

MARINE AQUACULTURE AND STOCK ENHANCEMENT IN FLORIDA: RESEARCH AND DEVELOPMENT

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THIRD INTERIM REPORT
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A. Collaborate in Research to Develop Stock Enhancement Capabilities with High-Priority Finfish Species - The Common Snook (*Centropomus undecimalis*)

A.1 Culture of High Priority FinFish Species: Common Snook

A.1.1. Production Efforts

Strip-Spawning and Larval Rearing

No activities took place in this area during this reporting period.

Live Feeds Production

Rotifer production efforts continued in the High Density Culture Systems at Mote Aquaculture Park (MAP). Testing of the new filtration system that was designed to cleanup the wastewater associated with harvesting rotifers continued during this reporting period. Samples of our rotifer batches were sent to Belgium for DNA analysis to determine the true strain of rotifer that was being cultured at Mote. Results from this analysis determined that we had an S-type strain (small type strain) and not an SS-type strain (super small type strain). Mote's live feeds section is working on obtaining a true SS-type rotifer strain from colleagues in Japan. The plan is to have both SS rotifers and copepod nauplii for experimental trials in 2006.

Broodstock Efforts

In mid-August 2005, an attempt was made to transport wild snook broodstock from Charlotte Harbor, FL (2 hours south of Sarasota) to Mote's main campus for a hormone induced spawning trial. Fish were collected from this area because of the consistently high levels of red tide in Sarasota's Bay throughout the snook spawning season. From this broodstock collection trip, five females (mean weight 2.64 Kg) and five males (approximately 1.5 Kg each) were obtained. All of the females were pit tagged, weighed, and injected with human chorionic gonadotropin (HCG) at 500 IU's/Kg to reduce the level of egg regression due to the handling and capture of the fish. Because findings in the literature show that HCG injections do more harm than good to the reproduction capabilities of male snook; these fish were only pit tagged and were not weighed to reduce stress on the fish.

The following day, approximately 1.2 million eggs were collected in the egg collectors. These eggs did not show signs of fertilization and were observed to have poor cellular division. In case any of the collected eggs had been fertilized,

they were stocked in a single 3.3 m³ production tank. The following day, all eggs had dropped out. Two days later, two of the female snook died due to unknown causes. It was later recommended by our broodstock research consultant to inject the remaining 3 female snook with Carp Pituitary Hormone (CPH) at 50 mg/kg and to then check the fish the following week for egg maturation. If the females were then showing signs of maturation, they would be injected with LHRH-a at 200µg/3 kg. Unfortunately, no further egg development was observed after the CPH injection. The remaining 13 fish were quarantined and later moved to a 54,315 L broodstock tank at MAP where they will be monitored for egg development and growth every four months.

From late September to mid-October 2005, the Mote maturation and spawning research team met with three expert broodstock consultants to assess the developmental status and to prepare a maturation strategy for the captive snook broodstock at MAP. Biopsy results in September and October revealed that some female snook were mature; however, none of the male snook were ready to spawn. In October, one female was implanted with LHRH and nine males were implanted with methyltestosterone to induce final maturation and spawning. The November sampling revealed that the implanted snook had regressed, which was not surprising since we were far beyond the natural spawning season for snook.

Based on the maturation and spawning plan developed in our October meeting, we began a photoperiod and temperature environmental manipulation using the snook broodstock in the two independent 54,315 L tanks. In late March, these fish will be examined for signs of maturation. These fish are currently under a summer temperature and photoperiod cycle.

B. Evaluate Snook and Red Drum Stock Enhancement Impact in Sarasota Bay and Tampa Bay

B.1 Evaluating release strategies to optimize survival of stocked, hatchery-reared snook.

The following manuscript is in revision describing the effects of *in situ* acclimation on survival of snook released in an estuary:

Brennan, N. P., M. C. Darcy, and K. M. Leber. In revision. Significance of predator-free enclosures on post-release survival of stocked common snook. *Journal of Experimental Marine Biology and Ecology*.

B.2 Test of Density-Dependency Effects with Hatchery-Reared Juvenile Snook Released in Critical Nursery Habitats

Proposed field work in this area has been completed. We are currently working on analysis and write-up of this study. Results will be distributed when they are completed.

B.3 Refining Tag Technology with the Common Snook and Red Drum

B.3.1 Adapting Tag Technology toward Stock Enhancement of the common Snook

We published this work under the following citation in 2005:

Brennan, N. P., K. M. Leber, H. L. Blankenship, J. M. Ransier, and R. DeBruler Jr. 2005. An evaluation of coded-wire and elastomer tag performance in juvenile common snook under field and laboratory conditions. North American Journal of Fisheries Management 25: 437-445.

The study of the effects of visible implant elastomer as a tag in fish cornea tissue has been completed. Results from this study are being analyzed and will be reported when completed.

We are investigating the use of acoustic transmitters (Vemco, V8SC1L, 24 mm long) in juvenile (age-0) snook. Both hatchery and wild snook were implanted with transmitters to monitor movement patterns in 2004. In January 2006, we submitted the following paper to peer reviewed journal, Fisheries Management and Ecology:

Malik, K., W. E. Pine III, K. M. Leber, and N. P. Brennan. In review. Risky Business: Differential Movement and Habitat Use of Wild and Hatchery-reared Juvenile Common Snook. Fisheries Management and Ecology.

B.3.2 Adapting Coded-wire Tags to "Phase-I" Red Drum

A manuscript that describes these activities is in progress.

B.4 Feeding Ecology of juvenile snook.

Experiment 1: Determine diel feeding activity of snook ranging from 100-500mm FL in size.

May 26-June 30, 2005: To determine when snook were actively feeding, two 24-hour observation periods were carried out in North and South Creek located in the southern portion of Sarasota Bay. Each 24-hour period was broken-up into 3-8 hour blocks and samples were taken every two hours. Snook were collected using a 73.15 x 3.05 m (240x10 ft.) bag seine with 0.32cm (1/8 in.) mesh with a 3.05 x 3.05 x 3.05 m (10x10x10 ft.) bag. Stomach contents were collected using the pulsed gastric lavage (PGL) technique, as described in Waters et al. (2004),

because this allowed for the fish to be released unharmed. This method involves using slightly pressurized water jetted through the esophageal opening to fill the stomach with water while the fish is in a head up position. Then the fish is turned downward at a 45-degree angle allowing any food items to flow out into the collection net. The underbelly is then massaged as the stomach is flushed with a continuous flow of water allowing any remaining food items to be removed. This process is repeated 2-3 times until the stomach is believed to be empty (Waters et. al. 2004).

A total of 197 snook were caught of which 168 were sampled for stomach contents. Of those sampled, a total of 127 stomach samples were successfully collected. The samples were analyzed using a digestion index ranging from 0-5, with 0 equaling a fresh, undigested sample and five equaling a nearly completely digested sample with only bones and/or other hard parts remaining, depending on the prey item. Preliminary analysis suggests that juvenile snook feed primarily after dusk and through the early morning hours, with light to moderate feeding during the daylight hours.

Experiment 2: Describe summer juvenile snook diet in estuaries of southern Sarasota Bay.

July 1-August 19, 2005: During this time period an additional 191 snook were caught and 181 checked for stomach contents. Of those, 181 snook sampled an additional 139 stomach samples were collected. These collections were performed at night in the same manner described above. Combined with the previous samples, a total of 266 stomach samples were collected throughout the summer and will be used to describe the diet of juvenile snook in southern Sarasota Bay. Of those 266 samples, 105 were collected from North Creek and 161 from South Creek, respectively.

These results are being analyzed and written up.

B.5 Fishery Independent Assessment of Adult Habitat

B.5.1 Identify Recruitment of Hatchery Snook to the Adult Populations

We are in the process of producing a publication entitled "Effects of release microhabitat on survival and growth of hatchery-released snook in a Florida estuary".

B.6 Fishery Dependent Sampling of Snook Populations in Sarasota Bay

SNOOK SHINDIG.

Currently, we are planning the 9th Annual Snook Shindig. The tournament will be held on October 20-21, 2006.

B.7 An evaluation of cannibalism risk in juvenile snook

Results from this study are being analyzed and will be reported on when complete.

B.8 Testing the capability of inland snook fisheries

We are investigating the capability of using the common snook in inland pond environments. Forty snook (300-450 mm SL; two age classes) were tagged with individual PIT tags and VIE marks and stocked into a freshwater pond at the Mote Aquaculture Project (MAP). The pond is designed to incorporate thermal refuge, vegetative habitat, structure, and various prey species for snook. An automatic feeder supplements snook diet. The submersed temperature loggers continue to monitor surface and bottom temperatures in the pond. In July 2005 we also set up a remote tag reading antenna in the MAP pond. This remote prototype system uses passive integrated transponder tags that are activated when a tag is within range of a powered antenna. We are setting up a second antenna along shallow shoreline habitat that will allow us to document differential habitat use of differently sized individuals in the pond. These systems will also allow us to monitor survival of the tagged individuals.

In November, 215 snook consisting of three age classes (1, 2, and 3 years old) were tagged with half duplex PIT tags. Lengths of each snook were recorded. These fish are being held in the Stock Enhancement Wet Lab Facility until release. Releases will occur in ponds next spring when water temperatures are warmer.

Currently, we are holding snook in our rearing facility for release this spring.

B.9 Project Tampa Bay – Red Drum Stock Enhancement

Since September 1, 2005, work has continued on Project Tampa Bay (PTB), a Florida Wildlife Research Institute (FWRI) and Mote Marine Laboratory (MML) partnership funded by saltwater fishing license funds to demonstrate the effectiveness and benefits of stock enhancement in a large estuarine ecosystem. Since 1999, more than four million red drum were reared at the Stock Enhancement Research Facility (SERF) and released into the Alafia and the Little Manatee River's in Tampa Bay.

To evaluate survival, distribution, and contribution of the hatchery-reared red drum to the fishery, MML, in collaboration with FWRI and SER staff, emphasized angler involvement, directed-target sampling, and application of acoustic telemetry. Results from FWRI and MML assessment efforts will be used to formulate management recommendations to develop an effective and responsible approach to use hatchery-releases as a tool to enhance and restore fisheries state-wide.

B.9.1 Red Drum Fin Clip Program

The goal of the Tampa Bay red drum stock enhancement project is to demonstrate the benefits of a marine stocking program. Recreational anglers are the primary recipients of the benefits of stocking and their participation was critical to assessment of project success.

The goal of the MML Red Drum Fin Clip Program (FCP) is to provide tissue samples for the evaluation of hatchery-reared red drum contribution to the fishery and for determination of their optimal size at release, and optimal release habitat. An objective of the program is to establish anglers as stakeholders in the program and have them contribute tissue samples from any size red drum they captured in Tampa Bay.

The Fin Clip Program is directed by Carole Neidig. During the report period invaluable assistance was provided by the following MML and FWC volunteers: John Angiolini, John Arbuckle, Merrily Dunn, Ric Ehlis, Roy Francis, Barney Frisk, Joe Gosselin, Richard Hill (FWC), Marcia Kagan, Thomas King, Diane Labhart, Joe Mazza, Cindy McClure, John McClure, Jack Rounds, Terry Simmons, Bob Steskal, Janice Wojick, and Bernie Waxman. The volunteers were instrumental in assembling Fin Clip Kits, processing fin clip samples, visiting bait and tackle shops, providing information to anglers, posting signage, collecting fin clips at tournaments, promoting public support and encouraging angler fish data retrieval at angler and community events. In addition, Gina Russo (SERF) provided Fin Clip Kits at angler events and Billy Wheat, Fisheries Dependent Monitoring (FDM) provided kits to anglers during creel surveys.

To promote project awareness and engage angler participation in the Fin Clip Program, an outreach campaign was continued by MML, in cooperation with SERF. The MML outreach program included displaying posters, distributing project information and fin clip kits to bait and tackle shops, and direct contact with anglers at fishing tournaments and community events.

Posters

Laminated project posters have been distributed to more than 250 bait and tackle shops, marinas, and angler and boat supply stores. A polyvinyl version of the poster was posted by volunteers at more than 20 boat ramps and locations where laminated posters would not last in the weather. The polyvinyl posters were generally bolted to a structure.

Events

The following events were attended to promote the PTB Redfish Fin Clip Program.

February 3, C. Neidig, and MML volunteer T. King prepared the first 2006 Redfish Fin Clip Program booth for the **30th Annual Manatee County Florida**

Fishing College at the Manatee County Convention Center. On February 4, C. McClure and J. McClure assisted C. Neidig at the MML booth to promote the Fin Clip Program. In addition, C. Neidig spoke to vendors to obtain in-kind donations for the Angler Reward Program and for Silent Auctions to raise project funds. More than 220 anglers joined the Fin Clip Program.

February 11-12 and 18-19, 2006, Linda and Rick Roberts of Extreme Edge Fishing presented a booth that featured both the PTB Redfish Fin Clip Program and the Mote Snook Foundation at the **Bass Pro Spring Fishing Classic**, held at the Bass Pro Shops, Orlando. On February 19, C. Neidig worked with the Robert's at the booth to promote the FCP.

February 22, C. Neidig presented the Angler Redfish Fin Clip Program at the **FLW Walmart Redfish Series** Captain's Meeting held at the Tierra Verde Resort Marina.

February 23 and 24, C. Neidig, J. Rounds, C. McClure, J. McClure, T. King, and R. Hill (FWC, volunteer) collected 233 fin clips from redfish at weigh-in during the three day **FLW Walmart Redfish Series Ranger** tournament held at the Tierra Verde Resort Marina.

February 25, C. Neidig and T. King attended the **FLW Walmart Redfish Series Ranger Tournament Award Ceremony** held at the St. Petersburg Walmart. The event was filmed by Blair Wiggins crew from Addictive Fishing and will be broadcast on March 26th on Fox Sports Network.

Media Coverage

February 24, a televised segment on PTB and the Fin Clip Program was filmed at MML and was featured on Bay News Channel 9. The segment was also shown on February 25 and 26.

Fin Clip Kits

Kits contain the supplies needed for anglers to take tissue samples from red drum, were easy to use, and could be easily stored in the angler's tackle box or cooler. No modifications were made to the Fin Clip Kits during this report period.

Angler Educational Materials

Several items supplemental to the Fin Clip Program were distributed to anglers requesting Fin Clip Kits or were provided to anglers at events. These included:

- FWC "Regulation" publication,
- Angler Reward Partner and Project Supporter list,
- Participating Bait and Tackle Shop list,
- PTB stick-on measuring tape, and
- Project update (modified on February 8, 2006) including highlights of hatchery-reared redfish returns. The hand-out was also distributed to Bait and Tackle shops for display.

Reward Program

Items for the Angler Reward Program were attained from existing business partners and several new businesses. Businesses providing in-kind or cash donations were sent a thank you letter, tax deduction information, Mote Aquarium passes, and if the in-kind contribution was over \$500.00, they received a Mote Laboratory Corporate Membership. Businesses that donated \$1,000 in in-kind gifts were also recognized with a plaque in the Mote Aquarium. In addition, the businesses were listed as Project Partners or Project Supporters on a hand-out distributed with Fin Clip Kits. Since November 2002, 80 businesses and individuals have provided merchandise and/or services for the Angler Reward portion of the project.

Bait and Tackle Shops

Monthly, MML volunteers J. Mazza, R. Francis, and/or J. Arbuckle called 63 participating bait and tackle shops and angler supply businesses to promote the Fin Clip Program, ask if fin clips needed to be retrieved, offer laminated project posters, Fin Clip Kits, and fin clip sample bags. Numerous trips were made each month by C. Neidig, and volunteers J. Arbuckle, J. Mazza, R. Francis, T. King and G. Russo (SERF) to businesses to pick up red drum fin clips, provide Fin Clip Kits, and project posters. To help prevent loss of fin clip samples in bait shop freezers, plastic boxes (4"x 5"x 2.5") displaying a PTB logo and a Hotline telephone number sticker were distributed. Because of employee turnover at many of the shops, shop visits were valuable for keeping their staff and subsequently their angler customers involved in the program.

Participating bait and tackle shop coverage included locations in north Sarasota, Bradenton, Palmetto, Ruskin, Gibsonton, Riverview, Apollo Beach, St. Petersburg, Madiera Beach, Treasure Island, Pinellas Park, Clearwater, Port Richey, Oldsmar, Largo, Dunedin, Tarpon Springs, Palm Harbor, and Tampa. As of March 1st, there were 63 participating Bait and Tackle Shops.

Angler Contributions

As of March 1st, 560 anglers participated in the PTB Fin Clip Program by providing red drum fin clips and fish capture information. Since our previous report ending November 30, 2005, an additional 514 fin clip samples were submitted for processing at MML. Capture locations reported by anglers included Old Tampa Bay, Hillsborough Bay, and off the east and west shorelines of Tampa Bay. Fin clips were also provided by anglers who fished south of Tampa Bay. These included Sarasota Bay, Palma Sola Bay, and Terra Ceia Bay. Several samples were submitted from locations south of Sarasota Bay including Charlotte Harbor. These samples were generally from fish brought in by tournament anglers and were clipped by MML staff and volunteers and were labeled low priority and kept at MML for processing at a later time. As of March 1, the range for samples was expanded to fish captured from Homassa to north

Charlotte Harbor. This decision was made based on discussions with Mike Triangali (FWC).

In January, 16 additional fin clips provided by anglers were determined to be from hatchery-reared red drum, bringing the total to 31. Of the 31 Angler Fin Clip Program samples determined to be hatchery-reared fish, 25 were determined to be Phase I at release, three were Phase II, and two were Phase III.

All of the hatchery-released fish caught by anglers were released in the Alafia River. Alafia release grids producing captured fish included:

Mile 1 (grid 136) = 5

Mile 2 (grid 461) = 6

Mile 3 (grid 469) = 9

Mile 4 (grid 470) = 6

Multiple release grids (miles 1-4, grids 136-470) = 5

The captured hatchery-reared fish ranged from 213 mm TL to 685 mm TL. Seventeen of the fish were under the slot and 14 were within the slot. No hatchery fish larger than the upper slot limit of 27 inches (685 mm) total length were identified. The shortest days of freedom was 106 and longest was 1,144.

Fish capture locations included the Old Tampa Bay, Weedon Island, Lassing Park, the Alafia River, Bullfrog Creek, Apollo Beach, Little Manatee River (Alafia River released fish), Little Cockroach Bay, Cockroach Bay, Piney Point, Bishop Harbor, Manatee River, Terra Ceia Bay, Palma Sola Bay, and Sarasota Bay.

In February, C. Neidig with information provided by Mike Triangali and Jamie Sullivan (MGL), Richard Cody (FDM), Brent Winner (FIM), and Chris Young (SERF) compiled a data file with release and capture information for the hatchery-reared red drum samples from both the Angler Fin Clip Program and FDM Angler Creel Census Program. The Excel data table was provided to the PTB team.

The genetic results (wild or hatchery) provided by FWRI Genetics for each fin clip sample were correlated by MML volunteer T. King to the capture data provided by the angler and entered in the Fin Clip Database. From this information he completed a "Thank You / Results" postcard for each participating angler to thank them for providing tissue samples for the Fin Clip Program and to provide them with the results of whether the fish they captured was hatchery or wild. The card included the date a sample was collected, the fish length, the capture location, and the genetic results wild or hatchery. Anglers who captured hatchery-reared red drum were also sent a letter with fish release information including date, location (river mile), phase, days at large, and number of miles captured from original release site.

B.9.2 Juvenile Red Drum Habitat Identification in Tampa Bay, FL

The Juvenile Red Drum Habitat Study in Tampa Bay was completed in August 2005. The Principal Investigators for this study were C. Neidig (MML), Dan Roberts (SERF) and Cindy Armstrong (Progress Energy, PE). The study responded to the critical need to provide habitat preference information for juvenile red drum "rat reds" (177-300 mm TL) in Tampa Bay. Monitoring of juvenile red drum implanted with acoustic transmitters was implemented in 2003 as a tool to address questions concerning habitat preferences, site-utilization, preferred environmental conditions, and movement. Funding for this project was provided by the Pinellas County Environmental Fund (PCEF) / National Fish and Wildlife Foundation (NFWF), with matching funds from FWRI through the FWRI/MML Stock Enhancement Project Contract, and MML.

The data for this study is currently being analyzed by D. Roberts (SERF) and C. Neidig. A final report is being prepared for PCEF / NFWF as well as two manuscripts. Results and conclusions will be provided in a FWC Progress Report upon completion of data analysis.

C. Assist the Commission with Strategic Planning

On Tuesday, 17 January, Ken Leber, Luiz Barbieri and Bill Halstead held a planning meeting to discuss future work on stock enhancement. Leber was involved in the Snook symposium at FWRI on 9 and 10 February, where stakeholders were briefed on future needs for snook management in Florida. Work continued at Mote to analyze and publish the results of snook stock enhancement research to date. A manuscript was submitted to the Journal of Experimental Marine Biology and Ecology on research that documented a doubling in survival afforded by acclimating hatchery snook /in situ/ at release sites prior to release into the wild.

D. Referenced Literature

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