a project proposed to catalog the possible diseases found in the environment that might affect cod culture.

Currently the large pharmaceutical companies do not see cod as a large enough market to invest research into. Currently there is about 14,000 MT of cod harvested a year in Norway, with small amounts being cultured in the remainder of the world.

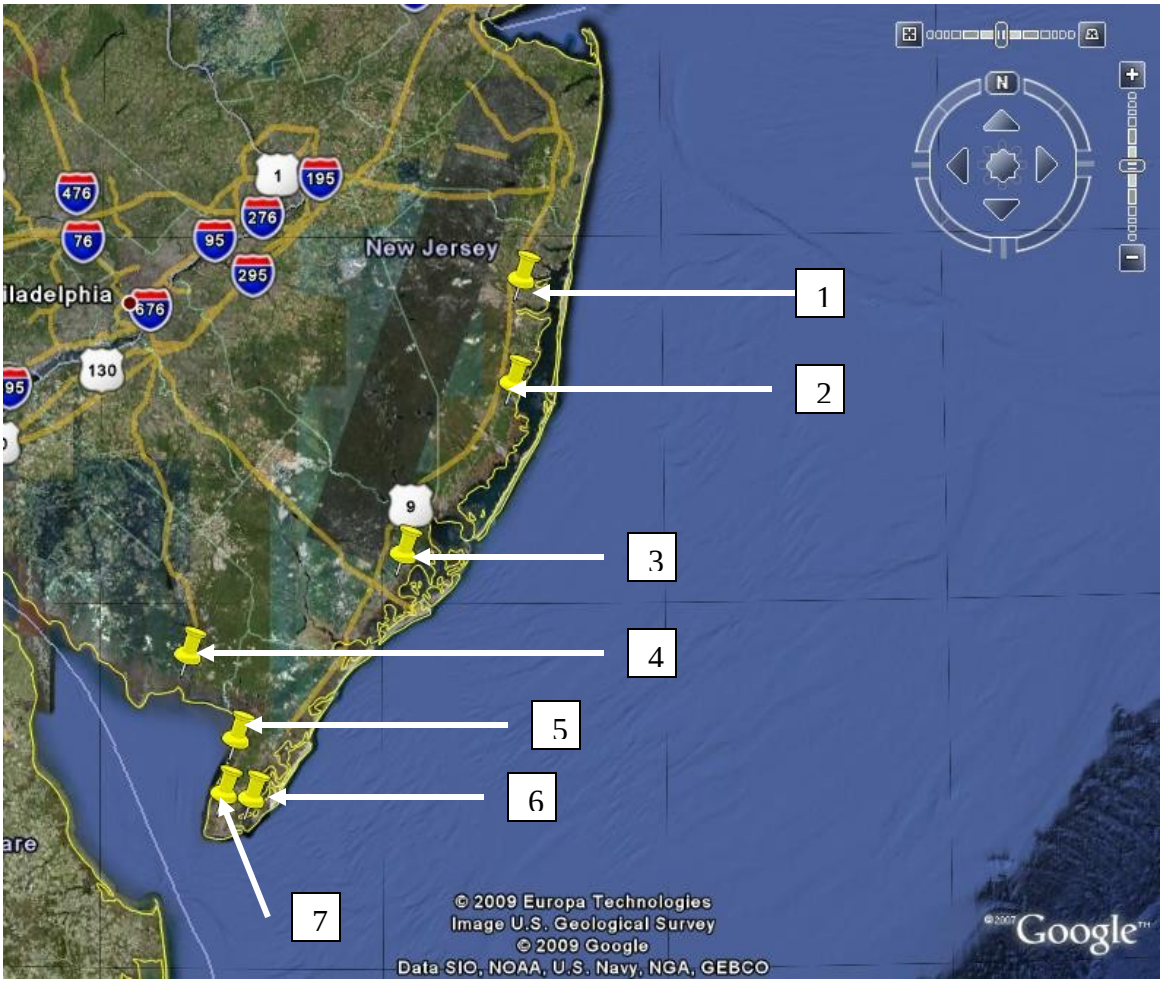
The second project GBA has underway is a joint project with the State of Maine, private capitol and the fishing industry to keep fishing industry participants gainfully employed, making a living from the sea and to keep the working waterfront vibrant and sustainable in the fish business by raising cod. The plan is to have an existing pen site near Cutler Maine operate as a farming (business incubation) facility to assist existing fishermen to make the transition to aquaculture. The fishermen will have to make an investment of time and capitol in order to participate in this project. There will be four participants at any one time. GBA has a number of interested parties and believes the first participants are ready to proceed in the process, which includes an application process, as one must be financially qualified. The project is in the initial stages.

One thing that that was strongly suggested would help the move to aquaculture in federal waters was a commercial size demonstration project. This would have to be a commercial operation, not a research project. As the permitting environment currently stands no entrepreneur would ever embark on a totally unknown process with unsure results at an unknown cost. Again the emphasis is on commercial scale not a research scale facility. A major product of this type of project would be to delineate the permitting process and to familiarize the federal agencies with the process thus charting the course for future private enterprises to follow.

The work on cod genetics is also an important component of the overall effort. In Norway they are already breeding a third generation fish resulting from selective breeding. The indication is that cod has a high heritability index for growth and there is hope that disease resistance is also amenable to selective breeding. The company believes there is still time to keep up with the rest of the world when it comes to cod culture, although the investment into cod other countries are making will soon leave the US too far behind if there is not a reasonable amount of investment in the US.

The economy is affecting GBA in many ways. They had opened a hatchery in the Dominican Republic to supply the farms culturing cobia in the western Caribbean Sea. The hatchery is currently mothballed as there is a shakeout of fish farms in the area as a result of the economic slowdown. Currently GBA is focusing on cod, but there is still a critical knowledge base in the company on summer flounder, cobia and black sea bass.

All-in-all the management of GBA is innovative and forward thinking. It is an enormous testament to their perseverance in the face of adversity that the company has survived so long under the permitting and investment climate that permeates the aquaculture industry in the US. If GBA had been located in almost any other country in the world it would be a highly valued addition to the local industry and the company's investors.



Map 5. This map shows the locations in New Jersey that were visited. Point #1 is Toms River, the location of the county extension office. Point #2 is Abescon, where meetings took place. Point #3 is Bivalve, where the Rutgers Haskin Laboratory is located. Point #4 is the site of the Rutgers Cape Shore Laboratory. Point #5 is the site of the Rutgers Multispecies Aquaculture Demonstration Facility. Points # 6 & 7 are in Cape May.

STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: **STATE:** New Jersey DATE: 4/15/09-4/17/09

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Various aquaculture sites in New Jersey

PERSONS CONTACTED: Various, hosted by Gef Flimlin, Rutgers Univ.

ACCOMPLISHMENTS:

As part of my continuing process to become familiar with the aquaculture industry in the Northeast Region, I recently visited New Jersey to learn the extent of the aquaculture industry in the state and to meet with some of the industry participants. I was fortunate to have a knowledgeable contact in the state, Mr. Gef Flimlin of the Rutgers University, who is an assistant Professor at Rutgers and the aquaculture and fisheries extension agent in Ocean Country. Mr. Flimlin's office is in Tom's River. On Wednesday, April 15th I drove to Tom's River. Almost immediately we drove down the coast to a meeting to discuss an experiment being planned. The experiment was being designed to answer the question of how clam culture affected SAV, specifically eelgrass restoration and regeneration. At this meeting was Dr. Paul Bologna of Montclair University, Dr. John Krauter of Rutgers Haskin Shellfish laboratory, some local shellfish growers who were participating in the experiment, and a representative from N. J. Congressman John Adler's staff. I observed the meeting. Generally there seems to be a real interest in addressing environmental concerns of shellfish aquaculture via scientific enquiry. The congressional representative also expressed support for aquaculture. He related that the congressman was surprised to learn about the industry and as he learned about it he was supportive and willing to help.

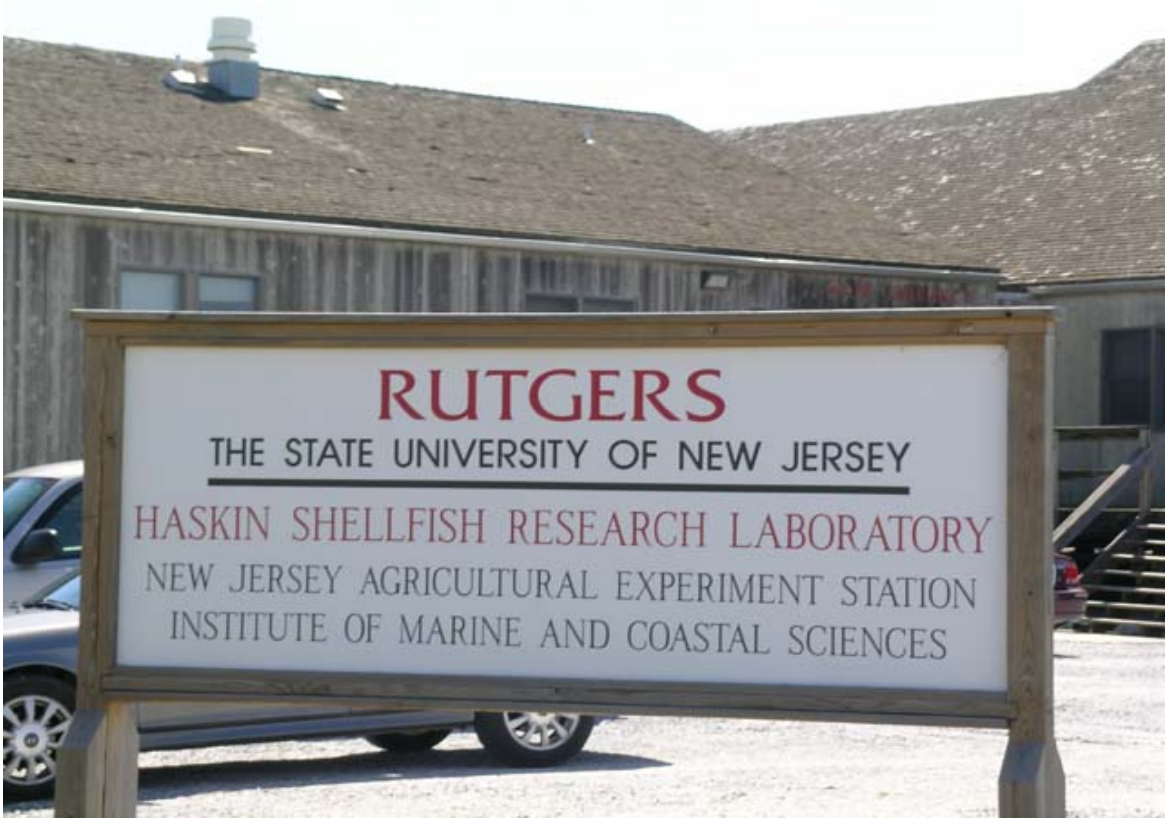
After this meeting Gef and I had a wide ranging discussion about the state of the aquaculture industry in New Jersey over dinner. One aspect of the industry that is notable is the participation by commercial wild harvesters in the industry. It was explained that as the natural resource declined there was a number of wild harvesters who realized that the future lay in the culture of shellfish. Thus today there is not the almost traditional conflict between the wild harvesters and the aquaculture industry seen in many other areas.

There is also an interesting geographical division of shellfish species grown. Currently shellfish are the only species being cultured in marine waters in the state. In Barnegat Bay the aquaculture industry is comprised of clam culture where in Delaware Bay the industry is comprised of oyster culture. One of the interesting projects Gef has underway is an oyster and clam restoration efforts and in Barnegat Bay that include a great deal of public participation and education.

The industry in New Jersey does have wide ranging support from some parts of the public, fishing industry and universities. There are also impediments to the industries development. The regional Army Corps office in Philadelphia seems to be not very supportive of aquaculture, as does the state fisheries agency. This might be the usual griping, but it did seem to have some basis since I heard the same issue from a number of people over the span of the site visit.

Later that evening I attended a meeting of the state leasing committee. This committee is comprised of participants in the aquaculture industry, including wild harvesters, county representatives to the state shellfish committee, academic advisors and the extension service. The state is in the process of developing Aquaculture Development Zones (ADZ) and this committee was set up to address issues arising from this effort. One issue was the non-participation by the NJ fisheries regulators. There was comments on how this committee is working in good faith to hammer out these issues to the participants satisfaction and that after the process the state fisheries management regulatory authority would want to either scupper the process as they didn't participate or change the agreements arrived at with out participating. When the meeting broke up at 8:30 the participants seemed to be satisfied progress had been made.

The next morning I met with Gef for a breakfast meeting where we discussed the laboratory's we were planning to visit that day. Then we drove to the Haskin Shellfish Research Laboratory in Bivalve N.J. This lab has been in existence more than 100 years. At the lab I met with Dr. John Krauter and Mr. Walt Canozier. We had a discussion pertaining to the status of shellfish culture in Delaware Bay, some history of aquaculture in the area and the history of the lab. I was then shown about the lab by Dr. Krauter. The lab has the capability to perform all aspects of shellfish research including genetics, molecular biology and field trials. The gentlemen also asked me about National Marine Fisheries Service interest in aquaculture and what future initiatives might come up. I mentioned the disaster relief projects for the blue crab fishery it was commented on that there has been a collapse of the clam fishery in Barnegat Bay and why didn't the clams fishery get some much needed relief.



Picture 1, the entrance to the Haskin Shellfish Research Laboratory.

Picture 2, from left to right, Dr. John Krauter, Mr. Walt Canozier and Mr. Gef Flimlin.

Picture 3, there is a long history of shellfish culture and harvesting in the area. The industry is much reduced form the past, as recently as the 1960's the area had a strong shellfish industry.

Picture 4, just a small example of the mountains of shells in the area.

Picture 5, some of the remaining fleet of oyster harvesting boats in Bivalve.

Picture 6, some of the fleet is quite old; these are two old wooden oyster boats in Bivalve.

Picture 7, some of the boats are getting quite old, but are still active in the fishery.

From the Haskin lab Gef and I then drove to the Haskin Lab Cape Shore Facility. Here we met with Dr. Greg Debrosse who runs the facility. He gave me a tour of the facility and a run down of the research conducted here. Dr. Debrosse's research concentrates on genetics. His facility has the capability of holding oysters in quarantine. He has conducted work on non-native species in this lab. He also produces American oyster seed for research and restoration purposes. This facility is on Delaware Bay on a large tidal flat. The flat is extensive and the seawater systems in use have to shut down during low tides. There a number of large sea water storage tanks to get this hatchery and research facility through these periods when they cannot pump water into the systems. The facility is quite isolated. There is also a dormitory to house summer students and researchers.

Picture 8, the entrance of the Haskin Lab Cape Shore Facility. This facility is quite out of the way down a long unimproved dirt road that the entrance to is tucked behind a trailer park.

Picture 9, the hatchery at the Haskin Cape Shore facility.

Picture 10, the hatchery in the Cape Shore facility.

Picture 11, the Cape Shore facility storage tanks for sea water. The facility has limited seawater availability during low tide. These tanks are used to store water for use during low tide. The further tank is an old wooden tank.

Picture 12, Dr. Greg DeBosse and Mr. Gef Flimlin at the cape Shore facility. This is one of the containment systems with a large storage tank in the background.

Picture 13, part of the laboratory at the Cape Shore facility.

Next we drove to the Rutgers Multispecies Aquaculture Demonstration (MAD) facility. This facility is in the process of being constructed. Located on 50 acres near Cape May. This facility is designed to a demonstrate production level facility for shellfish and finfish. This facility will also have the capacity to construct ponds for finfish culture. This facility is in the final phases of construction during my visit. The building is up, most of the system plumbing is in, and tanks were being set up. This facility will add significant capacity to the research capabilities of the Rutgers aquaculture program.

Picture 14, the new MADF facility near Cape May.

Picture 15, the intake for the MADF facility. There are two intakes, one lies fallow, thus going anaerobic, to clean out the fouling.

Picture 16, there are two large pumps to supply water to the facility. There is future capacity to add a third pump.

Picture 17, there are two large tanks to hold water for the facility. Water is pumped into the tanks and then fed via gravity to the facility. The third tank, on the right, is insulated to hold heated water.

Picture 18, part of the filtration system for incoming water. Large sand filters, for scale note the garage door in the background, mechanically filter incoming water and are automatically back flushed to clean the filter media.

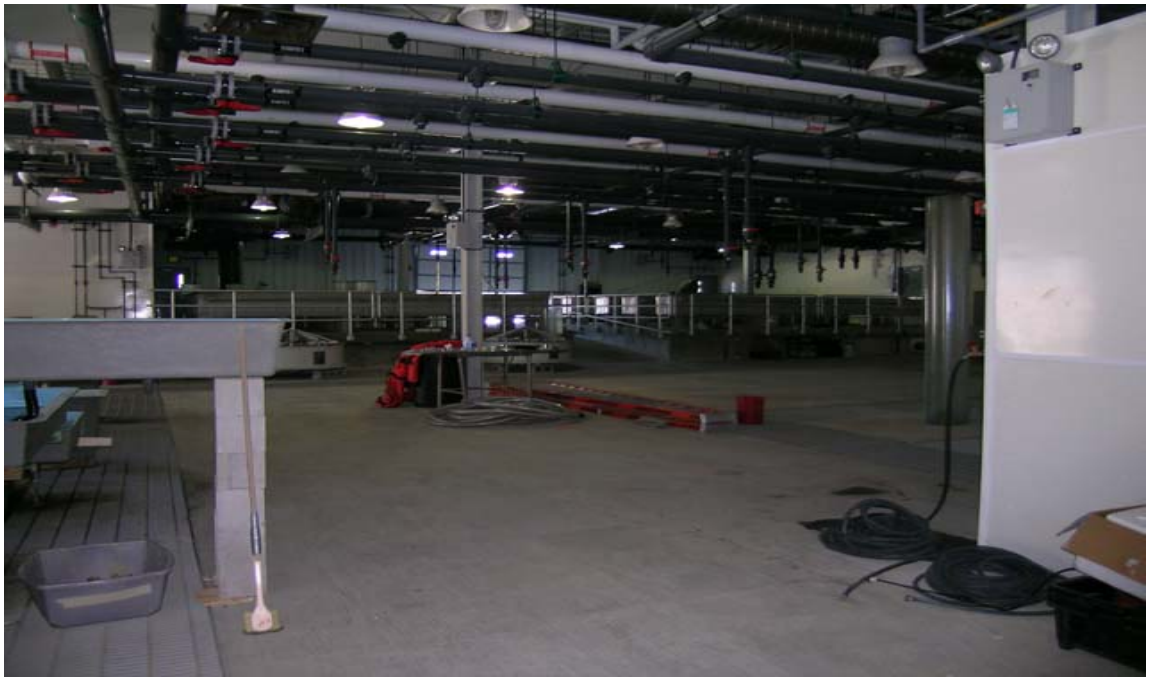
Picture 19, pumps in the filtration systems room move water through UV filters and heat exchangers, before moving the water into the building systems.

Picture 20, algal production room.

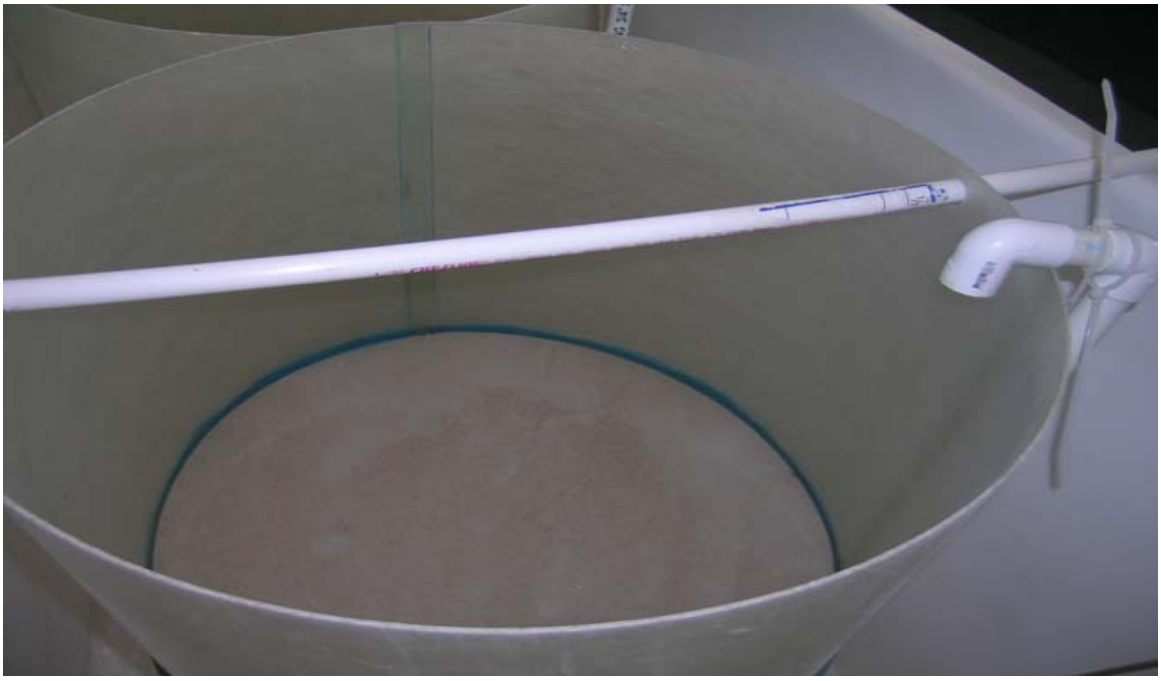
Picture 21, algal culture room where starter stocks are cultured before moving to the algal production room.

Picture 22, laboratory for the algal culture technician. A full time job during conditioning and spat production phases of shellfish culture. Algae are also used to feed prey for larval fish production.

Picture 23, some tanks are already in use. These tanks are holding shellfish.



Picture 24, not a very good photo, but gives a sense of the scale of the MAD facility.



Picture 25, down wellers for shellfish production. There is screening at the bottom of the tank, the juvenile shellfish will be in this tank, water will flow through the pipe on the right down through the shellfish. There is an outer in the outer tank that sets the water level.

Picture 26, showing another view of the shellfish downwellers. The outer tanks have water in them at the same level as the down weller tank.

Picture 27, it is hard to get a sense of the size of the MADF facility from these photos. Note the distance to the garage door in the background, these are industrial size doors, much larger than your garage door at home.

Picture 28, this pad is just outside the building, is designed to hold tank for finfish culture. The stacks of gear in the background are oyster culture cages for a longline operation.

Picture 29, the large MADF facility is almost totally blocked by long line oyster gear. All of this gear is being stored for a local oyster farmer.

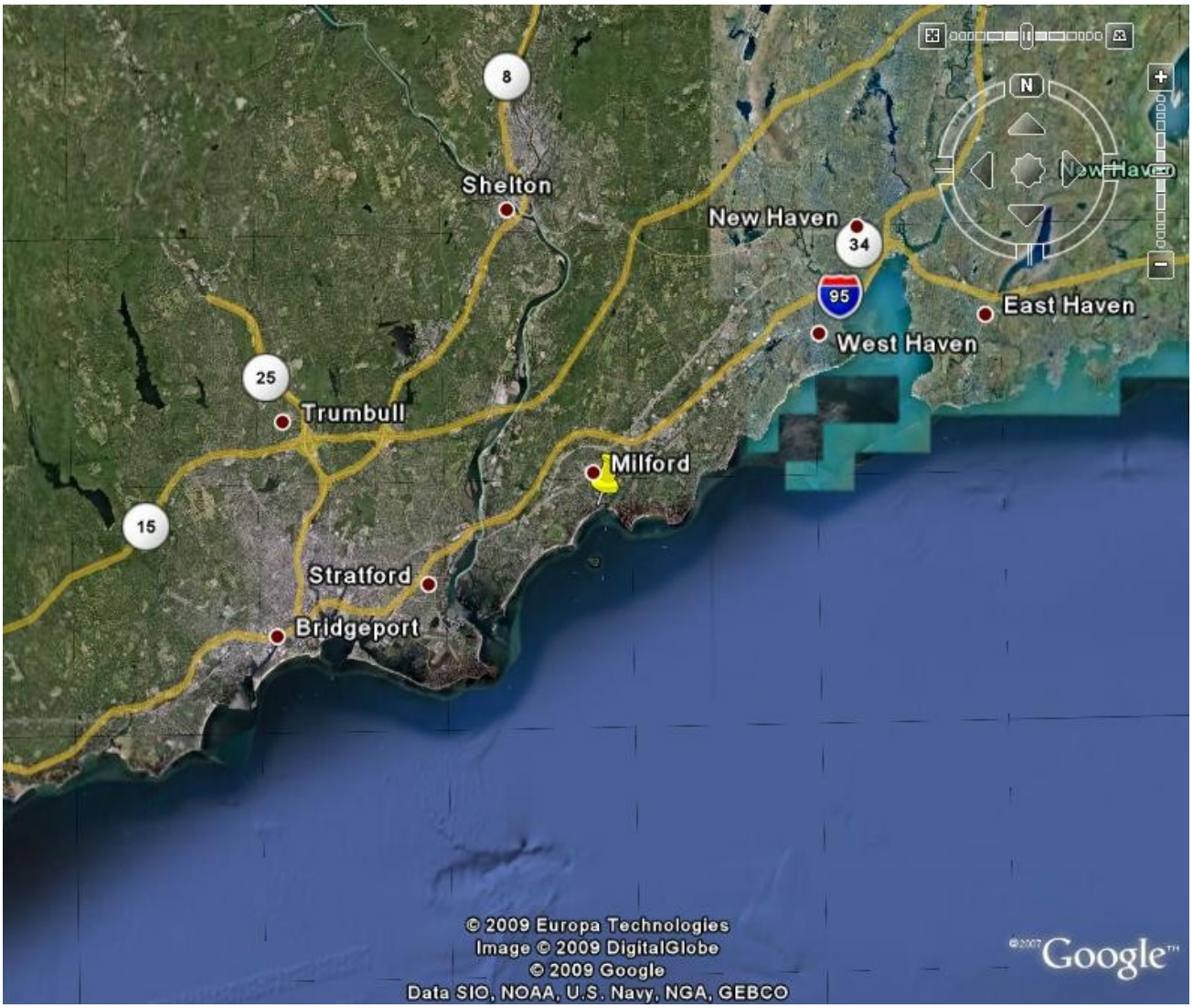
After touring the MADF facility we next went to Cape May NJ. Here we visited a local oyster farmer who is also working for a major wild harvest fishing company. Not only was this man active in the fishing and aquaculture industry, but also active in offshore energy proposals. He saw a possibility of combining offshore energy with aquaculture. The area is developed with a thriving tourist industry and a large fishing industry. The previous few days had been unsuitable for fishing, thus the fleet was in. The fishing fleet looked to comprise mostly small, 50-150 foot, inshore fishing boats.

Picture 30, the fishing fleet in Cape May.

Picture 31, the fishing fleet in Cape May

Picture 32, an interesting educational poster in Cape May.

After Cape May we returned to Absecon for a dinner meeting. The next day I finished up some office work and drove home. The trip was a valuable learning tool for this office. New Jersey has some significant capacity in facilities and personal for aquaculture production and research. I had known about some of the researchers through interactions at national and regional meetings, and they are top notch. What I learned was there is also a strong cadre of local fishermen and aquaculturist that you don't get to meet at the national and regional meetings. These people are driving an aquaculture industry, thus producing jobs and a nutritional product for local consumption, in the face of opposition and indifference from state and national regulatory agencies. In addition to a group of talented, resourceful and driven people, to grow an industry you also need significant infrastructure. The scale of the facilities and the research being conducted at these facilities was impressive. If given the support, from national and state regulatory agencies, that any industry needs to prosper, the aquaculture industry in New Jersey would grow exponentially. This office looks forward to working with the talented and hard working people of New Jersey in an effort to allow sustainable aquaculture to grow in the region.



Map 6. This map shows the location of the NMFS NFSC Laboratory in Milford, Connecticut.

STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: **STATE:** Connecticut DATE: May 15, 2009

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing State Federal coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Milford Laboratory, NEFSC

PERSONS CONTACTED: C. Brown, G. Wikfors, R. Goldberg and D. Carey

As part of my continuing process to become familiar with the aquaculture industry in the Northeast Region, I recently visited the Milford laboratory of the NMFS Northeast Fisheries Science Center. I arrived at in the morning and had a meeting with Dr. Chris Brown, the laboratory director. We discussed the projects the laboratory has underway. The Milford Laboratory is conducting an impressive amount of cutting edge research, both lab based and field based experiments.

The Milford laboratory has been in existence since 1931. You can read a brief history of the laboratory at: http://www.mi.nmfs.gov/history.html. The laboratory has been instrumental in developing modern culture methodology for shellfish.

Our discussion ranged from these experiments and the quality of the personnel conducting them to collaborations the laboratory has underway with other researchers around the world. There are connections with researchers in Asia, including China and the Philippines, Europe, including researchers in France and Britain.

Later I met with lab personal from the Biotechnology branch of the laboratory. Dr. Gary Wikfors introduced me to the group and each member gave me a brief update on their research. The research underway in this section is directed at commercially important species of shellfish. "The Branch applies the disciplines of microbiology, immunology, genetics, pathology, and algal nutrition to define and improve the health, survival, and growth of selected marine species, both in an aquaculture setting and in nature."

During the meeting with the laboratory I also discussed the position of aquaculture point-of-contact in the Northeast Region. After this Dr. Wikfors gave me a tour of the facilities.

Picture 1. The small garage in the middle of the picture was the first building on the site. The land and building were donated by local oyster farmers to get the laboratory started. The building was originally across the harbor and was moved to its present location by the same local oyster growers who donated the land. There are hopes of turning this original building into a small museum.

Picture 2. The brick building in this picture was the first laboratory building build by the government. It was built in the late 1930's. The small house to the right was the director's house. Presently it houses personal from the NER habitat office.

Picture 3. Dr. Wikfors is an internationally recognized expert on algae and their use in shellfish culture. The laboratory keeps a reference collection of important algal cultures. They have hundreds of cultures and are receiving and evaluating species constantly.

Picture 4. In addition to maintaining the collection of algae, the section also supplies starter cultures to commercial hatcheries. The lab also supplies larger quantities of algae to other research programs within the Milford Laboratory.

Picture 5. Further cultures in the reference section. These cultures, and those in picture 3, are contained in a climate controlled room.

After touring the algal cultures and the batch culture facilities, Dr. Wikfors continued the tour of the remaining labs in the main laboratory. They included areas conducting genetics research, finfish culture, black sea bass (*Centropristis striata*) and scup (*Stenotomus chrysops*), physiology and other interesting areas of research.

Picture 6. These computer-controlled containers are used for shellfish feeding experiments. The laboratory has personnel who built these containers. Like any good lab the folks at Milford are able to construct the specialized apparatus necessary.

Picture 7. These standard salmonid hatching trays, commercially available, are being used to hold bay scallops (*Argopecten irradians*). The laboratory has the capacity to supply chilled, heated and ambient sea water through out the building.

Later Dr. Wikfors handed me off to Mr. Ron Goldberg who is the chief of the Culture Systems and Habitat Evaluation Branch. Mr. Goldberg's section is responsible for "developing technology for culturing commercially and recreational important species amenable to aquaculture, improving hatchery culture techniques, enhancing growth of valued species, evaluating the habitat requirements of species to be used in potential enhancement programs, and conducting research in the reproductive biology, culture, and growth of cultured species." I was given a tour of the remaining facilities and an update on the field research being conducted.

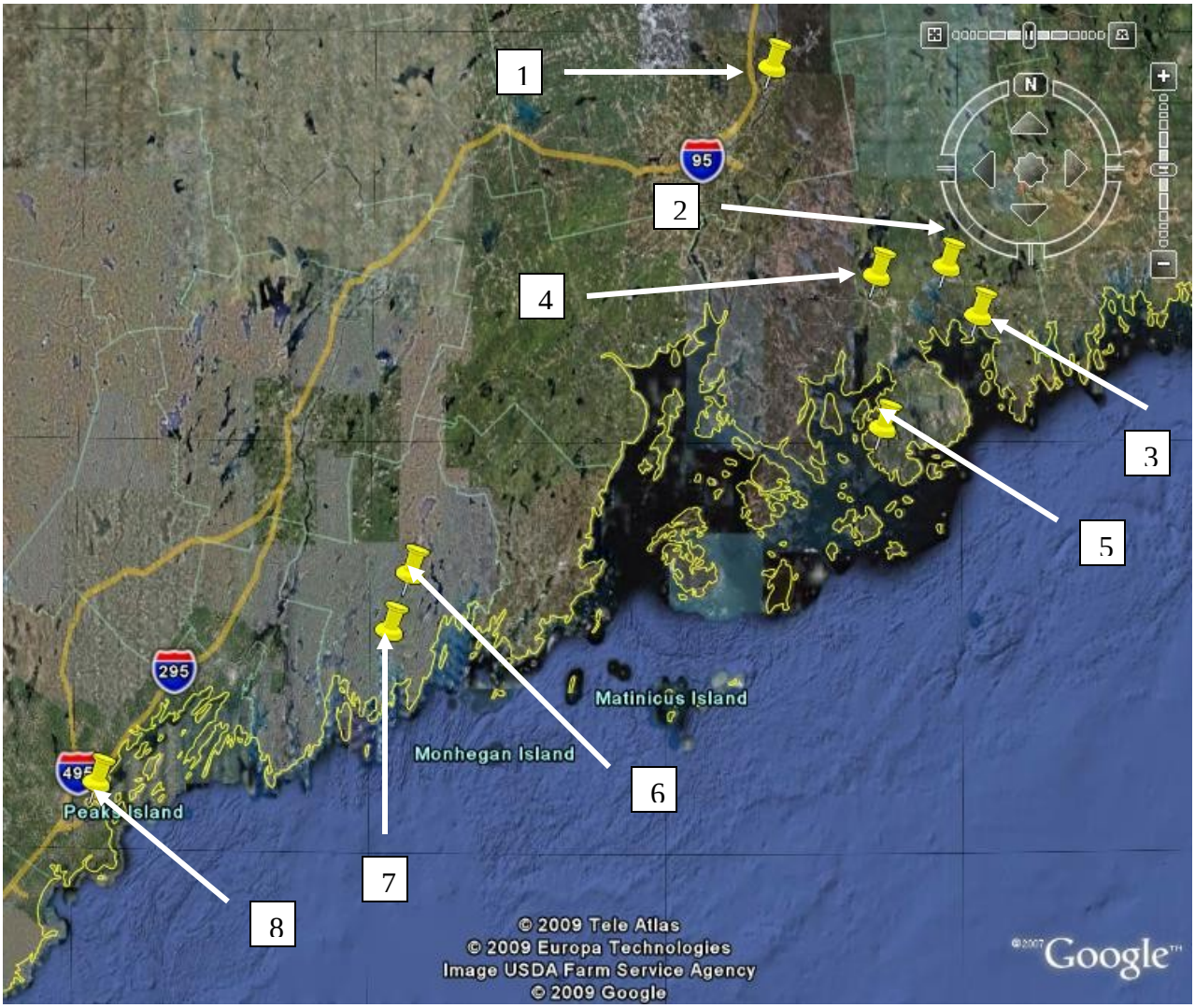
Picture 8. These tanks have flow of ambient water through them during the summer. They are used for large scale experiments. The greenhouse in the background was used for an algal culture experiment in the past and will be used again.

Picture 9. These large tanks have ambient water flow through them for larger scale experiments. Animals are held over winter as these tanks are in doors.

This Branch has some interesting experiments on the effects of shellfish culture on the benthos. The experiment is designed to look into the sediment chemistry before, during and after dredging to harvest the crop. Mr. Goldberg gave me a tour of the original office of Dr. Loosanoff, the research ship RV Loosanoff, and a tour of the culture raceways seen in pictures 8 & 9. Next was a pleasant lunch out on the picnic tables in the company of Dr. Brown, Wikfors and Goldberg. During lunch we continued our discussion of the laboratory, NMFS and aquaculture.

Next I walked over to the Connecticut Department of Agriculture, Bureau of Aquaculture offices, located on the same campus, where I had an informative meeting with Mr. David Carey, the Connecticut Aquaculture Coordinator. Mr. Carey and I discussed aquaculture in Connecticut, NMFS and interactions between the two. It was an informative meeting and I learned much about how shellfish aquaculture is conducted in Connecticut. The largest difference from my previous experience was a reliance on wild seed. The seed is harvested from wild beds managed by the state and then transplanted on private leases. Connecticut has a large shellfish industry. The industry was largely concentrated on oyster culture until a few years ago when the industry was hit by oyster diseases. The industry then concentrated on clam culture. Currently oyster culture has been making a come back, but it has yet to equal its peak of $70 million it reached a decade ago.

All in all it was an interesting visit to both the NMFS laboratory and the Connecticut Bureau of Aquaculture. The NMFS laboratory is a valuable addition to the aquaculture expertise and experience in the agency. It is certainly a resource to be made use of and this office plans to do so when necessary in the future. The Connecticut Aquaculture Coordinator serves Connecticut well in his job and has a wide range of knowledge on the Connecticut aquaculture industry.



Map 7. This map shows the locations visited in Maine. Point #1 is the University of Maine in Orono. Point #2 is the University of Maine and the USDA facility in Franklin. Point #3 is Sorrento, Maine, site of a cod farm. Point #4 is Ellsworth, Maine. Point #5 is Pretty Marsh on Mount Desert, site of a mussel farm. Point #6 is Damariscotta, Maine. Point #7 is the University of Maine Darling Marine Center. Point # 8 is Portland, Maine.

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STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: **STATE:** Maine **DATE:** 6/8/09-6/11/09

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Maine Aquaculture; academia, industry, and others

PERSONS CONTACTED: Many

ACCOMPLISHMENTS:

On June 6th, I picked up Gene Kim, NOAA national Sea Grant Program, Aquaculture Specialist, and Jess Beck, NOAA NMFS Southeast Region Aquaculture Coordinator, in Boston and we began a 4 day site visit to Maine. We started early, 6 am, and drove to Gloucester where we picked up a government car, and then drove to the University of Maine Darling Marine Research Center in Damariscotta Maine. We arrived and were greeted by Dana Morse, a Maine Sea Grant extension specialist for aquaculture and fisheries. Dana would be out host for the next 4 days. Once we settled in a bit we met with the Darling Center Director, Kevin Eckelbarger; the Dean of the School of Marine Sciences, Pete Jumars; Marcy Nelson, Maine Department of Marine Resources and Sebastian Belle, Maine Aquaculture Association.

Dr. Eckelbarger discussed the Darling Center's mission and how the center was in a rebuilding phase. The center had been rebuilding the infrastructure for the past few years and was now recruiting faculty and grants to utilize the new facilities. There was discussion on how the Center and faculty had been instrumental in the past in advancing shellfish aquaculture, with many breakthroughs taking place there in the past. There was hope that this level of research and innovation would again be possible in the near future.

Dr. Jumars discussed the School of Marine Sciences. The school was a fairly recent construct and had at first drawn its faculty from existing schools in the University of Maine. Since then there has been a concerted effort to bring coherence to this disparate group. Dr. Jumars expressed confidence that the School, despite the fact it had no physical presence, had indeed coalesced into a coherent body. They were currently recruiting faculty and had plans for continued development. Aquaculture is an important part of the schools mission and it was supported by the state, university and the school.

There was discussion of NOAA's role in aquaculture development, as well as questions about our individual roles in the agency. Next, Dana, Marcy, Sebastian, Jess, Gene and I walked down to the dock for a tour of the aquaculture sites in the Damariscotta River.

The Darling Center has played a critical role in developing shellfish aquaculture on the Damariscotta River in the 1970's through the 1990's. There was one particular researcher at the center, Dr. Herb Hidu, who was instrumental in the center being a center of excellence in shellfish research. His efforts led to many of the farms on the river being founded by his graduate students. Since then there has been a number of new farms founded.

Picture 1. The University of Maine Darling Marine Center from the Damariscotta River.

As we motored up the river there was discussion of the issues. Jess Beck and Marcy Nelson discussed the permitting process in Maine. Ms. Nelson is the lead person for pre-permitting surveys in the state for all aquaculture applications. Gene Kim was discussing aquaculture in Maine with Sebastian Belle, and I was discussing the situation on the river with Dana. The first farm we visited was an oyster farm, Muscongus Bay Aquaculture.

Picture 2. Marcy Nelson and Jess Beck discuss permitting as we motor up the Damariscotta River. The Darling Center dock is in the background.

Picture 3. Gene Kim and Sebastian Belle discuss aquaculture on the Damariscotta River.

As we tied up we introduced ourselves and were introduced to the manager Julie Adams. She went over the operations of the farm with us; seed was taken from the hatchery and then put in floating bags. The resulting seed, about an inch in size, was then planted on the bottom to mature. The day we were there they were harvesting oysters for market. They had one boat towing a dredge which harvester the oysters from the bottom. These were then brought to the floats, dumped, washed, sorted, marketable oysters were prepared for transport, and the rest are returned to the water for continued growth.

Picture 4. We approach the working platform of the Muscongus Bay Aquaculture farm on the Damariscotta River.

We discussed the farming process used on this farm, we asked the manager about what issues were important to continued profitable operation, and we explained who we were and why we were visiting. We were fortunate that it was a beautiful day, as it turned out it was the only sunny day of our visit.

Picture 5. The boat in the background was dredging up oysters that had been planted previously to grow to harvest size. The oysters were dumped on the tray, washed and sorted for market.

Picture 6. As we continued up the river we passed another oyster farm. This farm utilizes floating plastic mesh bags to hold the oysters.

After thanking the manager, we continued our tour by motoring up the river and slowly passing the other farms on the river. On the upper reaches of the river they were all oyster farms. We then drove down the river to a mussel farm. The farm utilized rafts to hang the mussels. We did not get too close to the rafts as an osprey had built a nest on

one of them and we did not want to disturb it as it was incubating eggs. This farm was near the first farm permitted in Maine, lease number one, permitted in the 1970's. This pioneer farm was no longer actively farmed.

Picture 7. Just shore ward of the existing farm is the location of Maine aquaculture lease #1. The farm is no longer in existence.

Picture 8. A mussel farm on the Damariscotta River which utilizes rafts. The osprey nest is on a raft that is not in the picture.

We then motored back to the Darling Center Dock, disembarked and we then toured the shellfish culture facilities. The facility includes a green house for algal culture, a quarantine facility for bringing in shellfish from other areas, and culture facilities.

Picture 9. The shellfish quarantine facility in the Darling Marine Center.

Picture 10. This bumper sticker is from a Long Island (New York) oyster gardening project.

Picture 11. Trays of soft shell clams being held for propagation, in the Darling Center shellfish facility.

Picture 12. A greenhouse at the Darling Center used for algal culture. The cages on the lefty hold bags for a continuous algal culture system that constantly feeds algae into the shellfish culture systems.

After this tour with Dana, we went into the town of Damariscotta for lunch. At lunch we were joined by Chris Davis, Maine Aquaculture Innovation Center (MAIC), Diantha Robinson of the Maine Department of Marine Resources (MDMR) and Mark DesMeules of the Damariscotta River Association. During lunch we discussed the permitting process with Ms. Robinson, who is the aquaculture hearings officer for MDMR. The state has a very comprehensive monitoring program for aquaculture leases, and its leasing process is quite open and transparent to the public. Dr. Davis gave us some history of the shellfish industry in the area, and the projects the state funded MAIC have underway. The discussion with Mr. DesMeules was centered on how the association supported the shellfish industry but there were concerns about long term impacts from too much of a good thing. After lunch we Dana Morse, gene Kim, Jess Beck and I, then drove to Orono Maine where we spent the night.

The next morning we met early and drove to the main campus of the University of Maine. There we met with Mike Hastings, Director of the Office of Research and Sponsored Programs; Linda Kling, Professor in the School of Marine Sciences; Mike Pietrak, PhD candidate and Maine Aquaculture Association; Susan White, Associate Director of Maine Sea Grant; Anne Lichtenwalner, professor and Veterinarian, Department of Animal and Veterinary Sciences; Paul Anderson, Professor School of Marine Sciences and Chris Davis MAIC. Mike Hastings welcomed us, introduced us to all in attendance and chaired the meeting. The discussion was begun with their asking what exactly was our agency to be referred to as, NOAA Fisheries or National Marine Fisheries Service. We explained the differences to the group as best we could. The discussion then revolved around the work that was being conducted at UMaine in aquaculture, and what was the input that could be expected from NOAA in this area.

After this meting we walked across campus to tour the Aquaculture Research Center. Here we were met by Neil Greenberg, the Operations Manager of the center. Here we also met with Michael Eckardt, Vice President for Research. Dr. Eckardt welcomed us to the campus and spoke for a few minutes on how the State of Maine and the University support aquaculture research. He was taking a few minutes between meetings and was popping in to make sure he touched base with us before we left campus. We then proceeded to tour the ARC facility with Mr. Greenberg. The facility started out as a chicken barn, and has been modified over the years. There are plans to replace it with a larger facility, as this one is being fully utilized. In addition to various aquaculture systems where research and teaching is carried out, there is also a wave tank and some teaching labs.

Picture 13. The Aquaculture Research Center on the University of Maine Orono Campus. The building began as a chicken rearing building and was converted into an aquaculture facility in the early 1990's.

Picture 14. Neil Greenberg, ARC operations manager, discusses the projects underway in the facility.

Picture 15. Rotifer culture for feeding to larval fish. Ms. Jackie Hunter has been working at the university for 48 years.

Picture 16. Smelt research underway in the ARC.

Picture 17. A research system currently used for Smelt culture. As an interesting side note, this system was designed and built by D. Alves in 1994 during his time as an undergraduate student at UMO.

Picture 18. The ARC also houses a wave tank. This system is used to test a variety of projects, including aquaculture technology.

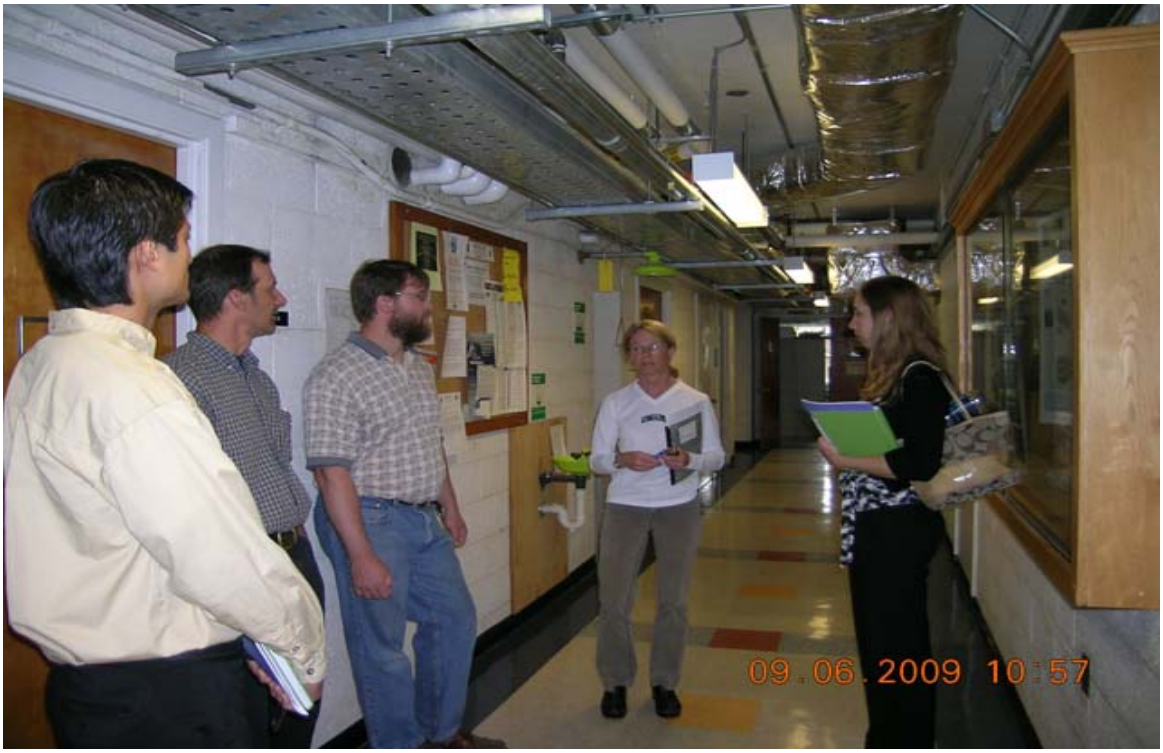
Picture 19. Lobster research is also conducted in the ARC.

Picture 20. Research into lobster disease issues being conducted in the ARC.

Picture 21. Marine ornamental culture in the ARC. This project is part of the business incubation mission the University has taken on.

After the tour of the ARC we, Dana, Jess, Gene and I, then walked to Hitchner Hall where we met with Anne Lichtenwalner the pathologist in charge of the Maine Aquatic Animal Health Lab. Dr. Lichtenwalner gave us a tour of the facility, which is spread through out the building. We discussed disease issues and the research she and her lab are conducting. Later we walked across campus back to our vehicle, grabbing a sandwich along the way to eat on the road. We then drove to Franklin Maine were we toured the Center for Cooperative Aquaculture Research (CCAR).

Picture 22. The university has a dedicated Aquatic Animal Health lab located in Hitchner Hall on the main campus in Orono.



Picture 23. Dr. Anne Lichtenwalner discussing the projects under way in the Maine Aquatic Animal health labs.

Nick Brown is the director of the facility. This center was a hive of activity with new construction and renovation of the facility taking place along with the culture of a number of marine species, including halibut, cod, and sea urchins. Dr. Brown has been active in the aquaculture field for years, working in Europe, Canada and now Maine. The CCAR was purchased by the University of Maine in the late 1990's. It started out as a salmon farm, when the company went out of business the university purchased the property. Since then the facility has expanded greatly, and attracted a new USDA aquaculture facility adjacent to it. The CCAR includes a business incubator to encourage and support nascent aquaculture businesses. The center has had support from the state, the university, local governments and businesses over the years. Dr. Brown sees halibut and cod as the next two species that are ready for large scale culture, and the center is trying to support research and businesses that are looking into developing businesses in these areas. The level of activity and expertise at this facility is impressive. There was activity in all parts of the facility, from growing mud worms for the bait industry, growing cod for industry, to researching the culture of halibut and sea urchins. The growth in the capabilities of this facility was a major attraction to the establishment of a USDA research facility that was established adjacent in the past few years.

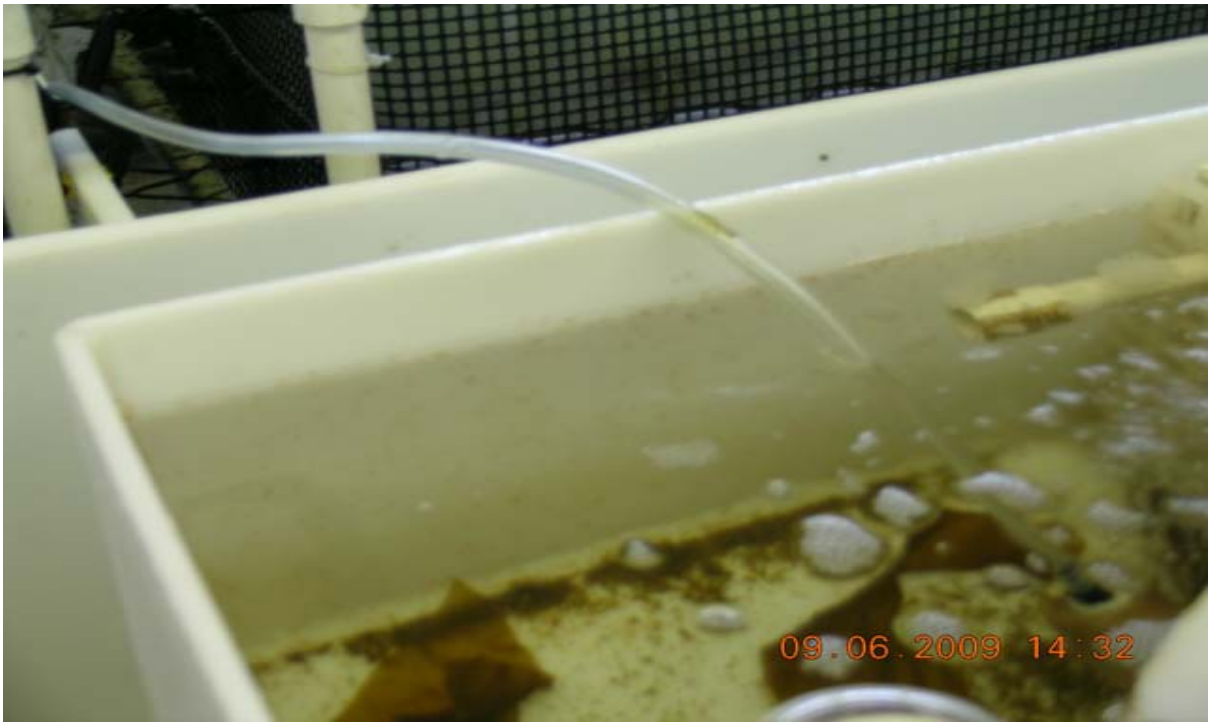
Picture 24. The CCAR facility in Franklin Maine.

Picture 25. The new building at the CCAR has fish represented on the building. This is a halibut.

Picture 26. Dr. Nick brown stands beside a halibut culture tank. To the right is a portion of the filter system. All of the tanks are part of a recirculation system.

Picture 27. Dr. Brown discusses halibut culture. These tanks are for the yolk sac stage, which lasts 5-7 weeks. The larval fish are very sensitive to environmental parameters during this phase.

Picture 28. These tanks are in use as a sea worm culture system. The center is notable for the variety of species of aquatic animals under culture.



Picture 29. The brown spots on the tank wall, right at the water line, are larval sea urchins. Researchers at the CCAR are conducting restoration experiments.

Picture 30. CCAR has even developed sea urchin chow.

Picture 31. Juvenile sea urchins in culture tanks.

Picture 32. The tanks in this green house held juvenile cod. The fish were being moved to the Great Bay Aquaculture grow out facility in Sorrento Maine.

Picture 33. Juvenile cod destined for the Great Bay Aquaculture cod farm.

After the tour of the CCAR facility we walked over to the USDA National Coldwater Marine Aquaculture Center. This facility concentrates on salmon genetics. Bill Wolters is the supervisory research geneticist and research leader at this facility. This facility if fairly new, construction began in 2003. The facility is biosecure with separate salt and fresh water systems for differing year classes of salmon. All systems are in separate parts of the facility with each room even having its own HVAC systems to prevent cross contamination. Dr. Wolters gave us the tour of the facility. One interesting part of the facility is that all of the feeding is done by robotic feeders that are computer controlled running on overhead rails. After touring this facility we drove to Ellsworth Maine to spend the evening.

Picture 34. The entryway to the USDA NCWMAC.

Picture 35. Dr. Bill Wolters, supervisory research geneticist and research leader, discusses the centers role in salmon genetics. This is the room with the very small juvenile fish.

Picture 36. This facility utilizes robot fish feeders. The system is computer controlled.

The next morning we, Dana, Jess, Gene and myself, met with Mike Pietrak and Sally Malloy and drove to Sorrento Maine to visit Great Bay Aquaculture's (GBA) cod grow-out facility. We arrived at the cod farms land based facility, which was the town's old fire station. The town donated the use of it to the farm operation. Here we met with

George Nardi and the farms manager, Clayton Coffin, and employees. We all introduced ourselves and then George brought us up to date on the farm's activities. The day before we had seen juvenile cod being loaded into totes at the CCAR facility. These cod were being stocked in the GBA offshore net pens. After this introduction we walked through town to the town dock. Here the farm had a vessel waiting for us. We motored out to the farm, about a half hour cruise, and then tied up to one of the net pens. Here we discussed the operations of the farm, including local acceptance and social impact. We watched as the farm employees used a home made feeder, a modified leaf blower, to feed the fish. We then motored back to the dock and walked back to the shore side facility. Here Mr. Nardi showed us pallets of three different feeds they were trying out on the farm. The feeds were part of an experiment the farm was conducting on fish meal and fish oil replacement diets. After more discussion of the farm, replacement diets and the like we drove to pretty marsh on Mount Desert Island to visit a mussel farm.

Picture 37. Great Bay Aquaculture's facility in Sorrento Maine.

Picture 38. We stroll down Main St. during rush hour in Sorrento Maine to get to the town dock.

Picture 39. The GBA barge at the town dock. You can tell its low tide. The totes on the barge are used to transport fish to the pens. The same fish we saw yesterday in the UMaine CCAR facility the day before.

Picture 40. The net pens are just a mile or so outside the harbor entrance. That's a seal resting on an almost submerged rock just before the rocks in the foreground.

Picture 41. A close up view of the pens. There are six currently in the water, three with cod in them.

Here at the town dock we met Eric Swanson, the owner Maine Cultured Mussels Inc, a suspended long line mussel farm in Blue Hill Bay. As we motored out to his farm we discussed the issues that concerned him. The largest biological issue during the first few years of operation was eider ducks. During the winter large flocks of eider ducks would congregate near the farm and feed on the mussels. He related to us that in a week they could clean out one suspended long line of all the mussels on it. They would then move on to his other lines. He has spent a lot of time and money experimenting on ways of preserving his crop from this predation. He reported that he has the problem solved, for now. The ducks would leave at the sound of a motor boats approach, he has set out two old boats on the farm (sort of nautical scare-crows), has set out a buoy with a recording of motors running (set to play at unpredictable intervals) and this combined with periodic visits by the farm's boat has kept the ducks away from his crop. He has had some issues with littoral landowners, but this has decreased over the years as his farm became established and the landowners have learned more about his operation.

Picture 42. Mr. Erick Swanson at the helm of the Maine Cultured Mussel Inc. motorized barge.

Currently he has three sites and is in the process of consolidating them into one. He operates the farm by his self, and has two employees helping out on the processing side. The farm was inconspicuous until you were right on top of it. The long lines are 6-10 feet below the surface of the water. He demonstrated for us how he harvests the mussels and the machinery that allows all this to occur with just one person. As we motored back into the harbor he stopped at his floating processing facility to show us how it all operates. Later, we motored by another barge that held equipment and gear for the farm, including a mussel socking machine, and anchors of his own design for the submerged long lines.

Picture 43. Heading out to the long line mussel farm. A typical Maine spring day along the coast, wet and raw.

Picture 44. We approach the farm. The use of darker buoys lessens the visual impact of the farm.

Picture 45. The crane is used to snag the lines and drop them into the star wheels. The yellow floats are 6-10 feet under water supporting the mussels.

Picture 46. The lines are brought up the conveyor belt, where at the top the mussels are scrapped off into a tote for further processing.

Picture 47. The mussel processing facility is on a barge in Pretty Marsh Harbor, Mount Desert Island, Maine.

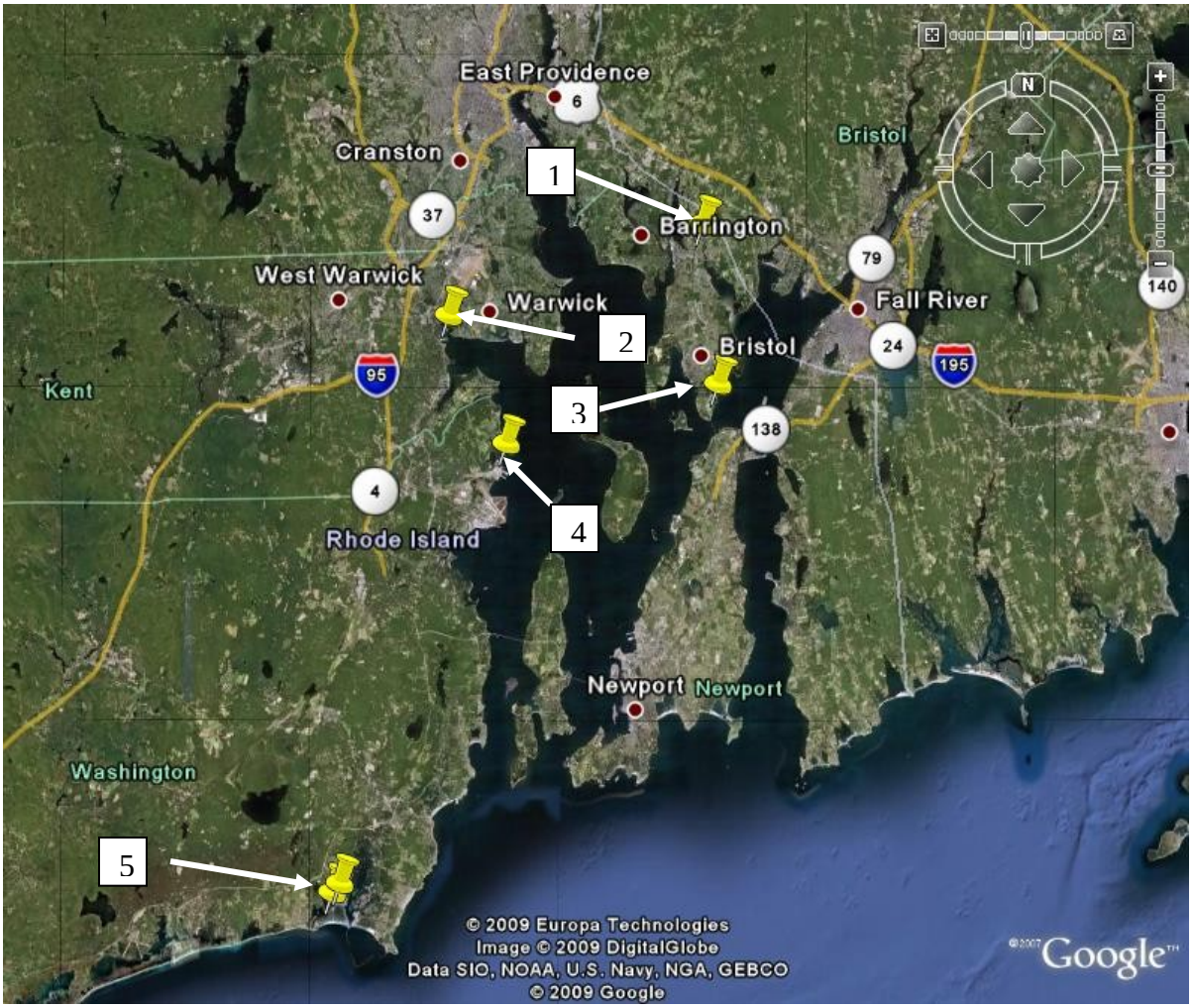
Picture 48. In the mussel processing facility, Mr. Swanson explains the process. (Photo courtesy of D. Morse.)

Picture 49. Mr. Swanson cooked up a sampling for us to taste test. They were delicious. You can't get them much fresher than this. (Picture courtesy of D. Morse.)

Picture 50. The mussel socking machine. Small immature mussels are loaded into the hopper, a line is fed through the bottom, the mussels are fed into the tube, the socking material is fastened around the mussels and the line. As the mussels grow they migrate through the biodegradable socking, having fastened themselves on to the rope.

After this tour we motored back to the dock where we discussed what we had seen, talked a bit more with Mr. Swanson, then drove back to Ellsworth. At Ellsworth we said good bye to Dana, Sally and Mike, thanked them for the very informative visit, and Jess, Gene and I drove to Portland Maine to spend the evening. The next morning we drove to Boston to let Gene off at the airport, Jess and I drove to NER for the afternoon. Later that afternoon I drove Jess to the airport and out visit was concluded.

This trip was very informative and showed the breadth of the aquaculture industry in Maine, and we didn't even get to far down east Maine to visit the salmon industry. One thing that stands out is the support from the state and academia that the aquaculture industry enjoys in Maine. Additionally we were struck by the wide variety of species either being grown, in the research phase or in the transition phase from research to commercial culture. The industry enjoys support from a wide variety of citizens in the state. As the industry matures in Maine there seems to be less conflict, this is resulting from the education of the industry and citizens. The merging of the aquaculture industry in Maine with the fishing industry was also striking. There was a real commitment to keeping rural areas economically viable.



Map 8. This map shows the sites visited in Rhode Island. Point #1 is Warren Rhode Island, site of the marine ornamental fish farm. Point #2 is East Greenwich, RI; the RV Jack Reed is moored there. Point #3 is Roger Williams University. Point #5 is the site of a shellfish farm and a nearby restaurant both owned by the same person.

STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: **STATE:** Rhode Island DATE: June 22, 2009

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Various aquaculture sites in Rhode Island

PERSONS CONTACTED: Various, hosted by David Beutel, RI CRMC

ACCOMPLISHMENTS:

As part of my continuing process to become familiar with the aquaculture industry in the Northeast Region, Harry Mears and I recently visited Rhode Island to learn the extent of the aquaculture industry in the state and to meet with some of the industry participants.

We met at 8 am at the RI Coastal Resources Management Council's research vessel, RV Jack Reed in East Greenwich RI. The plan was to begin our visit to Rhode Island with a visit to a submerged long line oyster and mussel farm in the eastern side of Narragansett Bay. We met Mr. David Beutel, the RI aquaculture coordinator, Mr. Dan Goulet, the RI dredging coordinator and the vessel's captain, and Mr. Bill Silkes, the farms owner, at the dock. Unfortunately the weather was against us, as it was blowing 25 knots out of the north northeast, and we abandon the planned visit. Harry was given a tour of the RV Jack Reed. The vessel is used by the agency to monitor dredging activities, aquaculture farms and is capable of conducting sonar surveys and being used as a platform for conducting research with local university professors. We then made backup plans on the fly and visited Mr. Silkes shellfish distribution facility in North Kingstown.

Picture 1. The RI CRMC boat the RV Jack Reed. (Photo courtesy of RI CRMC)

Mr. Silkes' company, American Mussel harvesters, is a major participant in the shellfish distribution business. The company imports shellfish from Canada, and buys American grown and wild harvested shellfish. The company then packages the product for delivery to restaurants. The company ships 2 semi loads of shellfish daily, one semi load goes to a Boston distribution center where shellfish is shipped to Boston area restaurants, and then on to Logan airport for shipment around the country. Another semi load goes to the New York City area. There are also smaller refrigerated trucks that make local deliveries to the RI and surrounding Massachusetts and Connecticut areas.

We began the tour by inspecting the shellfish aquaculture gear Mr. Silkes had stored at the site. Mr. Silkes is also the principal owner of Salt Water Farms, a 20 acre shellfish farm utilizing submerged line methodology to culture oysters and mussels. Mr. Silkes showed us the pad where equipment from his farm is brought ashore to be cleaned. The local USDA office assisted with the design and construction of the pad which collects the debris that is washed off the gear for eventual recycling. The debris is sold to a composting company which adds it to their compost mix. The water is also collected and reused in the cleaning process. Mr. Silkes showed us how the gear is used and displayed a number of cage units that were ready to be deployed. Then we walked over to the docks adjacent to the facility to look at a shellfish upweller the farm uses and the farms boats, both of which were at the dock because of the weather. At the dock we inspected a shellfish upweller and the two boats used on the farm. Mr. Silkes related how once he had hired a manager who used to be in the lobster fishery to run the farm, thus had commercial experience, all the on water farm work went much smoother than before. Of the two boats used on the farm one was owned by the farm and the other was owned by the manager, who hoped to establish his own farm in the near future. Mr. Silkes related to us how the culture gear used on the farm was brought into the dock on the boats, unloaded, harvestable product was separated and moved into the processing facility, and the remaining gear was cleaned and then returned to the farm.

Picture 2. One of the local delivery trucks.

Picture 3. Mr. Bill Silkes explaining how the shellfish farm gear is deployed to Mr. Harry Mears, NMFS/NER/SFCPO and Mr. David Beutel, RI CRMC.

Picture 4. In the foreground the pad and collecting station for cleaning gear, in the background a cache of shellfish cages ready to be deployed.

Picture 5. The two boats used on the farm are the green hulled 40' in the foreground and the white hulled boat two berths down.

Picture 6. Mr. Silkes showing us the juvenile shellfish growing in the upweller.

Picture 7. An upweller out of the water. The bins containing the shellfish are hung along the central spine. The pump seen in the spine pumps water out of that area, thus forcing water up through the bottom of the bins, fluidizing the shellfish and providing food.

Picture 8. The distribution plant interior. The workers in the center are cleaning and packing shellfish for distribution. The pallet of boxes in the right foreground is shellfish ready for distribution.

Picture 9. Mr. Silkes explaining the working of the shellfish holding system. The large white boxes hold the shellfish that are brought in from other areas. These shellfish are required to be in a separate recirculation system so as not allow any pathogens into the local waters. The water is circulated through a biofilter and UV filters and then back through the holding tanks.

Picture 10. This is the cold storage room where shellfish are held before processing and then after processing before shipment.

Picture 11. This is the mussel processing machinery in Mr. Silkes facility.

We then walked into the processing facility. In the facility was mussel sorting, cleaning and bagging machines, a recirculation system to hold shellfish from out of state, a grading cleaning and packing production line, and a large walk in cooler to store shellfish. This is an impressive facility, all the more impressive by the amount of shellfish distributed daily. Mr. Silkes is a knowledgeable business owner who knows the aquaculture industry well. The visit was informative to all of us.

We thanked Mr. Silkes for his time and next drove, with Mr. Beutel, to South Kingstown where we met with Mr. Perry Raso. Mr. Raso is the owner of an 8 acre shellfish farm in Potters Pond. Mr. Raso also sells at a number of farmer's markets in Rhode Island, and was in the process of opening a restaurant when we visited. Mr. Raso is also the president of the ocean State Aquaculture Association, the RI aquaculture trade organization. We spoke with Mr. Raso about the state of the industry in RI, the production from his farm, and the opening of the new restaurant. We ended up taking a short boat ride out to his farm. Potters Pond is well protected from the wind when it blows out of the west so we only got a little wet. He has 2 full time employees on the farm, another two – three part time employees who man his sales booths at the farmers markets, and soon to have kitchen staff, wait staff and a manager at his new oyster bar. We also spoke with a University of Rhode Island graduate student who was conducting research on Mr. Raso's farm over the summer. Mr. Raso is another hard working business owner who in the 6 years since starting his farm with 3 acres has grown to be the owner of a larger farm, a sea food restaurant and fish market. He certainly has kept busy over this time span, in addition to earning a master's degree in aquaculture at the University of Rhode Island.

Picture 12. On Mr. Raso's farm in Potters Pond, workers sort oysters and clean cages.

Picture 13. Mr. Raso is discussing the state of aquaculture in Rhode Island with Mr. Beutel and Mr. Mears. On the left is the oyster bar with a map of the oyster growing areas in RI on it.

Picture 14. The bar showing a detail of the map of the RI salt ponds.

Picture 15. The bar showing a map of Narragansett Bay.

Picture 16. The view from the dining room. This waterway is between Potters Pond and Point Judith Pond. Potters Pond is in the background.

Picture 17. Mr. Raso discussing the industry, the trials and tribulations of opening a restaurant and running a farm on the deck of the restaurant.

Picture 18. The sign for the restaurant, yet to be hung. The grand opening was to be two weeks after our visit. I hope to visit soon to try out the oysters.

Picture 19. The results of an experiment Mr. Raso is conducting. The experiment is in two parts, one is experimenting with seaweed culture for sale as food. The other part of the experiment is using cooking oil, Crisco, corn oil, etc. as a way of decreasing fouling. The line on the right has been coated with oil, the decrease in fouling is visually apparent.

We thanked Mr. Raso for taking time from his obviously more than overloaded schedule and then drove to the eastern shore of Narragansett Bay to visit Roger Williams University in Bristol Rhode Island. Roger Williams University is a private 4 year university. In the past decade it has been very active in the Rhode Island aquaculture arena. From a start with one director of the Center for Economic and Environmental Development (CEED) who was interested in aquaculture, the university now has four professors who are very active in the field, and three – four other professors who are interested in the field. The university also has a wet lab and lab director who is very active in the aquaculture area and a director of the oyster gardening program, in which they have 100 littoral landowners growing oysters for restoration efforts in the state. As a private university Roger Williams does not have an outreach/extension mission, yet the university has been active in shellfish restoration efforts, working with the shellfish industry, creating companies as a spin off from research and research activities.

We met with Dr. Tim Scott, the director of the CEED, Dr. Dale Leavitt, professor and extension specialist and Mr. Brad Bourque, wet lab director. Dr. Scott gave us an over view of all of the aquaculture activities the center is conducting. These activities range

from oyster gardening, shellfish restoration, ornamental marine fin fish culture, working with the fishing industry and a new component the center has just hired a shellfish pathology specialist and they have a newly hired ornamental fish researcher. An example of the university's commitment to the aquaculture program was the new addition that was being constructed. The additions total cost was four million dollars, university had acquired a one million dollar grant from Senator Reed to construct the addition and the university added three million dollars of it's own funds to complete the addition. The new addition includes specialized lab space for the shellfish pathologist, aquaculture research lab space and teaching labs.

After speaking with Dr. Scott we toured the facility. The building is bursting with activity and even the stair wells had projects in them. We toured the outside Koi pond, the research project for alternative energy powered shellfish upwellers, and the spat-on-shell tanks. We then went into the lab and saw summer student interns working on a variety of projects. There is a research shellfish hatchery, ornamental shellfish culture, a touch tank for education, and a myriad range of student projects. We then toured the new addition that was still under construction. As we looked things over the researchers filled us in on the projects underway. The level of activity is quite impressive, as was the level of student involvement in those projects. Roger Williams University's level of support for their aquaculture activities is impressive. The group of researchers and support staff Dr. Scott has assembled makes this group the premier aquaculture research group in Rhode Island and a strong player in the aquaculture industry overall.

Picture 20. Not the best picture, but this is a whale skeleton. The whale had been stranded and died. The university buried the carcass for a year, then dug up the skeleton and students put it back together. It now hangs in the lobby of the Marine Sciences Building.

Picture 21. Dr. Scott discusses the aquaculture activities of the university with Mr. Mears, Dr. Leavitt looks on. Mr. Beutel studies a map of the oyster gardening sites in RI.

Picture 22. The Koi pond just outside the Marine Sciences Building. The faculty at RWU has conducted research on nutrition of Koi. You can see the fish moving towards us hoping to be fed.

Picture 23. Dr. Leavitt, Mr. Mears and Dr. Scott inspecting a tank of algae and shellfish in a green house connected to the building.

Picture 23. Dr. Leavitt displaying a bag of oyster shell with oyster spat settled on it (remote set method). The bag of shell will be used for restoration projects.

Picture 24. In the RWU wet lab.

Picture 25. One of the species of shrimp cultured.

Picture 26. Sea horses being cultured.

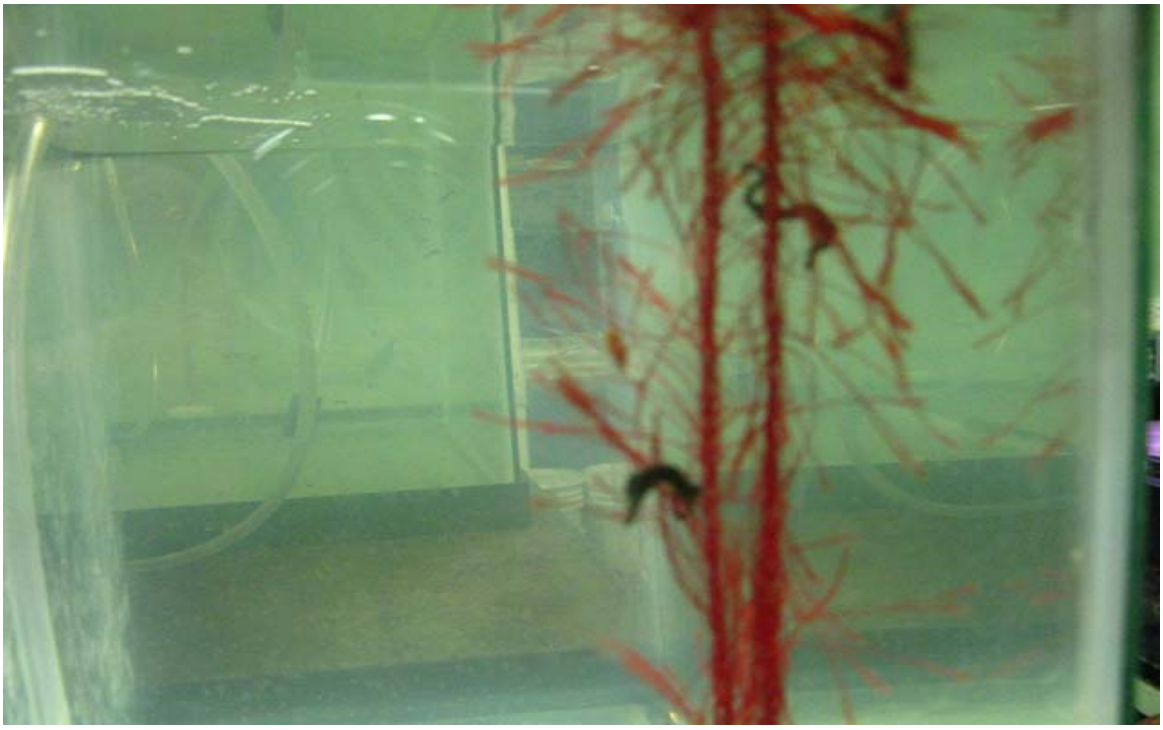
Picture 27. Juvenile clownfish being cultured.

After thanking Dr. Scott and the rest of his team we continued our tour and visited a marine ornamental fish farm that is a spin off from RWU research activities. Mr. Brad Bourque, the wet lab manager at RWU, along with Dr. Skip Pomoroy, professor of biology at RWU and Mr. Ron Fortunati, an RWU aquaculture program alum, started their private company, New England Marine Ornamentals (NEMO) a little more than a year ago. The company moved into an old mill building in Warren RI. The room they lease is crowded with tanks and support systems. Mr. Bourque reports that the company is close to breaking even on sales of product and they have plans for expanding. Currently all expansion capital is coming out of operating cash flow. Their market is the immediate Rhode Island area and parts of Massachusetts. They are raising a number of species, clown fish, cleaner shrimp, seahorses, and researching methods to produce other species economically. The company's facility is certainly a striking difference from the RWU facility. You can tell this company is a new start-up with small amounts of capital invested thus far. However, the market is wide open and they seem to be making a serious effort towards expansion while using only the money generated from ongoing cash flow. Mr. Bourque was optimistic about the company's future and predicted new expansion of the facility in the near future. It is quite impressive that they can produce a quality product in such a dilapidated setting.

Picture 28. The old mill complex where NEMO leases space. From the look of this place you wouldn't think there was any activity in it.

Picture 29. You raise sensitive tropical fish in here?

Picture 30. NEMO headquarters. All the water fro this operation is made up from fresh water with the addition of instant ocean type salts.

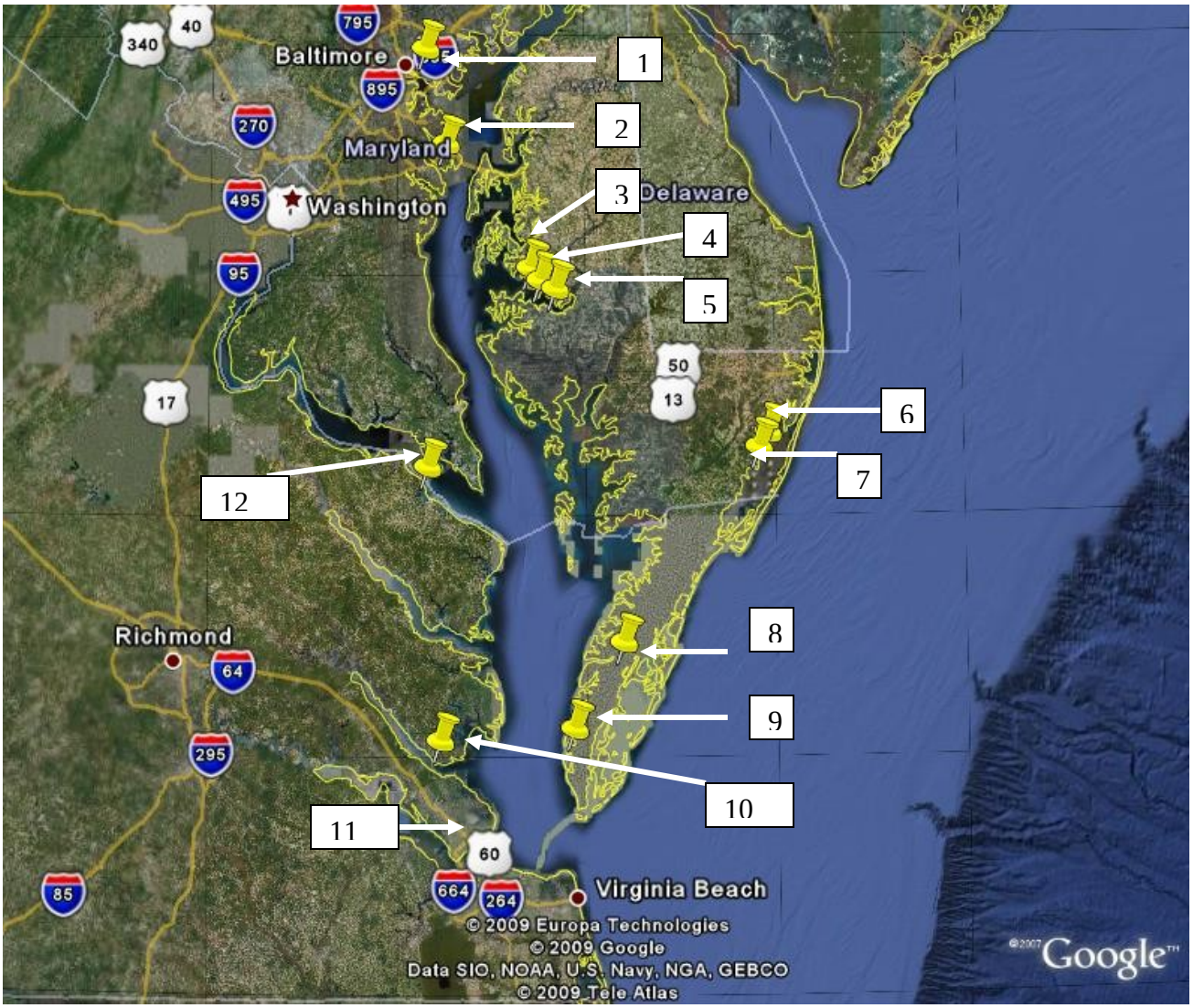


Picture 31. Juvenile seahorses.

Picture 32. Mr. Bourque is shown discussing the economics of marine ornamental fish culture with Mr. Mears and Mr. Beutel.

Picture 33. Clownfish seem to be the company's bread and butter at the moment.

We thanked Mr. Bourque and then drove back to our starting point to return to our vehicles. At the marina we thanked Mr. Beutel for hosting our tour and driving us around. The level of activity in Rhode Island is quite surprising. While almost all of the commercial activity is related to shellfish culture, with a small marine ornamental fish culture company. There is a high level of research being conducted in a number of areas. The level of expertise and experience we saw in just our one day tour was eye opening.



Map 9. This map shows the locations visited in Maryland and Virginia. Point #1 is Baltimore, location of the University of Maryland (UMD) Center Of Marine Biotechnology facility. Location #2 is Annapolis where the NOAA Chesapeake Bay Office is located. Point #3 is the UMD Horn point hatchery. Point #4 is Cambridge, MD. Point #5 is the Marinetics shellfish farm. Point #6 is a clam nursery site. Point #7 is an oyster farm. Point #8 is Exmore, Virginia. Point #9 is the site of Cherrystones Clam Farm. Point #10 is an oyster cage manufacture and farm. Point #11 is the Virginia Institute of Marine Sciences campus and Kaufman Center. Point #12 is an oyster hatchery.

STATE, FEDERAL AND CONSTITUENT PROGRAMS OFFICE
TRAVEL REPORT

NAME: David Alves **PROGRAM:** State & Federal Constituent Programs Office

AUTHORIZATION #: N/A **STATE:** Maryland and Virginia **DATE**: September 28-October 2, 2009

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Various aquaculture sites in Maryland and Virginia

PERSONS CONTACTED: Various, traveled with Dr. Peter Bergstrom of the NOAA Chesapeake Bay Office

ACCOMPLISHMENTS:

As part of my continuing process to become familiar with the aquaculture industry in the Northeast Region, I recently visited Maryland and Virginia to learn the extent of the aquaculture industry in the state and to meet with some of the industry participants. The trip was coordinated in conjunction with Dr. Peter Bergstrom of the NOAA Chesapeake Bay Office (NCBO). Dr. Bergstrom and I made arrangements with extension contacts in Maryland, Mr. Don Webster, and Virginia, Mr. Mike Oesterling, to visit a representative sample of shellfish hatchery's and farms in the region. The tour took 5 days in total and covered more than 600 miles. We ended up driving completely around the Chesapeake Bay starting in Baltimore, then to the eastern shore of Maryland, down the Delmarva peninsula, across the Chesapeake Bay Bridge-Tunnel, and then up the western shore of the bay. We visited 10 different facilities during the trip.

We began our trip Monday morning when Dr. Bergstrom and Derek Orner, of the NCBO, picked me up at the airport and we drove into Baltimore to visit the University of Maryland Center for Marine Biotechnology (COMB) on the inner harbor. We were joined on this part of our tour by Mr. Chris Botnick of the NOAA Aquaculture Program, Silver Spring, MD. The COMB facility (http://www.umbi.umd.edu/comb/home.php) is situated directly on the water and is an impressive facility. Dr. Keiko Saito, who is a senior scientist at the facility met us and gave us a tour of the facility. The facility is geared towards finfish aquaculture research, but also grows the blue crab (*Callinectes sapidus*) for restoration projects in the bay. The facility is completely comprised of recirculating culture systems and water is not used from the adjacent harbor for the culture of the fish. We were first given a tour of the crab culture project. The project has

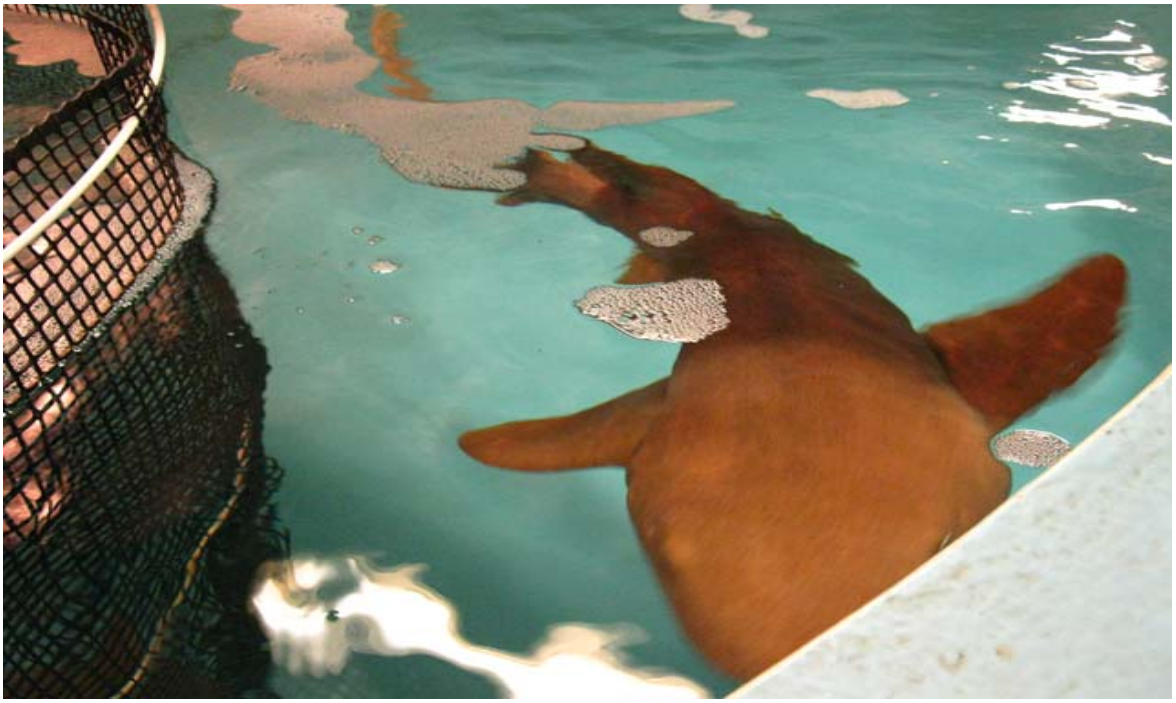
a number of colaborators from industry, the Smithonian and research institutions. We were guided through this project by Dr. Yossi Tal who was conducting the research.

Picture 1. Mr. Chris Botnick asks Dr. Yossi Tal a question about the crab enhancement project. From right to left: Dr. Tal, Dr. Keiko Saito, Mr. Chris Botnick, Mr. Derek Orner (obscured) and Dr. Peter Bergstrom.

We thanked Dr. Tal and continued our tour by inspecting the finfish part of the facility. The COMB facility had a number of systems holding multiple species of finfish. They have research underway on branzini (Otherwise known as European seabass, *Dicentrarchus labrax*. As an interesting side note the previous week there was a NOAA Aquaculture program staff retreat at the Silver Spring headquarters, at dinner the first evening the restaurant in Silver Spring had branzini on the menu) studying the economics of raising the fish for market. The facility also had striped bass (*Morone saxatilis*), nurse shark (*Ginglymostoma cirratum*) and cobia (*Rachycentron canadum*). The facility also conducts research on recirculation systems for raising finfish, and the biology and ecology of these fish.

Picture 2. A demonstration of the stages of a crab's life cycle and the feed that is necessary to culture to feed the crabs at different stages of the cycle. On the right front are two flasks with the algae necessary to culture to grow rotifers and artemia, in the two beakers to the left of the flasks, are necessary first feeds for crab larvae. The two small white containers on the left contain two early stages of crab larvae. They are so small that they were placed in white containers so they can be seen. The glass beakers near the white containers are later stages of crab larvae, there are 9 stages of development before the crabs metamorphose into adult form animals. Juvenile adult stage crabs are seen in the tray.

Picture 3. Striped Bass.



Picture 4. Nurse shark.

As the tour was winding up we had a brief discussion with Dr. Rosemary Jagus. Dr. Jagus is works on the COMB intern programs for minority students. She discussed this program with us and informed us that they were always looking for supported research for this program.

Picture 5. Dr. Jagus discussing her program with Mr. Botnick. From left to right: Dr. Jagus, Mr. Orner, Dr. Bergstrom, Mr. Botnick and Dr. Saito.

We thanked Dr. Saito for the tour, Mr. Botnick returned to Silver Spring, and Dr. Bergstrom, Mr. Orner and I drove to the NCBO offices in Annapolis Maryland (http://chesapeakebay.noaa.gov/index.aspx). Here we said good bye to Mr. Orner and I had a brief tour of the NCBO offices. I met briefly with the deputy director Sean Corson and we had a short conversation about the coming tour and aquaculture in the Chesapeake Bay. Dr. Bergstrom and I then drove to Cambridge Maryland, where we had dinner and spent the evening.

The next morning Dr. Bergstrom and I drove to the University of Maryland, Center for Environmental Science, Horn Point Oyster Hatchery (http://hpl.umces.edu/hatchery/home.html). Here we were met by Dr. Don Meritt, the Hatchery Program Director. We were also joined by Mr. Don Webster, MD Sea Grant Extension for aquaculture and Mr. Karl Roscher, the MD aquaculture coordinator. We began the tour with a discussion of the facility's goals and accomplishments. The Horn Point Hatchery concentrates on spat-on-shell production and is geared up to produce 6 billion spat a year. The scope of the operation is impressive and the production capabilities are a result of years of experimentation and improvement. The facility has quarantine facilities, labs, algae production and all the machinery necessary to process, move and plant tons of spat-on-shell oysters for restoration.

I highly recommend you take a look at the picture gallery on the Horn Point web site. They show the facility and processes in high quality photographs. The gallery can be accessed at: http://hpl.umces.edu/hatchery/gallery/index.html.

Picture 6. University of Maryland, Center for Environmental Science, Horn Point Oyster Hatchery.

Picture 7. Part of the Horn Point facility. The tanks are used for putting shell into then adding eyed oyster larvae, which then set on the shell. Large metal cages of shell ready to have spat set on them can be seen on the left.

Picture 8. The aquarium, set up for educational purposes, shows an oyster reef with the assemblage of fishes that might be found on it. It is used to illustrate the ecological services of an oyster reef in the bay.

Picture 9. If you plan to produce billions of oyster larvae, you need large tanks to do it efficiently. These tanks are the mass larvae culture system. This type of production and facilities are taken after hatcheries on the west coast. There were at least a dozen of these tanks in this one room.

Picture 10. Mass culture of oyster larvae takes mass culture of algae to feed them. This is the automated algal culture section of the lab. Notice the high intensity lights over the tanks. The system is automated and controlled by computer. The algae is pumped into the larval culture tanks and the density in the tanks is adjusted automatically. From left to right: Mr. Roscher, Dr. Bergstrom and Mr. Webster.

Picture 11. To plant the amount of shell that this facility produces you need to have efficient movement of large quantities of product. The traditional way of producing spat-on-shell is to put clean oyster shell in onion bags. These metal cages make handling large volumes of shell much more efficient.

Picture 12. The cages full of shell are moves with forklifts and put into tanks. In this picture you see cages in a tank before the water is put in. After the water is added air stones are put in to keep things moving, and then the eyed oyster larvae are added. Eyed larvae are ready to set on a substrate, and they naturally prefer other oysters to set on. Once the eyed larvae set the cages are moved to a barge and then set out in the environment for restoration.

Picture 13. This picture shows just a small portion of the oyster shells that are used per year and a boom truck used to move it.

Picture 14. Here we see a large number of cages with clean and washed shell ready to go into the tanks for spat settlement. The shell is washed and clumps broken up before being used.

Picture 15. Dr.'s Bergstrom and Meritt looking at the amount of shell to be put in cages that day and a piece of heavy equipment used to move the shell.

After touring the facility at Horn Point we were joined by Mr. Botnick. Then Mr. Botnick, Webster, Roscher, myself and Dr. Bergstrom drove south to a private oyster farm, Marinetics (http://www.marineticsinc.com/). This farm is three acres on the Choptank River. We were met by the manager, Mr. Kevin McClarren. Mr. McClarren spoke with us at length on his company's methodology in raising oysters and the business side of things. We toured the farm, which basically consists of one pier, a boathouse at the end of the pier which is now used as work space and space for upwellers in the boat berth in the house, and three acres of floating cages. The oysters grown here are branded as Choptank Sweets and sold in Baltimore and Philadelphia. There were 4 employees working on the farm the day we visited.

Picture 16. This is the view from shore looking out at the pier and boathouse and half of the farm. All of the oysters grown on this farm are cultured in floating cages.

Picture 17. Looking towards the shore from the pier. The floating cages, stacked on the right, comprise PVC frame with a plastic box secured in the middle. As one side of the cage gets clogs with fouling organisms the cage is flipped over. This allows water flow into the oysters, thus bring food to them. The side that is sunny-side-up dries in the sun and is later cleaned off. The cooler in the background is used to store market ready oysters for shipping.

Picture 18. This is an old fashioned boathouse the likes of you don't see very much anymore. Boats were berthed in the slip under cover. Now it contains the upwellers culturing the juvenile oysters before they are transferred to the floating cages seen previously.

Picture 19. In the boathouse, the crew uses a sorting machine to sort the juvenile oysters by size.

After touring the farm we thanked Mr. McClarren and Mr.'s Roscher, Webster, Dr. Bergstrom and myself drove much further south down the Maryland portion of the Delmarva Peninsula to visit Mr. Steven Gordon at his grow-out facility.

Here, at a facility near his house, Mr. Gordon runs a land based nursery for juvenile hard clams (*Mercenaria mercenaria*). This nursery supplies clam seed to the almost 200 acres Mr. Gordon leases from the state to grow-out the clams. Mr. Gordon is also in the process of building a clam hatchery to supply his farm. Mr. Gordon works full time in the seafood processing industry and the clam nursery and farm is a sideline.

Picture 20. Mr. Gordon's nursery facility. The screening is to keep birds off of the trays of clams, to shade the facility and to make the facility less obtrusive to neighbors. The large white pipe is the water distribution pipe. Water is pumped in from the salt pond, this facility is on the ocean side of the eastern shore, the water is not filters and the algae in this water feeds the juvenile clams.

Picture 21. Mr. Gordon explains the operation.

Picture 22. This old Chesapeake Bay crab fishing boat converted into a Tiki bar.

We thanked Mr. Gordon for showing us his facility and then jumped in the vehicles for the last stop in Maryland. Almost to the Virginia line in Chincoteague Bay, Maryland we visited the Great Eastern Shellfish Company. This operation is as ramshackle as you can get, but still manages to support the two owners. Everything on the farm is home made, and there are literally household extension cords running everywhere. This farm has had issues with disease in the past two years and they are now ramping up production again after losing almost all of the oysters that were being cultured. The owners, Mr. Luke Breza and Mr. David Chamberlain are the owners. Mr. Chamberlain establishing the farm and built all of the equipment. The farm is in a beautiful location on Chincoteague Bay. The production was modest, a few hundred thousand oysters yearly, but the expenses are minimal.

Picture 23. Great Eastern Oyster Farm. Those are household extension cords, like you might possibly find in your garage, strung up on the poles. They supplied power to the whole seaside operation. That is Chincoteague Island is in the background.

Picture 24. It was blowing pretty hard out of the south the day we visited. We were told that was a good thing or the mosquitoes would have carried us away. The farm is a little over an acre and uses floating cages to culture oysters.

Picture 25. Mr. Breza explains the operation of the elevated upwellers used as a nursery system on this farm.

We thanked Mr. Breza and Chamberlain for taking the time to show us their farm. Dr. Bergstrom and I took out leave of Mr. Webster and Mr. Roscher, we thanked them for their assistance in scheduling the Maryland part of the site visit and for the information they shared about Maryland aquaculture during the day. It was an interesting tour with a range of facilities from very high tech at Horn Point to the most basic down home engineering at the Great Eastern Oyster Farm. Maryland was late to the aquaculture game but is striving to catch up. We then headed south to Exemore Virginia to spend the evening.

The next morning we met with Brian Fredieu of the NOAA Aquaculture Program in Silver Spring. Brian would be joining us for the remaining two days of the tour. We drove south to visit Cherrystone Aqua Farms (http://www.littleneck.com/index.php). Cherrystone grows and sells 65 - 100 million clams a year making them the largest producer in the country of hard clams. Here me met with Mr. Mike Oesterling, VA Sea Grant Extension aquaculture specialist. Mr. Oesterling had worked with Dr. Bergstrom and myself to arrange this Virginia part of the tour. We also met with Dr. Mike Peirson the President and General Manager of the farm. Cherrystone has it's own shellfish hatchery, and thousands of acres of leased lands for nursery and grow-out phases. The package and ship their product around the country. Cherrystone Aqua Farms is a division of Ballard Fish and Oyster Company, Inc., a wholesale seafood distributor in the business since 1895. The company is in the early phases of expanding their product line to include oysters. An interesting review of the company can be found in a video found on their

web site at: http://www.littleneck.com/how-we-grow-our-clams.php. We toured the farms hatchery, nursery, packing and storage facilities. This operation is impressive in its scale, 65 million clams a year shipped takes 75 employees and several contract growers working full time to produce. After touring this facility Mr. Oesterling led us across the Chesapeake Bay Bridge Tunnel to the College of William & Mary, Virginia Institute of Marine Science Campus.

When we arrived we met Dr. Stan Allen at the research shellfish hatchery on campus. More information about the facility can be found on line at: http://web.vims.edu/abc/HatcheryTour.html. There we had a discussion with Dr. Allen on his work and the general state of aquaculture in Virginia. After this discussion we finished for the day and retired to hotel in Gloucester, Virginia. The next day we met Dr. Allen at the Kaufman Aquaculture Center. The Kauffman Aquaculture Center (KAC) lies 30 miles north of VIMS' main campus on a tributary of the Rappahannock River known as Locklies Creek, it is a rural area. The Kauffman Center was specifically designed to enhance and extend the work and facilities of VIMS' Aquaculture Genetics and Breeding Technology Center (ABC).

Picture 26. Inside the Cherrystone Aqua Farms clam hatchery. The facility is configured for mass production of clam seed for the farms 1000's of acres of grow out plots.

Picture 27. Ms. Tara Riley, the manager of the facility, shows up some clam seed. The hatchery was pretty much shut down for the season with only small amounts of seed still in the upwellers.

Picture 28. The nursery facility is located beside the hatchery. These tanks have raw sea water run through them.

Picture 29. In this picture we are looking westward over the bay. These are more nursery tanks. There is a nursery plot in the water in the background; you might be able to barely make out the stakes marking the plots.

Picture 30. This is containers of clam seed ready to be planted on nursery plots in the bay. If you look at the video produced by the farm you will notice that they use these Styrofoam containers because they float in the quadrates delineating the plot to be planted. On the left is Mr. Brian Fredieu, on the right Dr. Mike Peirson explaining the process.

Picture 31. In this picture we are looking at the packing room at Cherrystone. Each of these machines sorts, counts and bags clams for shipment.

Picture 32. In this picture we see clams that have come in from the farm waiting to be sorted and bagged for shipment to the customer.

Picture 33. The research shellfish hatchery on the VIMS campus.

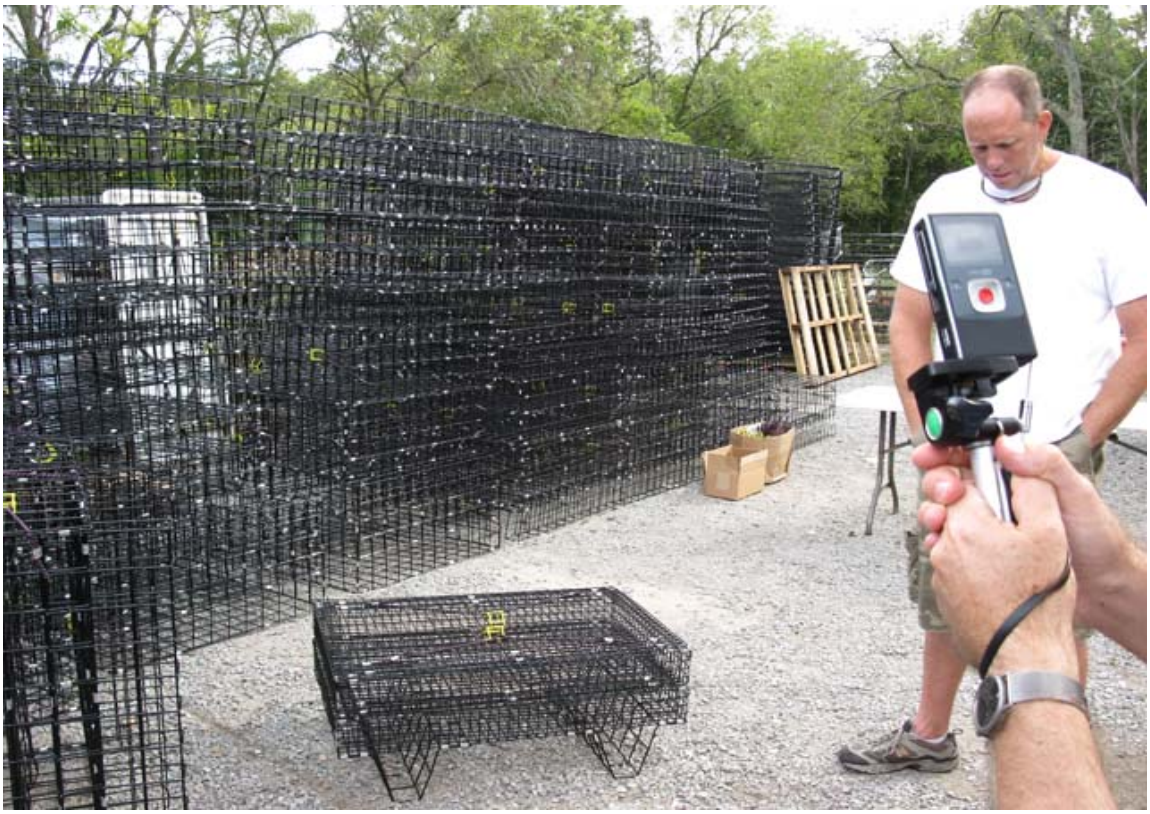
Picture 34. You would never guess this is a shellfish research center. This is the VIMS Kaufman Aquaculture Center. It was designed for with two major considerations: 1) to fit in with one of the major donors homes which is located adjacent to the center and 2) to function as a quarantine facility for working with non-indigenous shellfish species.

Picture 35. This is the inside of the Kaufman Center showing the large containers for algal production.

Picture 36. This picture shows the balcony where the algal production tubes are accessed. The bottom of these algal culture tubes were shown in the previous picture. On the left is Mr. Fredieu, in the background is Mr. Oesterling and in front of him is Dr. Allen. Dr. Bergstrom is on the far right.

Picture 37. In this picture Dr. Allen is describing the attributes of the facility. Each of the tanks in the background is filtered by separate recirculation systems. All of the waste water is treated before release, the building has negative pressure and there is restricted access. There were no non-native species being held at the time of our visit.

After the tour we thanked Dr. Allen for the tour and hit the road heading for Wake Virginia. In Wake we visited the Chesapeake Bay Oyster Company. The two owners, Doug McMinn and Irv Spurlock, are engaging and knowledgeable. The company builds equipment for other growers and has a farm growing Parrot Island Oysters. The farm is near the mouth of Virginia's Rappahannock River. We first met these gentlemen at their facility (in reality it was the garage adjacent to Mr. McMinn's home) where 4 employees were manufacturing cages for use in oyster culture. Many of these cages were destined for participants in the Blue Crab Disaster Relief funding administered by the State/Feb office. Mr. McMinn was quite willing to talk to us about all aspects of their manufacturing operation, their farm and aquaculture on the western shore of Virginia. More information can be found on their web site: http://www.bayoyster.com/. Be sure to check out their youtube channel at: http://www.youtube.com/user/bayoyster. Both sites are very instructive. One of the things that really struck our group is that Mr. McMinn and Mr. Spurlock are teaching prospective how to grow shellfish in addition to selling equipment. Mr. McMinn was previously a science teacher in the local school system before he made the transition to oyster farmer and equipment manufacture. When perusing the youtube channel you will notice that much of the content is geared to teaching people how to farm oysters. They are very open with information and willing to work with new entrants in the industry.



Picture 38. In this picture Mr. McMinn is discussing the types of gear the company makes. The cage on the ground is a type that many growers in this area use.

Picture 39. In this picture Mr. Spurlock displays another type of cage that his company builds. The company sells mostly to other growers in Virginia.

Picture 40. In this picture Mr. McMinn discusses the shore side operation. In the background is a shellfish sorter/tumbler.

After thanking Mr. McMinn and Mr. Spurlock for their time we loaded up in the cars and made the last visit of the tour. We headed north to the small town of Kinsale, Virginia to tour the Bevans Oyster Company shellfish hatchery. The hatchery is owned by three local shellfish harvesting and packing companies. Bevans is one of the three companies owning the hatchery and it is located on Bevans property . The manager is Mr. A. J. Erskine who gave us a tour of the facility. The facility has been in operation for one year now. Mr. Erskine told us that the demand for oyster seed has blossomed thus the decision by the three companies to band together to fund a hatchery to supply seed oysters. More information on the Bevans Company can be found at: http://www.bevansoyster.com/index.htm. Further web pages specifically on aquaculture can be found at: http://www.bevansoyster.com/gallery/aquaculture.htm and http://www.bevansoyster.com/gallery/dredging.htm.

Picture 41. The three companies funding the hatchery primarily produce shucked oysters for market. Thus the hatchery is producing spat-on-shell oysters that will be planted on leases. Mr. Erskine displays a clump of market size oysters that are heading for the shucking house.

Picture 42. This picture shows is a large west coast style upweller. The water is moved by the paddle wheel in the background. This is an extremely efficient way to move large amounts of water. The square bins contain the shellfish seed. An interesting video showing this upweller in operation can be seen at:
http://www.youtube.com/watch?v=z5oDgQG2I74

Picture 43. The hatchery is located in this old oyster packing house on the right. Not a very good picture, but this is Mr. Erskine discussing the operation with us.

Picture 44. Some of the oyster grow out plots as seen from the hatchery grounds.

We thanked Mr. Erskine for his time, said good bye to Mr. Oesterling and thanked him for his assistance in setting up the Virginia portion of the tour. Dr. Bergstrom, Mr. Fredieu and I headed north and back to our respective home bases. Mr. Fredieu headed back to his office in Silver Spring, Dr. Bergstrom and I headed back to the NCBO in Annapolis. We dropped off the government car and then Dr. Bergstrom drove me to the airport hotel. It was a long day, I didn't finish until 7:30 that evening, at the end of a long trip. We covered more than 600 miles and visited 10 different aquaculture sites on our trip. I was struck by how much activity there is in Virginia. Maryland is just beginning its effort to catch up. The difference, according to the people we talked to on out tour, was the support the government in Virginia gave to the aquaculture industry. For this support Virginia has an active shellfish culture industry worth close to $30 million. The trip was very instructive, I was able to let folks know that there was an NMFS aquaculture point of contact in the regional office and additionally I was able to make contact with some of the aquaculture industry in the area. I look forward to learning more about the industry in the Mid-Atlantic States and representing NMFS to these industry participants.

Map 10. This map shows the sites visited on Long Island, New York. Point #1 is the location of Pipes Cove oyster farm. Point #2 is the location of the FM Flower's hatchery and farm in Oyster Bay, NY. Point # 3 is the location of the Shellfishers Preserve. Point #4 is the location of Multi Aquaculture Systems. Point #5 is the location of the Suffolk County Extension offices.

OPERATIONS AND BUDGET DIVISION
TRAVEL REPORT

NAME: David Alves **PROGRAM:** Aquaculture, Operations and Budget Division

AUTHORIZATION #: N/A **STATE:** New York **DATE**: November 9-10, 2009

PURPOSE: Site visit

PROJECTS AND AREAS: Ongoing coordination effort

AWARD #: N/A

AWARDEE: N/A

PROJECT: Various aquaculture sites on Long Island, New York

PERSONS CONTACTED: Various, Host was Mr. Gregg Rivara, Cornell Cooperative Extension

ACCOMPLISHMENTS:

As part of my on going effort to visit each coastal state in the North East Region I visited Long Island, New York 0n November 9th and 10th, 2009. On the morning of the 9th I took the early ferry from New London to Point Orient on the north fork of Long Island and after arriving at Point Orient drove to the Suffolk County marine Environmental learning Center, operated by the Cornell Cooperative extension in Southold New York.

The learning center is home to a number of activities including eelgrass restoration, oyster gardening, adult education, horseshoe crab research among other activities (please see: http://ccesuffolk.org/marine/ for a complete list of the activities). Here I met Mr. Gregg Rivara who is the Cornell Cooperative extension marine and aquaculture extension agent for the county. He gave me a tour of the facility which is on the water and has a number of shellfish restoration projects underway and a shellfish hatchery to support these efforts.

Picture 1.

Picture 2. A dock at the Learning Center. The barge is used in the restorations efforts.

Picture 3. Eel grass for restoration efforts being cultured in a greenhouse at the Learning Center.

Picture 4. The SPAT shack, “Southold Project in Aquaculture Training” is a volunteer effort for oyster gardening and restoration. An interesting article on this project in the New York Times can be read at(you might have to copy the link and paste it in your browser): "Marine Dreams: an Oyster in Every Plot" (from the Long Island Journal section of The New York Times on January 21, 2001)
http://www.nytimes.com/2001/01/21/nyregion/long-island-journal-marine-dreams-an-oyster-in-every plot.html?scp=1&sq=long%20island%20journal:%20january%2021,%202001&st=cse

Picture 5. The learning center from the water. The plots at the waters edge are experimental plots for salt marsh restoration efforts. There is shellfish gear all over the place; from bags on the shore, lantern nets hanging off the float, to upwellers central tubes lying on the float.

Picture 6. The shellfish hatchery in the learning center. The hatchery produces seed for the SPAT project and restoration efforts.

Picture 7. Bay Scallops in a lantern net hanging off a dock at the learning center.

After touring the facility we drove to the Peconic Land Trust Shellfisher Preserve (http://www.peconiclandtrust.org/shellfisher_preserve.html) where Mr. Rivara is the care taker and his wife, Ms. Karen Rivara operates the Aeros Shellfish Hatchery. The hatchery leases the facility and is a commercial shellfish hatchery which is a member of the Noank Shellfish Cooperative which is a coop of 16 members. Ms. Rivara also operates a shellfish farm in the area. Mr. Rivara gave me a tour of the facility. The Shellfisher Preserve is the site of the former Shelter Island Oyster Company shellfish farming facility, owned by John & Anna Plock and John Plock, Jr., located in Southold, New York. The Land Trust and the Rivara's have been restoring the facility. The restoration web page can be viewed at: http://www.peconiclandtrust.org/restoration.html. The hatchery is located completely underground, there is a green house for algal production, a tidal creek with a quonset hut type building over a 155' section of it used for a nursery. It is quite the facility and could not be replicated today due to cost and environmental considerations.

Picture 8. The entrance to the Shellfisher preserve.

Picture 9. From this angle the only way you can tell there's an underground structure at the Aeros Hatchery is the chimney and exhaust stack coming up out of the ground. The green house for alga production is to the right, a quonset hut on the left is used for storage of gear.

Picture 10. Inside the Aeros greenhouse. The algal production tanks. Plastic bags sealed at each end go into the wire containers. This is a continous production system where airlines and water lines go into the bags and overflow alga production continously drips out through another tube. The production then goes down into the underground hatchery to feed the shellfish.

Picture 11. The entrance to the underground hatchery. The chminey, greenhouse and quonset hut previously seen in picture number 9 can be seen above the wall.

Picture 12. Ms. Rivara and their dog argo (as in *Argopecten irradians* the genus and species name for bay scallops) in the entrance to the underground hatchery.

Picture 13. Another room in the underground hatchery. These tanks are conical and used for larval shellfish production.

Picture 14. The small marina at the preserve. The building to the right is built over a waterway and is used as a shellfish nursery. There is an upweller in the water to the right of the dock and a float behind the upweller with a shellfish drum seed sorter on it.

Picture 15. This is the interior of the building built over the slough. It is used for shellfish nursery production.

After the tour of this facility Mr. Rivara and I drove across Shelter Island, taking a small car ferry on to the island and then off the island, and to the Multi Aquaculture Systems facility located in Amagansett, New York. Amagansett is the twon just west of Montaulk NY. So it was a bit of a drive to get there. There we met with the owner of the facility Dr. Robert Valenti, his wife Dr. Marie Valenti, Mr. Robert Link and an associate of Mr. Links. Here I learned that Dr. Valenti was proposing to partner with Mr. Link to resurrect the fish farm permitted in the mid 1990's at Plum Island, on the North Fork of Long Island. This farm was origionally permitted to grow summer flounder and has been dormant for a number of years now. We discussed the endeavor and permitting that might be necessary to culture striped bass. Later Dr. Valenti gave me a tour of the facility. It is quite the ramshackle operation, with geese, pure bred African Lion Hounds, chickens, too many cats to count and fish. There are approxitmately 8-10 large tanks for fish culture, a small hatchery and nursery facility. Currently the facility is used to hold fish that Dr. Valenti purchases, holds and then resells. His wife, Dr. Valenti runs a small take out restaurant, the Sea Slug Lounge, and gift shop on the site. They do not have a web page but a description of the facility can be found at: http://www.tripadvisor.com/Restaurant_Review-g29806-d1165106-Reviews-Sea_Slug_Lounge_at_Fish_Farm_Multi_Aquaculture_Systems-Amagansett_Long_Island_New_York.html. It was a very interesting place and the Valenti's are very nice people. I did buy some fig chutney and soap from France to take home as a gift.

Picture 16. Multi Aquaculture Systems main building. The fish tanks were to the left. The store and take out were on the right just past the flag. The aquaculture systems office is in the front right.

Picture 17. A greenhouse skeleton missing the plastic cover. The large tanks are currently used for holding wild caught fish.

Picture 18. Black Sea Bass are held in the totes. Escapees from the totes hang out under the totes.

Picture 19. A small hatchery in a attached greenhouse. In the past the systems were used to spawn and culture finfish.

Picture 20. At the Multi Aquaculture Systems facility, Mantis shrimp being held for the live bait market.

Picture 21. The sun was setting as we took the ferry from the north end of Shelter Island back to the North Fork of Long Island.

Picture 22. Pipes Cove Oyster Farm. The floats in the foreground delinate the swimming area for the motel. The boat is moored on the farm which is just offshore from the swimming area.

After an enjoyable couple of hours spent in the company of the Valenti's, Mr. Rivara and I said good bye and we then drove back across Shelter Island to Greenport to visit the Pipes Cove oyster farm (http://silversands-motel.com/Pipes%20Cove.htm). Here me met with Mr. Ed Jurczenia and his partner Mr. Dean Yaxa. Mr. Jurczenia owns and operates the Silver Sands Motel and his oyster farm is just off the hotel property. Mr. Yaxa is a retired fisherman. It was almost dark when we found these two gentlemenn on the beach. We discussed the farm and how things were going as the sun set over Peconic bay. These gentlemen are quite proud of the oysters they grow. I asked if the motel guests had any concerns about th farm being so close to the motel, just outside the marked swimming area. They informed me that most of the guests were interested in the farm and eager to learn what they were doing as they landed the boat. It was a good education experience for the guests. I have attached a article from the magizine "Edible East End" about these gentlemen and their farm. By now it was dark and pretty chilly. Wd thanked Mr. Jurczenia and Yaxa for their time and we took our leave.

Mr. Rivara and I then drove back to Southold where we chatted for a while before going out with Ms. Rivara to a local eatery for dinner. Here we discussed the state of the aquaculture industry on the island, the politics and issues confronting it over some very tasty locally caught fish. Ms. Rivara is active in local politics and is an officer in the East Coast Shellfish Growers Association. Mr. Rivara has been active in shellfish culture and restoration for decades. Between the two of them there's a wealth of information to be learned.

The next morning, after breakfast Mr. Rivara and I drove to the other end of Long Island to visit the Frank M. Flowers and Sons Shellfish Company in Oyster Bay NY. Here we met with Mr. Dave Relyea one of the owners of the company. The company has been in business more than a 100 years growing shellfish, oysters and clams, in the Oyster Bay area. The facility we visited was for their hatchery. They have another facility for the harvesting boats and landing and shipping the shellfish. They have thousands of acres of leases in the area. This facility is only 25 miles or so from New York City, one of the last places I would expect a shellfish farm to be.

Picture 23. A sign announcing the company has been in the same location since 1887.

Picture 24. Mr. David Relyea explaining how the alga needed for the hatchery is cultured in the large tanks. While the basics of algal culture is pretty standard, each facility has it's own way of accomplishing the task.

Picture 25. Flowers has an interesting way of culturing the larval shellfish. The shellfish are held in the smaller tanks that are inside the larger tanks. The larger tanks hold alga culture which is then pumped up to the shellfish. They evolved this system due to space constraints.

Picture 26. The marine railway used to haul the company's boats.

Picture 27. Another building in the facility. That is Oyster Harbor in the background. This building is used for juvenile culture.

Picture 28. The interior of the building seen in picture number 27. This shows the assorted gear and tanks necessary for juvenile shellfish culture.

Picture 29. Another view of the facility. The racks on the dock are home made juvenile culture racks. The racks have plastic mest attached to hold the juvenile shellfish.

We toured the facility which includes a shellfish hatchery, algal production, a marine railway to haul and repair the company's boats, and nursery grow out. Mr. Relyea gave me an interesting video on DVD detailing the history of the oyster in oyster bay. Mr. Relyea was very appreciative of the assistence he has received from the NEFSC Laboratory at Milford Connecticut. He shared with us that the scientific expertise at the lab has been invaluable to his company's continued existance over the years.

After the tour we thanked Mr. Relyea for his time and headed back to Southhold. We grabbed a quick fast food meal to eat in the car as I was hoping to make the 3 pm ferry back to Connecticut. We ended up getting back to Southhold at 3 pm, not enough time to make the ferry which was still an half hour drive further up the north fork of Long Island. I made reservations for the next ferry at 5 pm, and sat in the Learning Center's library and caught up with paperwork and e-mails. At a little bit after 4 I thanked Mr. Rivara for his assistence in arranging the visit and hosting me. I then drove to Point Orient where I caught the 5 pm ferry to the mainland.

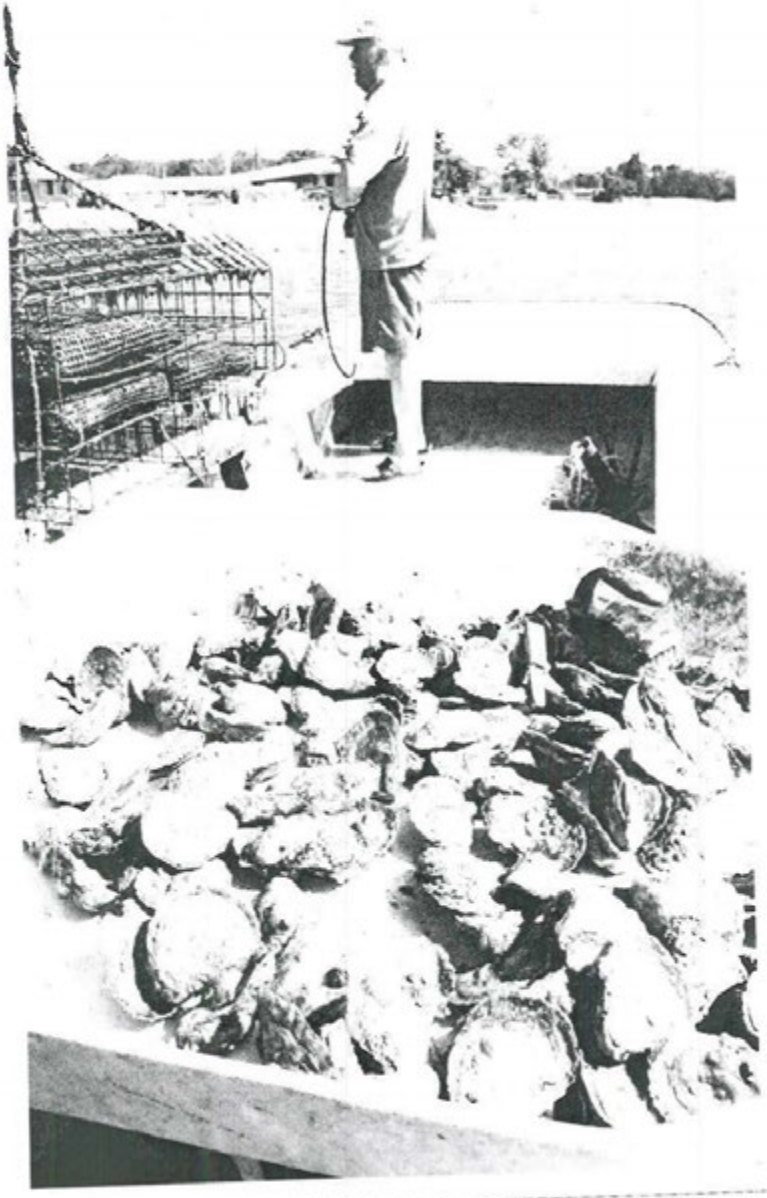
As all of my site visits to the various coastal states in the Northeast Region have been, this visit to New York was very informative. The aquaculture industry here ranges from a company within 25 miles of New York City that has been in business for more than a hundred years, small botique growers on the western end of the island, an underground shellfish hatchery and a fin fish facility that was dormant but the principals are planning to bring back on line. The people I was fortunate enough to meet all seem to be very capable and competent.

OUT TO SEA

BY E.L. WYVES

BURIED TREASURE

In Greenport's legendary oyster beds, a boutique brand rises.



GREENPORT—A little more than one hundred years ago, when New York City's ravenous appetite for oysters—and its cumulative soiling of its surrounding waters—depleted the shellfish beds around Manhattan, Greenport rose to fill the demand.

"The whole bay bottom was cut up into oyster beds," said Ed Jurczenia, whose family owns the Silver Sands Motel and Beach Cottages just west of Greenport Village. In his book, *The Food and Wine of the North Fork*, John Ross notes that as early as the 1920s companies like Lester and Toner, J. & J.W. Ellsworth, and the Greenport Oyster Company ran extensive harvesting and processing operations. (Ellsworth maintained an office in London to handle its European business.) Steam powered boats dredged thousands of acres of bay bottom, and a good shucker could process eight gallons of oyster meat a day. Greenport High School's teams used to be the Oystermen. (They are now called the more gender-neutral Porters.) These were legendary finishing grounds, sheltered from storms but with a salt content reminiscent of the ocean that could punch up the flavor of young oysters brought in from elsewhere. Pipes Cove, the area just in front of the Silver Sands that looks onto Shelter Island, was particularly well-suited.

"I remember in the first grade we went around and everybody said what their father did," said Jurczenia, who grew up in Greenport. "And everybody was in the oyster business except me."

But in the 1950s, a combination of pollution, overharvesting and a couple of well-publicized food poisonings decimated the local industry. Production dropped from a high of about 25 million pounds of oyster meat in the 1920s to one million pounds in 1960. It seemed as though Greenport would never ship another oyster to the Big Apple. Until today.

Six years ago, Jurczenia received a cache of 1500 baby oysters from the nearby Cornell Marine Center. Today, his supply stands in the hundreds of thousands and Pipes Cove Oysters is one of a growing number of start-up oyster farming ventures that have become the toast of New York connoisseurs again. The Grand Central Oyster Bar's Fifth Annual Oyster Frenzy on September 28 and 29 will feature Pipes Cove's harvest side by side with 30 other top oysters from around the world.

"The problem is not selling them," said Jurczenia recently as he waited on the shore for his longtime friend and new business partner Dean Yaxa to motor over with his first harvest of the morning. "Even if everybody growing them here on the Island quadrupled their business, there's still too much demand." While the price of a clam has remained at 15 cents for the last two decades, the price of oysters has jumped to 50 cents or more.

Local restaurants and chefs, like the Seafood Barge and Big Mama's in Southold, the Jedidiah Hawkins Inn in Jamesport, and Art of Eating catering in East Hampton, have also become reliable customers. "We had to get some of the chefs to get back in the swing of using oysters," said Jurczenia. "Some may not even know how to open them." Jurczenia remembers when every restaurant on the North Fork served raw oysters and oyster stew. "Oysters were like the first fast food."

Yaxa reaches the shore and starts raving about the bushel full of shellfish sitting on his deck. It's not long before Jurczenia, who is ogling them like a chest of jewels, cuts off his business partner: "You've got a knife, right? Aren't you going to let us try some?"

Yaxa pries one open and hands the dripping half shell to his partner who instantly sucks it down. "I'm a chewer," said Yaxa, who calls the flavor slightly nutty. "I like to chew it and let the taste buds explode in my mouth."

In the science of oyster flavor, what matters is flow. Steady movement of water means that oysters constantly receive a new supply of the microscopic algae that they eat. Compared to a brackish creek or deadend inlet, Pipes Cove is like being in the middle of the ocean. "We've got Peconic Bay on one side and freshwater marshes on both sides of me," Yaxa explains, pointing to a 17-acre wildlife sanctuary Jurczenia created in memory to his father, Thomas. The bay deepens as it approaches nearby Shelter Island to the south, encouraging even more flow. And this water is impeccably clean. Twenty years ago, Jurczenia spent nearly one million dollars to put the entire 40-room motel on town septic. "The water's as clean now as when the Indians were here," Jurczenia said. "The DEC has told us."

That doesn't make the work easy. Pipes Cove is a hands-on operation—"We handled each oyster," said Jurczenia, "and that's why we say every one has a name"—and the oyster farmer's lot is maintenance.

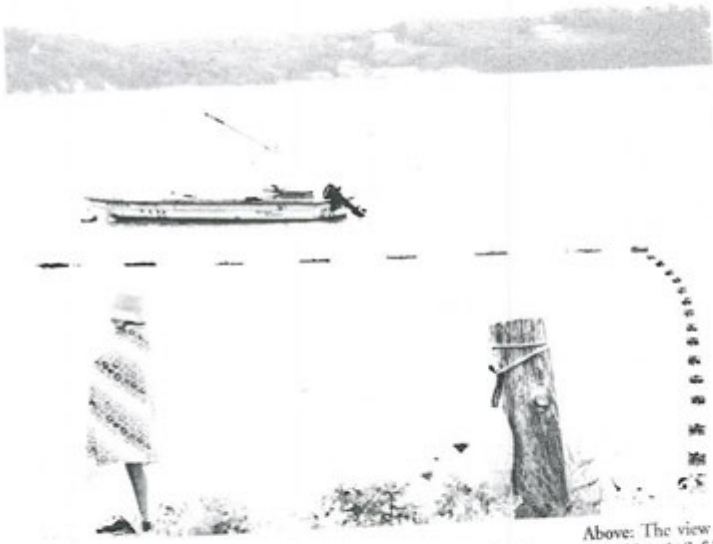
Throughout the year, Yaxa will regularly pick up each wire cage that holds the developing shellfish and remove any algae or other accumulation, as well as any parasites and predators he can dislodge. Crabs steal young oysters and there are all sorts of other creatures—tunicates, sponges, drills, and quarter-decks—that clog the holes in the cages, compete with the oysters for food, or cling to the shells.

"Even if everybody growing them here on the Island quadrupled their business, there's still too much demand," said Yaxa. The price of a clam has remained at 15 cents for the last two decades, while the price of oysters has jumped to 50 cents or more.

Given the strong demand, there's a powerful incentive to sell smaller oysters that have just grown during the summer. But Pipes Cove chooses to sell only oysters that it has kept in the water for at least one winter, since it feels that younger oysters have shells that are too thin and prone to chipping. "Anybody can sell shit and you don't want to do that," said Yaxa. Jurczenia offered a more nuanced explanation: "I know that we've got a great product when I go into the

Photographs: Brian Halweil and Stephen Munshin

Opposite: Dean Yaxa tends his cages on the legendary Pipes Cove.



Above: The view of Pipes Cove and Shelter Island from the Silver Sands' beach (left); inspecting the harvest (right).

kitchen and the waiters and chefs tell you how good it is. It goes back to the clean water and elbow grease. It's not like we have great brains. We just have a great place."

Darlene Duffy, Jurczenia's wife, often leaves Greenport at 4 a.m. so she can make deliveries to Manhattan and be back home by around 9 a.m. These "boutique oysters" aren't harvested until they are ordered and marketed directly to fine restaurants. "They've got just a hint of what I perceive when you salt a watermelon," said Mike Garvey, general manager of the Grand Central Oyster Bar, who likes to refer to an oyster's "aqua-oir," a variation on the wine-related term "terroir" that describes a shellfish's unique flavors based on the water and grounds where it is raised.

For the Silver Sands (which Jurczenia's mother bought in 1947 for $1500, having to borrow money for the $15 deposit), oyster farming is more than just a side business. It's a perfect complement to running a motel where weary city folk come to enjoy the pristine outdoors.

"It's sort of like a little eco-tourism," said Jurczenia. Sun bathers come over to see the haul, while curious children look up from their sand castle construction sites every time Yaxa starts his motor to move between the pattern of buoys that mark the cages of shellfish. In fact, oyster farming provides a sort of foundation for ecological resurgence, since the cages provide food for crabs, fish, and other sealife. "We've seen baby blackfish and even small codfish in the cages. And I've never seen cod here before." (In the hotel's lobby, which contains model whaling barks, scrimshaw, and unique oyster shells from the area's fishing history, a big Ultravision shows visitors images from the "osprey cam" trained on a nest in the memorial wetlands.)

And if the sealife comes back that could mean hundreds of boats plying these waters again to feed the craving of folks who might visit Long Island in search of the perfect oyster. Which would make both Jurczenia and Yaxa happy. "To see 100 boats out here," Yaxa said, "scallopers, flounder fishers, and oyster farmers. I think there's a great potential to bring it back." □

RECIPE

Roasted Oyster Stew

by John Ross

Light your char grill and let the coals turn white. Place two dozen oysters on the grill and roast, covered, about five minutes. Remove to a tray and open the oysters with a knife, scraping all the meats and juices into a bowl. Meanwhile soften one half stick of unsalted butter in a bowl and add chopped tarragon, thyme, shallots, garlic, and lemon juice. Mix well and roll in a piece of foil and refrigerate. In a small saucepan heat one cup of milk and a cup of heavy cream. Do not boil. Add the oysters and their juices and stir in the herb butter. Season with pepper and coarse salt and serve with oyster crackers.