

# South Carolina Department of Natural Resources Marine Aquaculture Program

- Fort Johnson Campus, Charleston SC
- Marine Resources Research Institute
  - Hollings Marine Laboratory
  - Waddell Mariculture Center, Bluffton



# Fort Johnson Campus, Marine Resources Center



# Marine Resources Research Institute (MRRI)

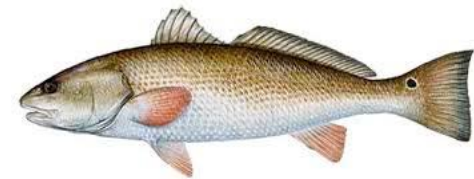


# Aquaculture and Stock Enhancement Team



# Aquaculture and Stock Enhancement Team

- Stock enhancement of marine species
- Environmental tolerance testing
- Fish nutrition/feed development
- “omics” for diet formulation and testing
- Demonstration-scale testing of diets and treatments
- Genetic tools for aquaculture
- Application of Nanobubble technology
- Effects of parasites on performance and flesh quality





## Dr. Aaron Watson and College of Charleston student David Klett

South Carolina Department of Natural Resources – Mariculture Section -  
Aquaculture Nutrition Research

- Develop and evaluate fishmeal and fish oil replacement feeds and ingredients
- Utilize traditional aquaculture production metrics as well as advanced metabolic techniques
- Increased utilization of more sustainable and cost-effective ingredients to replace fishmeal and fish oil
- Evaluate enzyme additions in plant-based fish feeds to increase mineral utilization
- Indigestible phytase-bond phosphorus in plant-based feeds
- Reduce effluent wastewater by adding phytase enzymes allow fish to efficiently utilize phosphorus
- Use of alternative feed ingredients
- Brewers waste as feed additive



# Broodstock Conditioning Culture at MRRI







# Hollings Marine Laboratory



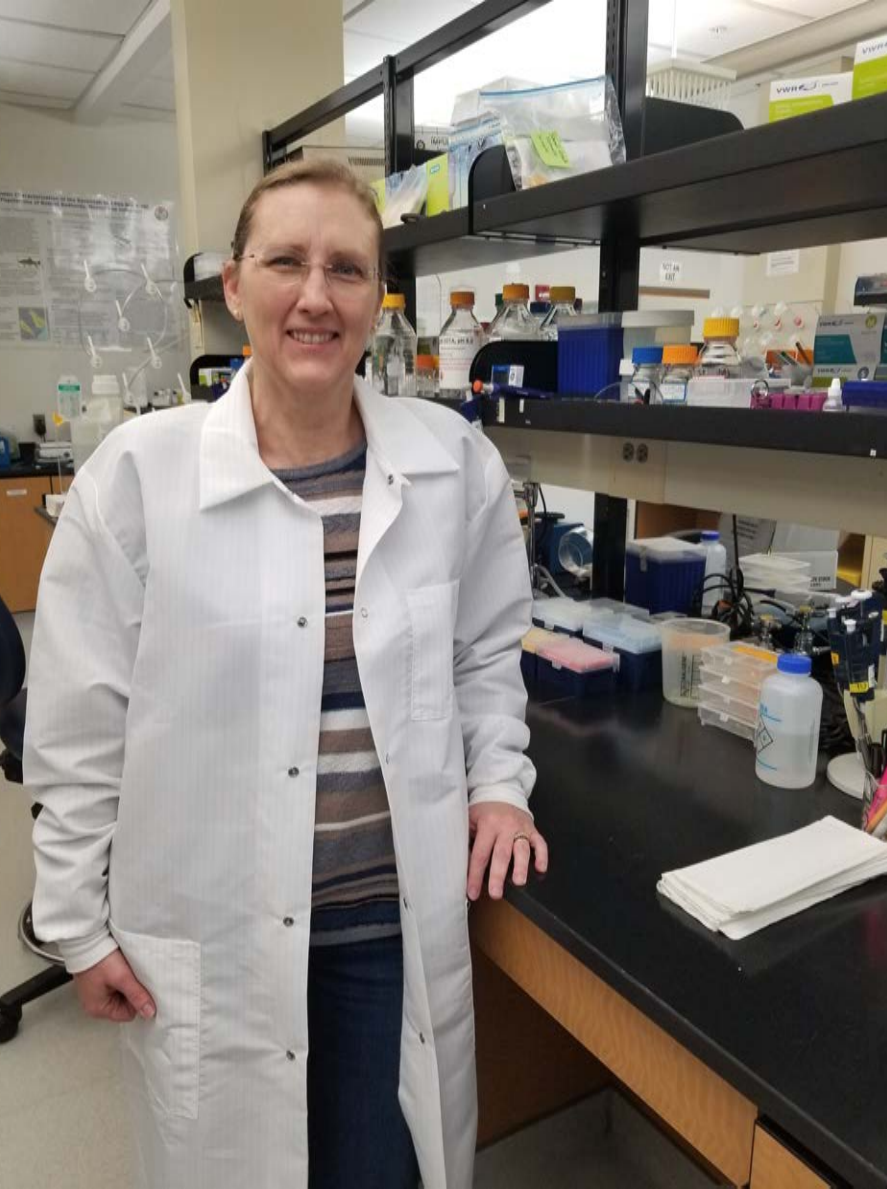




Dr. Fabio Casu

South Carolina Department of  
Natural Resources – Mariculture  
Section - Aquaculture Nutrition  
NMR based Metabolomics research

- Increase understanding of nutritional requirements through metabolic profiling
  - Apply NMR-based metabolite profiling and LCMS Orbitrap lipid profiling to identify nutritional needs in a variety of feeds, species, and life stages
- Develop “-Omics” tools for aquaculture research
  - Development of biomarker discovery methods and novel metabolism and physiology evaluation techniques
  - Leverage cutting-edge technology to identify and develop more rapid techniques to diagnose nutritional deficiencies



Dr. Tanya Darden

## South Carolina Department of Natural Resources – Genetics Research

- Using genetic tools to optimize hatchery production and sourcing broodstock
- Using Genetics and IBM to determine risk of net pen escapement
- Using Genetics and IBMs to optimize hatchery production and determine stocking goals for stock enhancement
- Genetic tools to track fish released into the wild
- Genetic tools for forensic evaluation of seafood products
- eDNA research to locate broodstock, invasive species detection

# NIST/NOAA/College of Charleston/Citadel Military College



Dr. Peter Moeller



Dr. Mike Janech



Dr. Isaure De Buron



Dr. Eric McElroy



Dr. Peter Lee



Dr. Jody Beers



Dr. Clinton Moran



Dr. Tracey Schock

# WMC Facilities and Research



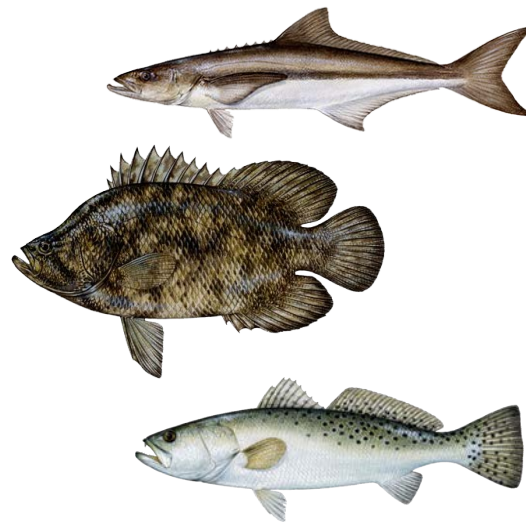


Erin Levesque and Dr. Jason Broach

South Carolina Department of  
Natural Resources – Mariculture  
Section – Waddell Mariculture  
Center



- Stock Enhancement Research
- Improve spawning and larval and juvenile grow-out techniques for red drum, spotted seatrout, and cobia
- Evaluate aquaculture potential and ecology of other species of recreational, commercial, and conservation interest to South Carolina
- Education and outreach to the public regarding marine resources and mariculture efforts in South Carolina



# Intensive Aquaculture Research WMC

- Growout systems
  - 4, 6-tank systems
    - 12, 1,250-L tanks
    - 12, 2,400-L tanks
  - Plumbing also adaptable for single, interconnected 24-tank system that allows for increased replication with reduced background variation
  - Evaluation of stocking densities, temperature effects, feed rates, diets, etc.
  - Plumbing adaptable to allow for external egg collectors and replicated spawning experiments for small-bodied fishes





# Intensive Aquaculture Research WMC

- Egg/Larval/Zooplankton System
  - 20, 155-L Tanks
  - 5, 1,063-L Tanks
  - Egg incubation
  - Mass culture of fish larvae
  - Replicated evaluations of environmental and nutrition effects on larvae
  - Plumbing allows for isolation of individual tanks for zooplankton culture (rotifers and *Artemia*)



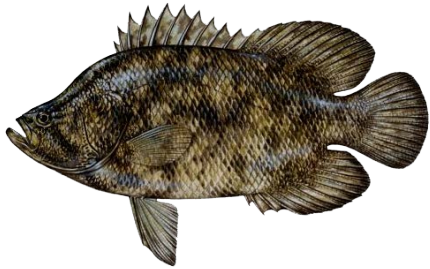
# Extensive Culture

- 12, 0.25-acre ponds
- 9, 0.5-acre ponds
- 3, 1.25-acre ponds
- Growout of juveniles and sub-adults for stock enhancement and tagging studies
- Commercial, pilot-scale testing for evaluating growout methods and feasibility
- Demonstration scale research



# Future Research Projects Funded

- Replacing *Artemia* Use in Larval Feeding Regimes of Three Marine Baitfish- Spot, Pinfish, and Pigfish
- Evaluating Shellfish Ponds to Produce a Compatible Crop of Marine Fish, Tripletail *Lobotes surinamensis*



# Opportunities

- As a consequence of producing fish for stock enhancement there is often excess fish
- Key southeast species available
- Demonstration-scale facilities
- Access to tools and techniques to help the aquaculture community
- SBIR partnerships
- Cooperative Extension projects
- Training opportunities
- Genetic sample processing
- Consulting

# Collaborations

## (Contractual funding, SBIR, Joint competitive grants)

- **Key Partners**
- State/federal natural resource agencies (NC, GA, MD), Universities (CofC, Clemson, USC, UGA, VCU, WVU)
- Zeigler - Red Drum Digestibility (novel ingredients) and Growth Trial
- Zeigler - Reduction in Fishmeal/effluent waste for Red Drum
- Ichthus Unlimited – Novel Tuna Diet NMR-based Metabolomics
- Ichthus Unlimited (pending) – Red Drum Digestibility (novel ingredients)
- Barron Algae-algae production as food/ animal feed additive
- Nanopure Technology-Nanobubble ozonation
- Hubbs Sea World Research Institute
- Charleston Brewmasters
- Swimming Rockfish and Shrimp Farm
- Southland Fisheries
- Hampton Roads Sanitation District

# Challenges to Public-Private Partnerships

- Use of public resources for private profit
- Easier for us to partner with organizations rather than companies
- Non-Disclosure Agreements/ Intellectual Property
- Cost (Collaborative grant-based model works best)
- Space (hasn't been too much of a problem)
- Risk
- Competition
- Time to manage the relationship
- Safety
- IACUC

# Acknowledgements

- Saltwater Recreational Saltwater License Funds
- Sportfish Restoration Funds
- Soy Aquaculture Alliance
- Waddell Mariculture Center Fund
- State of South Carolina
- Hollings Marine Laboratory
- Grice Marine Laboratory
- SCDNR Aquaculture Team

