

**Design and Evaluation of Marine Fish and Live Feeds  
Recirculating Systems for Inland Aquaculture – Year 2**

**Progress Report  
July 1 – September 30, 2008**

**FDACS Contract No. 013966**

**Submitted to  
Mr. Kal Knickerbocker  
DIVISION OF AQUACULTURE  
DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES**

**Principal Investigators  
Kevan L. Main, Mote Marine Laboratory  
Thomas Losordo, North Carolina State University**

**Submitted by  
MOTE MARINE LABORATORY**

**October 8, 2008**

**Mote Technical Report # 1297**

## **BRIEF PROJECT OVERVIEW**

This progress report for the project entitled Design and Evaluation of Marine Fish and Live Feeds Recirculating Systems for Inland Aquaculture – Year 2 covers the period from July 1 through September 30, 2008. The overall goal of this project is to design, construct and evaluate innovative recirculating systems to advance the development of a sustainable marine aquaculture industry in Florida. Research teams at Mote Marine Laboratory (MML) and North Carolina State University (NCSU) are working together to address the following objectives:

1. to assess the performance and improve the efficiency of large-scale marine fish larval and nursery recirculating filtration systems,
2. to assess the performance and improve the efficiency of live feeds recirculating filtration systems,
3. to design, construct and test the operational capabilities of marine fish fingerling and growout recirculating filtration systems,
4. to identify containment, utilization, and breakdown strategies for the salty sludge produced through filtration,
5. to estimate recirculating filtration system costs, and
6. to outreach project results through educational programs, and to research institutions and the Florida aquaculture industry.

## **PROJECT ACCOMPLISHMENTS**

### ***Objective 1: Assess the performance and improve the efficiency of large-scale marine fish larval and nursery recirculating filtration systems***

Larval and early nursery-stage marine fish are stocked at higher densities and receive larger quantities and different types of food than is used in marine broodstock systems. As a result, the design of these systems requires the ability to maintain excellent water quality, while large quantities of live food and later artificial diets are added to the system. Currently, the ability to filter these systems has only been implemented in freshwater or small-scale marine systems at MML. In Year 1 of this project, we designed and tested large-scale recirculating filter systems for larval/nursery stage marine fish. These systems were designed based upon our experience with the large-scale freshwater systems and the marine broodstock systems currently operating at Mote. Small-scale (lightly loaded) larval trials were conducted in the systems and they performed well.

Performance of the solids and biofiltration systems for the larval/nursery rearing systems will be conducted in conjunction with an intensive larval trial that will be conducted in 2009. These systems will be evaluated for ease of operation and consistent maintenance of water chemistry parameters (nitrate, ammonia, nitrite) using pompano or redfish larvae. The systems developed in this project will be documented with drawings and an operations manual.

### ***Objective 2: Assess the performance and improve the efficiency of live feeds recirculating filtration systems***

Live food production systems for rotifers and *Artemia* may require the addition of live algae or algae paste and enrichment prior to harvest with DHA Protein Selco. The enrichments are

required to provide the essential fatty acids for marine larval fish culture; however, the water that from the enrichment tank contains high concentrations of oils, which must be extracted during the filtration process. In year 1 of this project, we designed and tested the recycle systems for the wastewater generated in live food production system. Performance and monitoring of the operational characteristics and water chemistry parameters for this system will be evaluated in conjunction with the larval rearing system trial conducted in 2009.

### ***Objective 3: Design, construct and test the operational capabilities of marine fish fingerling and growout recirculating filtration systems***

Fingerling and growout stage marine fish are stocked at higher densities and receive larger quantities and different types of feed than is used in marine broodstock, larval/nursery systems. In order to maintain appropriate water quality for these life stages, efficient and effective filtration components must be included in the recirculating system design. This technology has been implemented in freshwater growout systems at MML. The goal of this objective is to design, construct and test recirculating filter systems for marine fish fingerling and growout stages.

Dr. Tom Losordo and the Mote Marine Aquaculture Research Program research team completed the design for a prototype marine fish fingerling filtration system capable of supporting a final biomass of 20 kg/m<sup>3</sup> in May 2008. This design effort was supported by additional grant funding provided by the Florida Fish and Wildlife Conservation Commission (FWC) as part of the Satellite Marine Fish Hatchery Initiative. Construction of the tank and filtration systems was initiated in June and is ongoing in the existing Aquaculture and Stock Enhancement Building at Mote Aquaculture Park with funding from DACS and FWC. The tank systems are expected to be operational by December 2008. A fingerling production trial will be conducted when the system is operational (estimated start date for the trial is December 7, 2008). The DACS funding will support the monitoring and evaluation solids removal and water chemistry parameters (nitrate, ammonia, nitrite) and the FWC funding will support the fish production trial.

### ***Objective 4 – Identify containment, utilization, and breakdown strategies for the salty sludge produced through filtration***

Aquaculture recirculating components have been developed to remove solid waste (sludge) from the culture tanks; however, the containment, utilization, and breakdown of that solid material once it is removed from the fish systems can be difficult when those solids contain salt. We will explore methods to isolate and contain those solids, potential uses, and bacterial breakdown or reduction of those solids. Mesh bags (Geotube) will be evaluated as a containment strategy for the solids. The waste treatment system is currently under construction. In 2009, we will explore the use of isolated sludge as a nutrient-rich material for production of salt tolerant plants (i.e., red mangrove) and removal of salt from the soils. Finally, we will explore the breakdown of salty sludge through anaerobic digestion.

### ***Objective 5 - Estimate recirculating filtration system costs***

We are continuing to monitor and document the baseline costs associated with the recirculating systems for the various phases of marine fish culture, which will be incorporated into the

spreadsheet designed by the University of Florida research team. These results will be reported in the final project report.

***Objective 6 - Outreach project results through educational programs, and to research institutions and the Florida aquaculture industry***

We are working with the Riverview High School Aquaculture Cousteau Academy and give presentations to their classes on career opportunities in aquaculture. Student interns from Manatee Community College and other Universities volunteer in our research efforts to gain hands on experience in aquaculture. A tour of Mote Aquaculture Park and presentation is scheduled for the Marine Science Educators Conference in May 2009. Mote will work together with FAA to incorporate a presentation by FAA in association with that conference.