Greetings from the Fisheries and Aquatic Sciences Program!

By Bill Lindberg, PhD, Associate Director, Fisheries and Aquatic Sciences Program

The Fisheries and Aquatic Sciences (FAS) program has long enjoyed strong partnerships with our stakeholders. The Tropical Aquaculture Laboratory in Ruskin and aquaculture programming throughout the State are prime examples of industry partners helping to shape our research, teaching and extension efforts. Clearly, the new FAS faculty members introduced in our January 2015 issue of WaterWorks are building on that foundation.

More recently, UF/IFAS took another major step in this tradition by creating the Nature Coast Biological Station (NCBS) in Cedar Key, with Dr. Mike Allen as its first Director. This issue of Waterworks features the NCBS and the work that laid its foundation. The NCBS is broader than just FAS, which we see as an opportunity for even further integration and partnerships to address real-world needs in a rather unique part of Florida.

Such integration is also occurring on other fronts. As part of UF's Institute for Sustainable Food Systems, Dr. Frank Asche will join the FAS faculty in January 2016. Frank comes to us from the University of Stavanger, Norway and is internationally known as an expert in fisheries and aquaculture economics. We'll feature Frank and his work with the Institute in a future issue of WaterWorks.

And as noted inside this issue, Dr. Sue Lowerre Barbieri at FWC’s Fish and Wildlife Research Institute in St. Petersburg is now also a half-time faculty member in FAS, which further strengthens our partnership with FWRI. As part of the internal proposal that secured Sue’s position, Dr. Jack Payne, Senior Vice-President of UF/IFAS, also approved a cluster of three new faculty positions to strengthen work across UF/IFAS related to sustainable fisheries. The faculty position to be housed in FAS will be focused on remote sensing and geospatial analyses, which was a priority identified last year by the FAS Program Advisory Committee and SFRC Advisory Board. Our stakeholders spoke and we listened.

We hope you enjoy this issue of WaterWorks. Please feel free to let us know what you think of the programs described and any other needs or opportunities on the horizon.

All the best!

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**Nature Coast Biological Station**

By Mike Allen, PhD, Professor, Fisheries and Aquatic Sciences Program, and Director, Nature Coast Biological Station (NCBS)

UF/IFAS has a long history of research, teaching and extension programs in the Nature Coast region, along with an extensive track record of working with agency cooperators to improve the conservation and management of natural resources and communities in the region.

Specifically, the Fisheries and Aquatic Sciences (FAS) program has been working in this region for the past 30 years, and FAS faculty, staff and students have helped find solutions to a wide range of problems in the region. FAS faculty helped jump start the hard clam aquaculture industry in the mid 1990’s, and have addressed Gulf sturgeon conservation, reef fish ecology, as well as long-term projects evaluating water quality in rivers, springs, and estuaries along the Nature Coast. These previous efforts have built a foundation on which the Nature Coast Biological Station will further develop the UF/IFAS mission of research, teaching, and extension in the region.

The mission of the Nature Coast Biological Station (NCBS) is to enhance the conservation and sustainability of natural resources throughout the Nature Coast through collaborative research, enhanced public engagement, field-based courses, and hands-on training workshops.

Highlights of the history of UF/IFAS activities in the region follow below:

When Florida enacted a ban on gill net fishing in state waters in 1994, hundreds of commercial fishers were put out of work. Using Job Training Partnership Act funding, the Harbor Branch Oceanographic Institute and UF/IFAS developed the technology and retrained these workers to culture hard clams. Today, the hard clam aquaculture industry is valued at $40 million annually, and employs over 500 people. UF/IFAS research and extension programs developed this program into a primary economic engine for communities in the Nature Coast. See Leslie Sturmer’s article on page 5 of this edition or visit [http://shellfish.ifas.ufl.edu](http://shellfish.ifas.ufl.edu) for background and up-to-date information on this valuable industry.

In 1997, Bill Lindberg led a symposium and published proceedings for the “Florida Big Bend Coastal Research Workshop,” held in Steinhatchee, Florida. In partnership with Florida Sea Grant, this workshop highlighted the unique physical and biological components of the region and described a need for ecosystem-level management to protect the pristine resources and enhance their value to the communities. The proceedings included a comprehensive assessment of natural resources in the region, and focused on processes influencing rivers, wetlands, estuaries, and reef habitats. The seminal workshop coalesced a diverse group of state and federal agency partners to identify key natural resource needs for the future. In many ways, this workshop was a precursor to the current NCBS and its mission.

Project Coast, a water quality sampling program along the Nature Coast, was initiated in 1997 by Tom Frazer and was an extension of the Florida LAKEWATCH program. Since that time, water quality data have been collected monthly at nearly 100 sampling stations between Hernando and Taylor counties. This long-term baseline data, combined with targeted diagnostic studies and research, can guide the design of cost-effective monitoring that continually evaluates and adapts management actions to ensure healthy coastal systems that deliver value to citizens in the region.

FAS faculty have worked with USGS scientists on Gulf Sturgeon ecology and conservation over the past 25 years. Researchers from both groups have conducted extensive mark-recapture data, obtained robust population estimates for Gulf sturgeon that are critical to assessing population status, as well as developed reproduction and culture methodology.

In 1991-93, Bill Lindberg’s research team helped develop the Suwannee Regional Reef System and in 2011-12 developed the Steinhatchee Fisheries Management Areas. These extensive experimental reef systems have allowed faculty and students to explore how the landscape of reef habitat quality influences reef fish and the highly valuable grouper fisheries. These unique reef systems were constructed in cooperation with counties of the Nature Coast (Levy, Dixie, Taylor) and in partnership with the Florida Fish and Wildlife Conservation Commission.

Our history shows that FAS has strong collaborations with state and federal agencies that have improved the conservation and management of natural resources in the region. The Nature Coast Biological Station will serve as a catalyst for even stronger programs and partnerships in the future.

The following pages contain more details about the extensive work our FAS program conducts in the Nature Coast region.
**Oyster Reef Restoration in Florida’s Big Bend**

By Peter Frederick, PhD, Research Professor, Department of Wildlife Ecology and Conservation

The Big Bend of Florida is the largest undeveloped coastline in the U.S. and contains vast acreages of unspoiled seagrass beds, salt marsh, and other estuarine habitat that supports vibrant sport and commercial fishing, ecotourism and recreation. It was therefore a surprise for UF scientists Peter Frederick, Bill Pine and Leslie Sturmer to find that oyster reefs had declined in area by a net 66% in only 30 years, and the most productive offshore bars by 88%.

Eastern Oysters need intermediate salinities, and the most likely mechanism of decline appears to be repeated episodes of low freshwater flow from the Suwannee River, creating high salinities for long periods of time (Figure 1). This pattern results in high mortality from disease and predation, and when these low flow events occur in series, mass mortality of oysters and breakup of the shell substrate can lead to sandbars substrate. This is a one-way process – once the reef loses the shell structure, it will not be recolonized by young oysters.

But from this, a restoration hypothesis emerged:

**If durable structure can be provided, then oyster populations could repeatedly recolonize the reef following dieoffs.**

To test this idea, Frederick, Pine and Sturmer created a series of 21x21 meter square pilot restoration sites on the reef (Figure 2) using limerock boulders and used clam aquaculture materials (Figure 3). Restoration sites attracted 9x more oysters than control sites did, and achieved densities that are higher than all but one other restoration site in the Gulf of Mexico in just 18 months. Furthermore, elevations also increased by an average of 16 cm.

This suggests that these reef chains can be restored at reasonable cost, and the process of decline can be rapidly reversed.

During this work, it became apparent that the oyster reefs in this part of the coast grow parallel to the coast, and might be sufficient to block or slow down the flow of fresh water from the land, fomenting estuarine conditions on the landward side.

Collaborators David Kaplan, Maitane Olabareta and Anoldo Valle-Levinson from UF’s College of Engineering helped demonstrate that this process occurs, and models suggest that rebuilding the elevation of reef chains will result in greater freshwater detention.

This demonstrates a novel and very valuable ecosystem service of oyster reefs – buffering salinities in estuaries by detaining freshwater inflows. Collectively this research strongly bolsters the value of restoring oyster reef chains in the Big Bend, and of using oyster reefs as aquascaping tools to retain declining freshwater in estuaries.

This work was funded with grants from Florida Sea Grant, the National Fish and Wildlife Foundation, The Nature Conservancy and the National Atmospheric and Oceanic Administration.
Reef Fish Habitat Use and Enhancement

By Bill Lindberg, PhD, Associate Professor, Fisheries and Aquatic Sciences Program

It’s intuitive that habitat is important. It’s less obvious what exactly constitutes habitat quality and how best to use it in fisheries management. Our objectives are to assess the implications of habitat quality for fisheries-independent monitoring and to determine if ecologically designed reef systems can be fisheries management tools, beyond simply destinations for anglers.

Gag is our focus and the Suwannee Regional Reef System (SRRS) and Steinhatchee Fisheries Management Area (SFMA) are the settings (Figure 1). Recent analyses of 15-year and 9-year datasets showed how gag distribute themselves in response to differences in habitat quality, changes in habitat availability and changes in stock size:

- Differences in habitat quality affected the observable trends in gag abundance.
- Year classes likely buffered higher quality reefs from declines in abundance after a 2005 red tide.
- Gag abundance equilibrated regionally among reefs of equal habitat quality, when “all other things were equal.”
- Offshore reefs showed a shadow effect from the inshore deployment of 500 “conservation reefs” (i.e., a regional change in reef habitat availability).
- An unequivocal regional decline in gag abundance followed the 2014 red tide in the Big Bend.

Such findings are important for fisheries management. Fisheries-independent indices of abundance, as inputs to fishery stock assessments, can be improved by incorporating habitat quality metrics or by controlling habitat quality with standardized reefs. Large-scale reef developments can alter spatial distributions of reef fish, affecting observable trends in abundance. Natural mortality (and likely fishing mortality) varies across time and space, with implications for stock assessments. And ongoing work will determine if reefs built to enhance juvenile growth and survival measurably benefit the overall stock.

Seagrass Morphology and Ecosystem Services

By Savanna Barry, PhD Student, Fisheries and Aquatic Sciences Program (Advisor: Tom Frazer, Professor, FAS)

The objective of this study is to examine relationships between above-ground morphological variation in seagrass and 1) nutrient concentrations, 2) above to below ground biomass allocation, 3) seagrass resilience, and 4) the important functions provided by seagrasses including carbon sequestration and habitat provisioning.

Key Findings:
- **Seagrass** above-ground morphology and allocation to above- vs. below-ground tissues were both significantly correlated to water quality (especially phosphorus levels)
- Seagrasses along the gradient differed in their magnitude and direction of response to shading in a controlled experiment, suggesting the morphology of seagrasses relates to their ability to withstand certain types of disturbance
- Preliminary results from sediment cores collected from seagrass meadows along the gradient show that sediments harbored differing amounts of organic carbon, suggesting that background productivity levels can influence the amount of blue carbon stored in seagrass meadows
- Invertebrate communities seem to show several differences across the gradient sampled, but data are still being compiled

Seagrass shoots from sites along a phosphorus gradient. Source: Savanna Barry.

Savanna collecting benthic invertebrates with a self-built suction sampler. Source: Elene Oehmig
Our overall goal is to model the potential spatial and temporal effects of the Deepwater Horizon oil spill on the growth and productivity of representative recreationally and commercially important fish species in the Gulf of Mexico. Representative fish species associated with estuarine, reef, sand/mud, and pelagic habitats within and outside of the areas directly impacted by the Deepwater Horizon oil spill have been targeted for these analyses (Louisiana versus the west coast of Florida, respectively). Changes in growth and productivity of these fishes is being estimated by measuring the annual growth patterns captured in their ear stones (otoliths), which work as natural chronometers just like tree rings. The potential impact of the Deepwater Horizon oil spill at a fisheries production level is being modeled using stock assessments that take into account the potential changes in the growth of these fishes at specific ages. At an ecosystem level, we are using a time-series analysis of the annual growth increments from older red drum and red snapper, a process known as sclerochronology, in combination with intervention/impact analysis.

Key to the study is being able to compare the effects of the oil spill on fish exposed to the oil off Louisiana relative to the same species that were not exposed, hence we are using the west coast of Florida as our reference area.

The major part of the study relies on a time series ranging from 2005 to 2015 for the growth analysis, so our analysis is continuing on as we add our final years of data to the series. To date, we have focused on spotted seatrout and red drum because these species use estuaries extensively, especially when young. We have measured and aged over 20,000 individual fish to date. For seatrout, our model species, we have not observed any decrease in growth of fish from Louisiana that are 1 to 4 years of age before and after the oil spill. In fact, there appears to have been a marginal increase in the growth rate of spotted seatrout in Louisiana, presumably due to a density-dependent response due to the acute mortality of spotted seatrout immediately following the oil spill.

Through incorporating relative growth changes into the age-structured stock assessments for each species from both Louisiana and the west coast of Florida, we intend to estimate any changes in productivity of the fisheries that may be associated with the oil spill off of Louisiana.

**Hard Clam Aquaculture Generates Ecosystem Services**

Ecosystem services are the transformation of a set of natural resources supplied by ecosystems into beneficial goods and functions that humans value. Services provided by shellfish farms may help to mitigate the effects of global warming and climate change that can threaten local coastal economies.

The objective was to describe ecosystem services provided by hard clam culture, summarize value estimates, and relate them to the clam aquaculture industry in Florida.

**Key Findings:**

- **Seawater Filtration**  
  544 million gallons of seawater were filtered per day by the statewide production of 136 million clams.

- **Nitrogen Removal**  
  25.4 thousand pounds of nitrogen were removed from the coastal waters.

- **Carbon Storage**  
  760.6 thousand pounds of carbon were sequestered from the coastal environment.

- **Economic Value**  
  Value of these benefits was estimated at $99,680, which represents the public good value provided to Florida citizens at no cost.

Management implications:

Shellfish aquaculture provides valuable ecosystem services. This Information allows growers, wholesalers, and retailers to inform buyers, consumers, and resource managers of the environmental benefits of sustainable shellfish aquaculture. Estimates of nutrient reduction and carbon storage may, in the future, be adopted as usable or saleable nitrogen and carbon credits, further benefiting clam growers.

Additional Information:

This project resulted in several deliverables for the industry to use. With inputs of farm location and number of clams harvested per year, the Clam Farm Benefits Calculator allows growers to make a simple estimate of the environmental benefits their farms provide to the coastal waters in which their crops are grown. The Calculator, along with the complete project report, can be found at the Online Resource Guide for Florida Shellfish Aquaculture website, or at Florida Clams website, which was also developed in partnership with the industry to promote Florida cultured clams as an environmentally friendly and sustainable seafood product.
Project VENUS
(Vocational Educational Network Using Sunrays)

By Leslie Sturmer, MS, Extension Agent IV, Fisheries and Aquatic Sciences Program, Charles Sims, PhD, Professor, Food Science and Human Nutrition, UF/IFAS, Todd Osborne, PhD, Assistant Professor, Soil and Water Sciences, UF/IFAS, LeRoy Creswell, Sea Grant Extension Agent, John Scarpa, and Martin May, Department of Agriculture and Consumer Services (DACS), Bureau of Seafood and Aquaculture Marketing

The goal of this integrated research and extension project is to provide the impetus needed for the shellfish aquaculture industry to advance the production and distribution of a promising new aquaculture species, the sunray venus (SRV) clam *Macrocallista nimbosa*.

Project objectives are to ensure shellfish hatchery operators are capable of producing sunray venus seed, educate growers about culture and handling methods suitable for SRV production, characterize sediments to determine compatibility of existing leases and siting of new leases for SRV culture, evaluate protocols for freezing SRV clams to ensure product quality and flavor stability, and educate consumers and seafood buyers about the availability and attributes of a new Florida aquaculture product.

**Key Findings**

One of the first steps in this project was to allow growers in Cedar Key, where over 80% of the hard clams are produced in the state, to learn and "experiment" with SRV culture practices without the investment and commitment of acquiring a lease.

The majority of existing leases in Cedar Key are not optimally suitable in terms of soil properties and salinity regimes for farming SRV clams. A 5-acre demonstration site was established with the DACS Division of Aquaculture at an area where prior Florida Sea Grant-funded test plots resulted in good SRV survival and growth. The submerged sand spit was marked and divided into 34 0.15-acre parcels to accommodate the number of participating growers.

Grower selection, cultivation requirements, and other criteria for participating in the project were developed in conjunction with the Cedar Key Aquaculture Association. Growers began planting SRV seed when they became available by participating hatcheries last summer.

A series of workshops was developed to coincide with culture practices associated with producing a crop of SRV clams. This fall, participants began harvesting SRVs and shellfish wholesalers have noted high market acceptance, value, and demand.

**Implications**

To provide the necessary infrastructure, as was accomplished two decades ago through shellfish aquaculture retraining programs for former fishermen in Florida, a public-private partnership was initiated to commercialize the SRV clam through ongoing information exchange, large-scale demonstration, and applied research efforts. Revitalization of an industry that is currently based on a single clam species crop will be achieved by facilitating technology transfer to the various industry sectors (seed suppliers, growers, wholesalers) of the established hard clam industry, geographically diversifying culture areas, and advancing market development.
UF Scientific Diver Development Program

By Doug Marcinek, Research Coordinator/Marine Ecologist Coordinator, Science Diver Development Program, UF/IFAS School of Forest Resources and Conservation

The University of Florida had an academic SCUBA diver training program (UFADP) since the 1970’s in the Department of Health and Human Performance (HHP). In 2009, HHP restructured its offerings and discontinued the UFADP. Doug Marcinek, Research Coordinator in Fisheries and Aquatic Sciences (FAS) Program, immediately recognized the value and importance of this training program and also saw the opportunity to transform what was a recreational program into a Science Diver Development Program (SDDP). Backed by leadership in FAS, the School of Forest Resources and Conservation, and the College of Agricultural and Life Sciences, and with the cooperation of HHP and the assistance of Environmental Health and Safety, transition was made from HHP’s UFADP to FAS’s new SDDP and the first course offering was made in Fall of 2011. Today, the SDDP continues to serve the student body as a SCUBA training program and, in addition, is a resource for research programs at the University that require a pipeline of qualified divers to staff their field operations.

The SDDP now offers basic open water SCUBA, advanced SCUBA including advanced, rescue, and nitrox training, American Academy of Underwater Scientists (AAUS) / UF science diver training, and leadership training for those individuals desiring to become research dive masters and SCUBA instructors. Every year the program certifies approximately 150 open water divers, 40 advanced divers, 25 scientific divers, and 5-15 leadership candidates. SCUBA certifications offered are through NAUI, an internationally recognized SCUBA training agency. The SDDP received a Training Excellence Award from NAUI in 2012, 2013, and 2014.

The true success of the SDDP is that it is developing divers who are actively using their training to dive on research projects at the University of Florida and at other AAUS institutions. Every semester our students are integrating into diving research programs in fields such as Fisheries, Biology, Wildlife, Coastal Engineering, and Natural History, to name a few.

For more information contact Doug Marcinek, marcinek@ufl.edu.
Faculty

Dr. Karl Havens, Director, Florida Sea Grant College Program and Professor, University of Florida/IFAS, was appointed to the National Academy of Sciences Committee on Independent Scientific Review of Everglades Restoration Progress.


Congratulations to Dr. Debra Murie and Dr. Daryl Parkyn, Fisheries and Aquatic Sciences Program at UF, and Dr. Andy Fischer, Louisiana Department of Fisheries and Wildlife. They were granted a NMFS Marine Fisheries Initiative (MARFIN), 2015-2017 for $334,206. The grant is to test whether Bigger, Older, Fatter, and more Fecund Females (BOFFFs) contribute disproportionately more to the spawning stock biomass of greater amberjack in the Gulf of Mexico; and if so, would an alternative management plan based on conserving the reproductive potential of the BOFFFs using a harvest-size slot limit be more efficacious for rebuilding the stock compared to using a minimum size limit?

Students

Nicholas Ducharme-Barth, a doctoral student in the University of Florida's Fisheries and Aquatic Sciences Program (Rob Ahrens, advisor) received the Sea Grant/NOAA Fisheries population dynamics fellowship. The fellowship provides up to three years of funding to outstanding Ph.D. candidates who study ways to improve the sustainability of fish stocks that are commercially or recreationally valuable. Ducharme-Barth’s research is focused on developing tools to help scientists better understand fishing fleet behavior.

Tim Lyons, one of our Marine Sciences students was not only awarded a CALS Fred W. and Mabel H. Barber Scholarship, but also won the 2015-2016 Marine Aquarium Societies of North America Student Scholarship.

That’s a really big deal!

Tim is currently interested in marine ornamental aquaculture and larval microfoods, and is interested in the potential of tunicates for feed production. He hopes to pursue a Master’s degree in invertebrate aquaculture.

Notes & News

Dr. Sue Lowerre-Barbieri has accepted a 50% Research Associate Professor position within the UF/IFAS Fisheries and Aquatic Sciences Program. Sue will continue to work as a 50% Research Scientist in Marine Fisheries Biology for the Florida Fish and Wildlife Conservation Commission (FWC) at its Fish and Wildlife Research Institute. This unique arrangement is part of FWC’s efforts to strengthen its connection with academia, and the University of Florida in particular. In this bridge position, Sue will be able to foster collaboration on a wide range of fish ecology, fish biology, and stock assessment and modeling issues. Dr. Lowerre-Barbieri said that FWC “appreciates the support of our strong partners at UF, particularly Dr. Mike Allen, who was instrumental in working with us to frame out this partnership.”

The Marine Sciences Interdisciplinary Studies major in the Fisheries and Aquatic Sciences Program has received a lot of promotion by a few online news services. Check out: UF CALS courses, majors evolve to meet changing demands.

As noted by Shirley Baker, the major was developed in consultation with stakeholders and employers and “our students have been accepted into highly competitive internship programs.”

Please visit the following online news services for more information:

- Newswise
- IFAS-News
- Growing Florida
- (e) Science News
The UF School of Forest Resources and Conservation is pleased to acknowledge our Summer and Fall 2015 graduates with majors in Fisheries and Aquatic Sciences (FAS).

**Summer Semester**

**Master of Science**

- **Dawn Davis**  
  Title: Using the Fluid Imaging Flowcam to Analyze Phytoplankton Communities in Florida Freshwaters of Different Trophic Status. Chair: Daniel Canfield

- **Devin Flawd**  
  Title: Batch Fecundity of Red Snapper before and after the 2010 Deepwater Horizon Oil Spill in the Gulf of Mexico. Chair: Debra Murie

- **Ryan Jiorle**  
  Title: Determining the Utility of Electronic, Self-Reported Recreational Data for Fisheries Stock Assessment. Chair: Micheal Allen

**Master of Fisheries and Aquatic Sciences (non-thesis)**

- **Jessica Horton**  
  Chair: Shirley Baker

**Major in Marine Sciences Interdisciplinary**

- **Amanda Bartley** (Summer 2015)

- **Sarah Eden** (Fall 2015)

**Fall Semester**

**Doctor of Philosophy**

- **Taryn Garlock**  
  Title: An Integrative Approach to Evaluating Fisheries Enhancement in Florida. Chair: Kai Lorenzen

- **Akeapot Srifa**  
  Title: Plankton Community Structure, Biomass and Succession as It Relates to Environmental Variability in Lake George, Florida. Chair: Edwards Philips

**Master of Science**

- **Emily Olson**  
  Title: Evaluating the Accuracy of Data-Poor Stock Assessment Methods in the Southeast. Chair: Robert Ahrens

- **Joellen Wilson**  
  Title: Growth, Density, Survival, and Emigration of Juvenile Tarpon in an Altered Nursery Habitat in Southwest Florida. Chair: Robert Ahrens

- **Julia Simonetti**  
  Title: Economic Analysis of a Small Urban Aquaponic System. Chair: Shirley Baker

- **Jordan Skaggs**  
  Title: Application of Catch-At-Age Models for Assessing Inland Recreational Fisheries. Chair: Micheal Allen

**Master of Fisheries and Aquatic Sciences (non-thesis)**

- **Kevin Kollar**  
  Chair: Cortney Ohs

- **Rachel Martin**  
  Chair: Bill Lindberg

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**Recent Publications By Our Faculty**


Recent Publications By Our Faculty


