Marine Aquaculture and Stock Enhancement in Florida: 
Research and Development
Florida Project, FDEP Contract No. MR 216
MML Project No. 109.682 and MML Project No. 170.697

Prepared for:
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June 21, 1999
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Mr. Bill Halstead
Florida Department of Environmental Protection
Stock Enhancement Research Facility
14495 Harllee Road
Port Manatee, Florida 34221


Dear Mr. Halstead,

Please find enclosed our final report for the 1998-1999 fiscal year of the above referenced project. This report covers activities from June 15, 1998 through June 16, 1999. The activities from April 1, 1999 through June 16, 1999 are emphasized. Four sections are included in this report and include (I) Live Feed Production Systems, (II) Fishery Independent Assessment of Red Drum Stock Enhancement Impact in Biscayne Bay, (III) Research Collaboration to Develop Stock Enhancement Capabilities with High-Priority Finfish Species, and (IV) Assisting the Department with Strategic Planning in Stock Enhancement. We have been very pleased with the results and accomplishments in all of these areas.

We will provide updates to this information periodically as significant developments occur in our understanding of the potential for stock enhancement in Florida. Work in Biscayne Bay has not yet been finalized and will continue at least through 1999 with no additional cost to the project beyond what was contracted. When this work is finalized we will submit a complete report. On behalf of the Center for Fisheries Enhancement at Mote Marine Laboratory, we look forward to continuing our successful cooperation with Florida’s Department of Environmental Protection.

Sincerely,

Ken Leber
Nathan Brennan
Stock Enhancement Program
Center for Fisheries Enhancement
I. Live Feed Production Systems

Substantial progress has been made toward the development of a live feed production system at the Port Manatee DEP stock enhancement facility during the 1998 - 1999 fiscal year. Earlier work was outlined in the interim reports submitted in the Fall and Winter of 1998. On January 28, 1999, Reza Moosapanah, an Oregon State University doctoral graduate who is a specialist in the polyculture of bivalves, was employed by MML as a post-doctoral scientist to direct and make improvements on the existing live feed production system at the Port Manatee hatchery facility. The following information was provided by Dr. Moosapanah...

Introduction:

The primary function of the phytoplankton production program at SERF, Port Manatee, is the production of monoculture of those species that are used as a nutritional source for growing scallops and zooplankton (rotifers, artemia) that in turn are to be used as food for larval fish. The foundation of the program is to provide the algae culture necessary to assist the new foundation of Fisheries Enhancement at Mote Marine Laboratory. The objective of the phytoplankton production is to maintain stocks and to provide inoculum for upscaling. This facility is designed so that several species could be raised simultaneously without fear of contamination.

Types of Culture:

There are many different ways of culturing algae. However, there are certain requirements for all methods. A culture must be inoculated, and algae left to grow and divide. The rate of growth and division varies with different types of algae and also depends on how well the various culture conditions necessary for growth have been met. When there are sufficient algal cells in the container for feeding, one of the two culture methods described below may be followed:

Batch culture:

With this method the total culture is harvested and used as food. If required, another culture can be set up to replace it. We will implement a 2-liter to 10-liter per day production rate in our laboratory.

Semi-continuous culture:

In this culture method, a part of the culture is harvested and used as food, and the amount taken is replaced with fresh culture medium. This method will be used in our lab for 200-liter cylinders. After allowing 2-3 days for the remaining cells to grow and divide, the process is repeated. It is suggested to harvest every 3-7 days depending on species. This method can be operated for up to 4 weeks (in some reports 7-8 weeks).
Implemented Task:
The following strategies have been recently accomplished in the lab:
* The daily production system was maintained to produce algae at an adequate level to maintain a continuous supply. Observations, measurements, and the recording of physical and chemical factors of the culture system were performed daily (light, mixing, pH, salinity, density, temperature, aeration, etc.).

* Standard reporting forms were prepared to document the daily performance and the microbiological analysis.

* A cover for the storage tank located outside the algae room was installed. This improvement prevented temperature increase, air contamination, and the reduction of rainfall into the tank.

* Some of the achieved knowledge pertaining to the current methods for phytoplankton production were implemented from the practical course at Harbor Branch Oceanographic Institution's research facility (Feb. 22-26, 1999).

* A primary protocol for algae production under title of “A primary report on phytoplankton production outlook” was prepared and reported to the Center for Fisheries Enhancement at Mote Marine Laboratory.

* New Facility and Supplies were obtained. It was determined that a lack of adequate nutrition was one of the factors accounting for low scallop larvae survival rate last fall. The first step toward improving the quality of the food (algae) was modification of the phytoplankton production system. Therefore, some modifications were suggested which included the ordering of new supplies for the facility. The phytoplankton laboratory would like to thank the Center for Fisheries Enhancement at Mote Marine Laboratory and SERF at Port Manatee for their support and cooperation.

* The increase of phytoplankton production activity towards improving production efficiency resulted in the need for volunteers and interns to be involved in the algae production program. The lab presently has two interns that are working in Port Manatee.

* A reverse osmosis unit was installed to provide the ability to monitor and adjust the salinity of the system to increase overall phytoplankton production. Salinity was not monitored previously. The use of a reverse osmosis unit will aid in daily salinity adjustments. The reverse osmosis system will also give us the ability to clean, rinse, and prepare glassware for use with the cultures and media.

* New 0.3um (preferably 0.2 um) filters were installed at each cylinder and carboy to reduce contamination and food competition due to foreign organisms, which improved the health of the culture.
Future Work:

Improvements in phytoplankton production will result in a healthier scallop broodstock, increased egg viability, and increased larvae survival. To maintain viable bivalve and zooplankton production, producing high quality algae culture is the key. Some modifications that are currently underway will act to improve our ability to maintain the high quality of phytoplankton production. This is crucial to the survival of the larval species involved.

The following strategies will be implemented in near future:

1. To produce a viable algae supply, a standard protocol needs to be fitted to the system for each step from water treatment to producing a high volume of phytoplankton. Referring to the protocol will aid in trouble shooting and in correcting any problem arising during the production process. Production procedures (e.g.: inoculation, sterilization, nutrient level, etc.) will be standardized based upon the protocol.

2. Currently, there is not a reliable and efficient water filtration system available in the lab. The primary water source for the phytoplankton facility is drawn directly from Tampa Bay. The water is stored in a tank outside of the hatchery to be treated with Hypo-chloride. The water will be left for at least 24 hours, and then will be brought into the phytoplankton room. Water is pumped into the phytoplankton room and stored in a reservoir tank to acclimate to room temperature. The pump system is then cycled over night and filtered with a 10um-pleated filter cartridge. The water is left to stand with aeration, and must be treated to eliminate residual chlorine before use.

The water source cannot be altered. Therefore, the treatment of the water needs to be modified. The initial treatment using 600 grams of Hypo-chloride will remain, while the filtration process inside the phytoplankton room needs to be changed. There will be an initial filter (35um) process as the water is pumped to the reservoir tank. The water will then be filtered as needed through a 10, 5, 1 um (down to 0.2 is desired) filter cartridge followed by treatment with UV (ultra-violet light) before use.

3. The air source is a contamination concern. A high-volume, low-pressure blower outside the phytoplankton room (inside the hatchery) supplies aeration to the phytoplankton culture room. The difference of the temperature between inside the phytoplankton room and outside (hatchery) where the blower is located causes the condensation of water in the air transferring pipes which results in the accumulation of moisture in the pipes that creates a suitable environment for bacteria, ciliate, and rotifer contamination growth. This can affect the growth, health, and survival of the algae cultures. The air supply needs to be drawn from inside the culture room. This will reduce the temperature change associated with the excessive moisture.

4. The phytoplankton lab has been modified from an office and workshop space. Therefore, it was not designed to be a culture room. At present, considering the nature of the work on a daily basis, there is a need for two floor drains to be added.

5. There is some shelf space available in the algae room that is used for storing flasks, culture and carboys. However, there is no light available in those areas. We are hoping that by installing
more fluorescent lights in that area in the near future we will be able to use those spaces more efficiently.

6. New stock culture is currently needed. Presently, the SERF facility at Port Manatee has in possession old stocks of algae species. Some of these are contaminated. Storage of culture stock at SERF is integral to maintaining young culture stocks and culture purity. The lab has recently received a refrigerator that enables us to keep algal stock cultures and to store nutrients to reduce contamination and maintain the exponential growth phase.

7. Bacteriological analysis will be implemented and recorded on a regular basis.

8. A chart indicating the ecological characteristics of all species under culture will be installed in the lab. For example:

- Picture of the species:
- Species:
- Temperature:
- Diameter (micron):
- Used for:
- Advantage as feed:
- Disadvantage as feed:
- Growth rate:

**Phytoplankton Species, present and future:**

The following species are currently available at the Port Manatee facility:

*Isochrysis galbana, Tetraselmis chuii, Tetraselmis candice, Dunaliella salina, Nanochoropsis sp., Nanochloris oculata.*

Only certain types of algae will give good growth when fed to bivalves, rotifers, and brine shrimp. They comprise two groups: the flagellates (able to swim) and diatoms (not mobile). Individual species of algae can be used as food, but feeding mixed diets, consisting of at least one type of diatom and one type of flagellate, produces much better growth for bivalves. Scallops are not an exception. Since scallops grow best when fed a variety of algae, several species of phytoplankton are suggested to grow in our facility. The species that are suggested for scallops are: Tahitian *Isochrysis* (T-ISO), *Isochrysis* (galbana), *Monochrysis*, *Dunaliella*(tertiolecta), *Chaetoceros*, *Tetraselmis*, *Thalassiosira*, *Monochrysis*(lutheri), *Nanochloris*(oculata), *phaeodactylum*(tricornutum), and *Navicula* sp.

**New Tasks:**

It is wise to consider the possibility of culturing species of algae that are abundant at the scallop release sites. The adaptation of the hatchery scallops to the species that are available at release sites may improve survival in the wild.

**Scale of Production:**

The phytoplankton lab is capable of producing 200-300 liters per day. However, we are hoping to reach higher production after completion of the suggested modifications to the system, and with two continuous laborers available (intern or volunteer).

The information and text within this section was provided by senior biologist Carole Neidig:

In October 1998, Carole Neidig, Senior Biologist (MML) implemented a project under the direction of Ken Leber, Ph.D. (Director, MML Center for Fisheries Enhancement) to increase our information on the success of red drum stock enhancement in Biscayne Bay based on fishery-independent sampling. This project complemented and expanded on fishery-dependent assessment work performed from the early 1990's by FDEP, the University of Miami, Florida International University, and MML (January through August 1998). Emphasis on direct fishery-independent sampling will negate many of the biases associated with creel interviews, defective tags, and voluntary tag returns. Fishery-independent sampling will also provide better population estimates and information on long-term survival of the various release cohorts. While this is the final report for FDEP Contract No. MR 216, the red drum fishery-independent assessment project (MML Project No. 107.332) in Biscayne Bay will continue into the fall of 1999. At the conclusion of this project assessment data will be reported to FDEP. C. Neidig will continue to provide informative updates to Bill Halstead (SERF) on a regular basis.

Project activities in Biscayne Bay from October 1998 through June 15, 1999 included: 1) increasing angler awareness, 2) conducting interviews with anglers to collect information about red drum fishing effort and capture rates, 3) obtaining red drum carcasses for evaluation of coded-wire-tag retention and genetic determination, and 4) conducting fishery-independent sampling, including sonic tracking, to capture hatchery-reared red drum released in Biscayne Bay.

1. Increased Angler Awareness

To better inform anglers and promote public support for the project, C. Neidig gave presentations to angler organizations and attended fishing shows and tournaments from Fort Lauderdale to Homestead, FL. Presentations included the history of the project and the contributions of the University of Miami and Florida International University. The goals and objectives of the red drum assessment project involving the partnership between Mote Marine Laboratory (MML) and the Department of Environmental Protection (DEP) were defined. Presentations also included information on hatchery production, tagging methods, stocking, genetic evaluation, and assessment. Photographs of volunteers catching red drum while assisting C. Neidig were displayed. Demonstrations were given on the use of sonic tracking equipment and techniques for taking fin clips for genetic testing. Business cards (Appendix A), genetic fin clip kits, and information packets were provided to interested anglers. In addition, members were asked for their suggestions and for their participation in the project.

Many anglers enthusiastically offered their boats, volunteered assistance, and provided information on red drum captures and sightings. At one of the presentations an attorney indicated his intent to fly his brother (an expert red drum fishing guide from Louisiana) to assist with capturing red drum for one week at his expense this summer. Enthusiasm shown by the public was expressed by a angler in the statement, "By helping you with this project we will be helping to make a better future for Biscayne Bay". Presentations to angler organizations
included Fish and Game Unlimited of Homestead, Fort Lauderdale South Florida Flats Anglers Association, Homestead/Florida Keys South Florida Flats Anglers Association, South Florida Fly Fishing Clubs in Fort Lauderdale and Homestead. Fishing shows and tournaments included the Florida Sportsmen Fishing Show in Miami and the Fish and Game Unlimited Annual Youth Fishing Tournament held in Homestead. Several presentations were given at the Fish and Game Unlimited of Homestead meetings.

C. Neidig made regular visits to over thirty angler supply stores, bait and tackle shops, boat supply centers, marinas, and to dock masters to elicit their support in the project and keep them informed of current findings. These have been tremendously cooperative and supportive and have taken the project on as a community effort. Their daily contact with anglers has been instrumental in providing information to the public and increasing awareness of the project goals and objectives.

When visiting the above, C. Neidig provides project information hand-outs, makes inquiries concerning red drum captures and sightings, and obtains red drum carcasses. In addition, information published by FDEP concerning fishing regulations, life history of red drum, and posters of different fish species have been distributed.

C. Neidig spoke with fishing guides and recreational boat and shoreline anglers at Matheson Hammock, Black Point and Homestead Bayfront Park marinas about the new study and asked for any red drum information they could provide. Information gathered from these anglers indicates that there are four groups of fishers that: 1) fish offshore, and have not seen red drum, 2) fish in Bay, and have not seen red drum or do not know what red drum look like, 3) fish in Bay and have caught red drum but were targeting snook or permit, and 4) fish in Bay for red drum. Several anglers reported their intent to target red drum because they have heard about recent catches.

On February 19th, an article titled “Redfish Rebound” written by Susan Cocking (Appendix B) was published in the Miami Herald. The article appeared in the “Sports Weekend/Outdoors and What to Watch” section. S. Cocking spent a day on the water with C. Neidig, Cliff Kunde (Game and Fish Unlimited of Homestead) and Harrison Bresee (Sea Grant, Miami) tracking and catching red drum. She had an opportunity to see red drum in several areas north and south of Black Point. She also toured SERF and met with Bill Halstead, John Ransier, Cindy Armstrong, and C. Neidig. The article was informative and beneficial for the project. The article resulted in C. Neidig receiving many telephone calls concerning the project. Calls included anglers interested in assisting with the project, information on where red drum had been sighted, and general questions concerning red drum life history. S. Cocking has offered to publish requests for assistance and plans to follow our progress. On the day the article was published Roger DeBruler (MML) and C. Neidig delivered copies to each of the participating bait shops listed in the article and gave copies to several additional shops.

2. Creel Surveys

From January through August 31, 1998, S. Maloney (MML) conducted creel surveys at boat ramps, docks and other angler sites from Oleta River in north Biscayne Bay to Homestead Bayfront Park in south Biscayne Bay. The results of these creel surveys were presented in the Final Report for contract No. MR 237, “Critical Evaluation of Red Drum Stock Enhancement
Releases in Biscayne Bay, Florida” November 25, 1998. Creel survey efforts are being continued by MML sub-contractors at boat ramps close to areas of red drum sightings, capture areas of tagged red drum returns, and sites with highest fishing activity (ie. Black Point and Homestead Bayfront Park). Creel surveys are taken of anglers aboard boats and each person who fished was considered as a single interview. The following information is included in each interview:

1) date,
2) time,
3) location of interview,
4) name of boat,
5) did the angler fish in or outside of Biscayne Bay,
6) length of time angler fished,
7) did the angler target red drum, or if not, what species was targeted,
8) did the angler catch red drum on this trip or on previous trips,
   a) approximate date
   b) location
   c) did fish have a visible tag
   d) was tag number reported
   e) was fish released
9) did the angler see red drum on this trip or on previous trips
   a) approximate date
   b) location
   c) approximate number of fish.

Anglers are provided information concerning the project and are given a card for contacting MML/DEP to report red drum captures and sightings. C. Neidig is also working closely with the U.S. National Park Service (NPS), Biscayne Bay office to obtain creel census data. The NPS performs creel surveys on Sundays at Homestead Bayfront Park and provides MML/FDEP project information packets to interested anglers and red drum capture or sighting reports to C. Neidig.

3. **Angler Reports**

Informal interviews were conducted to obtain information “unconfirmed” of where red drum were caught or sighted. The interviews were conducted at:

1) Bait and Tackle Shops - owners, managers and customers,
2) Boat Supply Stores - owners, manager and customers,
3) Fishing Clubs - fishing guides and anglers,
4) Marinas (Matheson Hammock, Black Point, Homestead Bayfront Park) - shoreline anglers and anglers on boats,
5) Florida Power, Turkey Point Power Plant - shoreline anglers,
6) Biscayne Bay National Park (Convoy Point) - park rangers, shoreline anglers, and
7) Telephone Interviews - anglers who call C. Neidig for information and calls made to anglers by C. Neidig and C. Armstrong (SERF).

The following list includes "unconfirmed" reports of locations where red drum were sighted or caught by anglers:

North Bay
• Oleta River
• East Reynolds Park
• Belle Island
• Bakers Haulover Inlet
• Miami Beach - South Point Park fishing jetty
• Key Biscayne - north-side, near Miami Marine Stadium
• Bear Cut
• Virginia Key

South Bay
• Matheson Hammock
• Snapper Creek
• Kings Bay
• Chicken Key - *canals on mainland east of key,
• Black Point - *marine patrol boat dock, *main channel, *lagoon north of marina channel, and marsh north of lagoon.
• Black Point Spoil Islands (south) - *spoil island banks, *embayment north of spoil islands, creek north of spoil islands.
• 102 Canal - *inside canal, outside mouth of canal
• Homestead Bayfront Park - *marina dock, cleaning station, shoreline in front of park, and *lagoon north of park channel.
• Turkey Point - *main canal in front of Power Plant
• Turkey Point Cooling Canals (4 miles south of main canal)
• East Arsenicker Island
• Pelican Shoal
• Card Sound - under Card Sound bridge, channel southeast of bridge
• Barnes Sound

* indicates red drum were captured or sighted by MML and/or DEP biologists.

4. Head/ Carcass/ Tissue Returns

To obtain accurate information from anglers on red drum captures detailed guidelines were posted at participating bait and tackle shops and were included in sampling packets provided to interested anglers. Instructions were included for catching tagged and non-tagged red drum. A copy of the guidelines is included in Appendix C.

Fish sampling packets consisted of a quart Ziploc ® bag containing instructions (Appendix D), ten waterproof identification tags with preprinted areas for information to be recorded (Appendix E), ten waterproof identification cards (for fin clips), tags, one pair of four-
inch scissors, ten pieces of three inch square freezer foil, ten snack size Ziploc® plastic bags, ten
13-gallon size plastic bags (for whole carcasses), one fine point black marker, and one pencil.

Examination of fish carcasses will provide information on coded wire tag (CWT) retention, tag validation (correlate CWT series with internal tag code), standard and total length, gonad maturation, and the presence of a sonic tag (sometimes missed when fish are filleted). Genetic evaluation (DEP) of fin clips will help to identify untagged hatchery-reared fish (or one that has lost its tag). This can be done if we obtain sufficient tissue samples from the field. Methods for collecting fin clips were reviewed and approved by Terry Bert, Ph.D (DEP). C. Neidig retrieved over 30 red drum carcasses and/or heads.

Four shops who provided freezer space for the University of Miami/DEP red drum project in Biscayne Bay agreed to be listed as the primary sites for anglers to obtain fish kits and for anglers to drop off carcasses. The shops include:

A-OK Fish ‘N’ Bait
732 S. Krome Ave.
Homestead, FL 33030

Don’s Bait and Tackle
30710 South Federal Hwy.
Homestead, FL 33030

High Tailin-It
20264 Old Cutler Rd.
Miami, FL 331189

Ship & Shore Marine Store
541 West Ave.
Miami Beach, FL 33139

Since October 1998 there have been approximately 166 confirmed red drum tag returns to DEP. A total of 731 tags have been returned since the start of the project.

5. Fishery-Independent Assessment

Efforts were continued to increase our information on the success of red drum stock enhancement in Biscayne Bay based on fishery-independent sampling. Sampling included sonic tracking and angling from boats and from shore. At each site (when applicable) the following parameters were recorded: date, time, latitude, longitude, tide, wind, depth, water temperature, dissolved oxygen, pH, salinity, and site description. In addition, red drum sightings and captures were recorded. Fish information included: collection gear, internal anchor tag number, coded wire tag retention, total length, fin clip removed, and fish and tag condition. A copy of the field data form is included in Appendix F. Sampling assistance was provided by volunteers, hired fishing guides and volunteer anglers with boats and from shore. Areas sampled include:

Note: the shoreline north of Chicken Key south to Card Sound, including creeks and mosquito control ditches were sampled regularly.

- Oleta River - to Maule Lake
- South Bay
  - Snapper Creek
  - Chicken Key - *canal adjacent to Florida Power, Cutler Ridge Power Plant
  - Black Point North - *bird lagoon north of marsh
  - Black Point North - *marsh
  - Black Point North - *embayment north of marina channel.
• Black Point Central - *marine patrol boat dock, *main channel, *shrimp boat docks.
• Black Point South - *spoil island banks, *embayment adjacent to spoil islands, creek north of spoil islands.
• 102 Canal - *inside canal, outside mouth of canal
• Mowry Canal - inside canal, outside mouth of canal
• Military Canal - inside canal, outside mouth of canal
• Homestead Bayfront Park - *marina dock, *mangrove shoreline on north side of marina, marina cleaning station, and in front of park (canon).
• Turkey Point Power Plant - *main canal
  West Arsenicker Island
  Arsenicker Key
  Long Arsenicker Island
Card Sound
• Turkey Point Cooling Canals - two canals located approximately 2 miles south of Power Plant
• Creek - adjacent to the canals mentioned above
• Card Sound bridge
• Canal North (adjacent to bridge)
• Canal South (adjacent to bridge, leads to boat ramp and Alabama Jack’s)
• East Creek - east shoreline, north of bridge
* indicates red drum were captured or sighted by MML and/or DEP biologists.

Land-based sonic tracking was conducted from Chicken Key to Homestead Bayfront Park. C. Kunde obtained permission for C. Neidig to access several private properties (i.e. Montgomery Botanical Foundation, Snowden Site, Snapper Creek Dam, Chapman Estate, Kunde Property- his parents house). The properties are located on the west shore of North Biscayne Bay. The Montgomery Botanical Foundation site has five lakes that are connected to the Bay by a series of mosquito control ditches. No red drum were seen at the time of sampling.

C. Kunde and J. Moore (volunteers) assisted C. Neidig in obtaining permission to access the Florida Power Turkey Point Power Plant main canal by shore or by land. In addition, C. Kunde provided locations where narrow canals could be accessed from shore or from bridges in the North Bay.

A 24 foot Tremblay with a 9 foot tower and 150 hp Evinrude engine was purchased by MML for sampling in Biscayne Bay. A 90 hp Evinrude engine was provided by DEP for use as back-up. The boat is equipped with a recirculating live well for transport of fish, if necessary. A Trammel net was purchased by Metropolitan Dade County Environmental Resource Management for sampling in Biscayne Bay.

Sampling efforts, angling and seining have resulted in over 50 fish being recovered. Sonic tracking has been a useful tool for locating red drum. Fish have been located in areas which might have otherwise not been considered for sampling. On many occasions a sonic tagged fish was seen schooling with other red drum. Several fish captured with sonic tagged red drum were from previous releases in Biscayne Bay. In addition, several fish were recovered without tags and were provided to DEP for genetic evaluation. Data forms from tracking trips
and fish collections were sent to C. Armstrong (SERF). Evaluation of capture data to present are being analyzed.

Some interesting findings have included several red drum that have been sighted numerous times since their release in November 1998. One of the fish moved two miles south to a marina soon after release and has been located there repeatedly. Most red drum have been sighted under mangrove prop roots or under snags close to the shoreline. Using the sonic tracking equipment, one school of approximately 20 fish were found in the main canal of the Turkey Point Power Plant. The canal is 24 feet deep and has a six to eight foot slope with a steep drop-off on each side. The back of the canal is closed by a concrete wall. Several FPL employees have caught red drum from the canal by angling from the shoreline. The sonic equipment was invaluable in locating a school of over 75 red drum which were within two feet of shore hidden under dense mangrove branches. In addition, several fish have been located in mosquito ditches too narrow and shallow to access by boat.

C. Neidig worked with Randy Edwards and J. Sprinkel (MML) to define a database and format for entering sonic tagged fish information to plot relocations and movement patterns. It was determined that data would be entered on a Quattro-Pro spreadsheet. File copies will be sent to SERF.

6. Additional Activities

In March, the National Park Service requested project information for their web-site listing research in Biscayne Bay. A project summary was submitted and included information concerning project objectives, funding source, and status.

On April 24th (Saturday), 1999, C. Neidig attended the Fish and Game Unlimited of Homestead Annual Youth Fishing Tournament at Homestead Bayfront Park. Approximately 525 children participated. There was no entry fee and each child (3-18) received a free rod and reel and bait. Many prizes were provided. One of the children (8 yrs old) caught a tagged red drum (17 3/4") off the bank. It was the third time the child had fished. It was the largest fish caught during the tournament. One-hundred dollars worth of items from the MML Aquarium Gift Shop for Fish and Game Unlimited to give away as prizes in the Youth Fishing Tournament in April. This was in exchange for them allowing DEP and MML to use their facility in Homestead.

In February, the technician hired by MML in December 1998 was dismissed. In February job announcements were posted and applicants were reviewed in March. The technician position was offered to the best applicant, but was declined. To increase our opportunity for success the following suggestion was proposed to K. Leber, Ph.D. and B. Halstead. In May, five anglers who have assisted C. Neidig with the project were hired as sub-contractors at a technician salary. They include: Cliff Kunde, James Johnson, Bobby Shiver, Steve Owens, and George Kunde. Tom King was hired to assist from June through August. Collectively the first five subcontractors would not work over 40 hours per week unless otherwise indicated. The anglers own their own flats boats, are familiar with the Bay, and have many times expressed their eagerness to assist C. Neidig with the project. One subcontractor assists with coordinating sampling activities and data collection.
III. Collaborate in Research to Develop Stock Enhancement Capabilities with High-Priority Finfish Species.

Snook is an excellent test species for developing and evaluating coastal stock enhancement technology. In partnership with Florida Department of Environmental Protection (FDEP), the Stock Enhancement Program at Mote Marine Laboratory has continued to work on an evaluation of responsible snook stock enhancement potential in Florida. The principle activities included are: (A) Tagging and release activities with juvenile hatchery snook, (B) follow up field sampling to test and evaluate a snook stock enhancement prototype, and (C) ongoing snook production to provide fingerlings for the prototype release-recapture experiments.

(A) Tagging and release activities with juvenile hatchery snook

1. Tag Retention Studies with juvenile snook

A responsible approach in a marine stock enhancement program can only be accomplished when a successful, reliable tagging system has been established and applied towards the stocked species. Ideal qualifications of a tag selected for this endeavor are that (1) it be retained over the lifetime of the organism, (2) it contain information about its stocking history, (3) it is benign and does not cause harm or stress to the stocked species, (4) it does not cause increased mortality for the tagged animal, (5) it does not modify the animal’s behavior compared to untagged animals of the same species, (6) it is easily identifiable in the field, (7) it is not too expensive, and (8) it can be applied easily and quickly, especially in a large-scale tagging production.

Mote Marine Lab researchers in partnership with Florida Department of Environmental Protection researchers are actively seeking methods to accomplish these goals. The coded-wire tag (CWT) was selected to be applied toward the snook stock enhancement program because it qualifies in many ways. A second tag, the visible implant elastomer (VIE), is currently being tested to serve as an external indicator of a hatchery fish which is not possible with the CWT alone. VIE’s are internal and benign, yet if placed in clear tissue they can be easily visible to the untrained eye. Used together, the CWT would allow researchers to collect information critical to stocking success through independent sampling, while the VIE would allow fishermen to be able to identify a hatchery fish in their catch. Participation of fishermen can be extremely helpful to researchers, and can be very important in developing satisfaction and pride toward a stock enhancement program among both the public and professionals.


In April 1998, a long-term VIE retention study was initiated with juvenile snook. VIE material was injected into the ventral side of the lower jaw on both the left and right sides of the fish. A “full” amount of VIE material was injected into the right ventral side of the jaw, while the left ventral side of the same jaw received only “half” of the VIE material. A “full” amount of VIE material was also injected into the ventral caudal peduncle of the same fish.

Retention was monitored periodically after tagging with checks at 1.5 months, 3 months, 4.5 months, 6 months, 9 months and 12 months. Remarkably, at 1.5 months after tagging, VIE retention in the right jaw (which received only “half” the amount of VIE material per injection)
was higher (71%) than the VIE retention in the left jaw which received the “full” amount of VIE material (46%). Although tag loss was steady, this pattern remained the same after 12 months with retention rates of 21% vs. 12% respectively.

Twelve months after tagging, VIE tags in the caudal peduncle were visible under a black light in 80% of the fish originally tagged. At that time the fish were approximately 2 years old. Because pigmentation occurred over the tag, tag visibility with the naked eye was only 33% at 12 months after tagging. Caudal pigmentation occurs gradually in juvenile snook with age. These results show that although VIE retention is acceptable in the caudal peduncle, visibility declines over time and is not suitable as an external indicator of a hatchery fish for long periods of time.

1b. CWT placement in caudal peduncle, (b) development of head molds and application to nose cartilage, and (c) application of VIE tags into various body locations.

In January 1999, detailed tag-retention experiments were performed to test optimal tag types, body location and tagging methods with juvenile snook. Mote researchers, with the collaboration and assistance of John Ransier and Cindy Armstrong of FDEP, tagged approximately 1,000 juvenile snook that had been reared at the Mote Aquaculture facility. (1) Coded-wire tags (CWT, developed by Northwest Marine Technology, Shaw Island, WA) were injected into the muscle tissue of the dorsal caudal peduncle. (2) CWT’s were also injected into anterior nose cartilage tissue with the use of specialized, size-dependent head molds. These head molds were fabricated and applied towards large-scale CWT tagging in attempts to direct accurate placement of the CWT into the cartilaginous nose tissue, and to improve tagging speed. (3) Visible Implant Elastomers (VIE, developed by Northwest Marine Technology, Shaw Island, WA) were injected into the adipose eyelid tissue (posterior to the eye), underneath the nose skin, and ventrally into the muscle tissue of the caudal peduncle. For the adipose eyelid and the nose locations, VIE’s were injected into both the right and left sides of the fish. These fish were held at the MML fisheries facility where tag retention checks were performed at 10 d and 38 d after tagging.

Tag Retention 38 d after tagging was as follows: (1) CWT retention in the caudal peduncle was 100% for snook 135-165 mm FL, (2) CWT retention in the nose cartilage for 60-90 mm (FL) snook was 80%, 76% for 90-110 mm (FL); 94% for 110-135 mm, and 45% for 135-165 mm (FL), (3) overall VIE retention was 59% in the adipose eye tissue, 49% in the nose skin, and 86% in the caudal peduncle. Treatments of juvenile snook for all sizes which received approximately “half” amount of VIE material per injection in the adipose eyelid site had 43% retention after 38 d compared to 59% retention after 38 d from treatments which received the “full” amount of VIE injected into the same site.

CWT retention in the caudal peduncle was excellent. Tagging in this area is relatively easy because of the large amount of target tissue. We predict that other fleshy tissue along the dorsal area would also be suitable for CWT placement with high retention rates. Tag location can be deciphered with field wand detectors when CWT’s are placed in different body locations—even for CWT’s placed on opposite sides of the body. CWT’s injected in this way may eventually serve to identify fish groups based on CWT placement alone (ie. wild vs. hatchery fish).
For snook tagged in the nose cartilage, CWT retention is a result of tag placement directed by a given head-mold. Because the CWT retention rates among different size classes varied from poor (45%) to excellent (94%) it is plausible that with improvement/recreation of the head-mold models we will achieve consistent retention rates of 94% or better for all snook tagged between 60 - 200 mm FL. Several adjustments to the head mold design will be tested. When perfected, head-molds will allow fast and accurate tagging from relatively inexperienced taggers. At this time however we will continue to coded-wire tag juvenile snook in the cheek muscle.

Tag retention of VIE’s placed in the adipose eyelid tissue was similar to retention of VIE injected into the nose skin. VIE retention was strongly affected by tagger experience for all VIE injection sites. Tagger also showed preferences for certain tagging sites over others - VIE retention rates were not consistently higher in the nose vs the adipose eyelid. Some taggers had significantly better retention rates with the adipose eyelid location while other taggers had significantly better retention rates with the nose skin location. This prevented strong conclusions from being drawn as to which target tissue was most suitable for implantation of VIE’s.

Retention of VIE injected into the caudal peduncle was excellent (100%). However, the caudal peduncle is not suitable for long-term studies because pigmentation occurs in the tissue and tag visibility becomes poor. We will continue to test VIE’s placed in snook body locations with clear tissue.

2. Test and Establish a Snook Stock Enhancement Prototype in Sarasota Bay.

In collaboration with ongoing snook stock enhancement research, partially funded by the U.S. Gulf of Mexico Marine Stock Enhancement Program (USGMSEP), and partially funded by FDEP, Mote stock enhancement researchers have conducted ongoing pilot stock enhancement experiments with snook in Sarasota Bay since 1997. Through partnership with FDEP, these activities involve detailed tagging and release experiments which test optimal release strategies for stock enhancement of snook in Florida. More specifically, some of these goals include determining optimal release habitat, optimal size-at-release, and optimal release season. This research continues to be supported with an additional technician partially funded by this FDEP project as well as the use of coded-wire tagging and detecting equipment owned by FDEP.

2a. Experimental Design and Release

A modified randomized block design was used for the snook releases into Sarasota Bay. Stream habitats were selected as the basis of habitat type for release with four “micro-habitats” or stratum selected within. Each experimental block (stream) consisted of four micro-habitats including: (1) upstream habitat, (2) midstream habitat, (3) stream mouth habitat, and (4) mangrove shoreline habitat across the inter-coastal waterway from the stream mouth. Within each micro-habitat three size classes of juvenile snook were released. This overall design was replicated with similar numbers and sizes of released fish per micro-habitat two weeks after the first release (Table 1). Releases occurred between 21 April 1999 and 4 May 1999. All releases were performed during daylight hours between 9:00 - 14:00.

Large-scale juvenile snook tagging was performed at the Mote Marine Laboratories’ Mote Aquaculture facility. Mote Marine Lab personnel, with the cooperation and assistance of FDEP tagging personnel, John Ransier and Cindy Armstrong, and Lee Blankenship, a tagging expert from Washington Department of Fish and Wildlife, performed a large-scale juvenile snook tagging operation on April 5, 1999 through April 12, 1999. All snook were sedated with MS 222 prior and during tagging. Single-length CWT’s were injected into the cheek muscle with Mark IV tagging machines owned by FDEP. After CWT’s were injected into the juvenile snook, VIE’s were also injected into both the adipose eyelid and the nose skin of each fish. These tags served as externally visible indicators of hatchery fish. Therefore each fish received a CWT, and two VIE tags. Sequential CWT’s were used to identify individual release groups. Length and weight subsamples of each release group were taken during the tagging process. Tagged juvenile snook were then returned to their tanks and held until release. Health certification checks were performed by Dr. John Slaughter on subsampled snook from each source group prior to tagging. Upon receiving approval for release the tagged juvenile snook were released into different habitats of Sarasota Bay. 9,510 juvenile snook were successfully tagged and released into the wild; this represented ninety eight coded release groups, the largest juvenile snook tagging and release operation since the inception of the program in 1997.

2c. Tag Retention

Tagged juvenile snook were held in conical tanks with recirculating water systems. Tank salinity ranged from 3 ppt - 6 ppt and water temperature between 26 - 33° C. Subsamples were taken from each release group 2-3 hours before the release occurred. Therefore tag retention was checked 10-14 d after tagging. Approximately 50 fish (~50%) from each release group was checked for the presence of a CWT with a CWT detector; each fish was also checked visually for the presence of a VIE. The overall CWT retention 10 d after tagging for all sizes of snook was 97% (n=4,842). This represents the best CWT retention achieved to date among all snook releases performed in Sarasota Bay. Average CWT retention 10 d after tagging was 95% for “small” fish (70 - 130 mm FL; n=3,299), and 98% for “medium” and “large” fish (130 - 260 mm FL; n=1,543). VIE retention rates 10 d after tagging was 65% for “small” snook, and 84% for “medium” and “large” snook tagged in the adipose eyelid, and 78%, for “small”, and 84% for “medium” and “large” snook tagged with VIE’s in the nose skin.

(B) Follow up field sampling to test and evaluate a snook stock enhancement prototype

1. Recapture Efforts

A standardized sampling program was designed and tested to evaluate the contribution rates, growth, relative survival, and migration of the different release cohorts of hatchery snook in the wild. Standardized sampling has been an ongoing program since the first releases in 1997. However, continual improvements have been made to this sampling program mainly in the form of selection and use of more efficient gear, and the reduction of less suitable and less efficient gear. Notably, the use of a 150' long x 10' deep seine has increased snook catches ten fold while
it does not require significant increases in manpower and effort to be made. Also, several other forms of sampling outside of the juvenile release habitats has been implemented in 1998, such as sampling adult snook involved in spawning activities along beaches during the summer months, the implementation of a night hook and line fishing program, and the first stock enhancement snook tournament held in Sarasota Bay, in October.

1a. Standardized Sampling

Standardized sampling was performed monthly following the releases in April 1998 at all release sites through July 1998 (See 1st interim report; Section 3A). After July 1998, sampling was redirected towards collecting snook along passes and beaches. These activities coincided with snook spawning behavior (See 2nd interim report; Section 3A: “Adult Snook Sampling”). In addition to beach and pass sampling, snook were sampled at night in the inter-coastal waterways with hook and line gear (See 2nd interim report; Section 3A: “Night Sampling”). By the fall of 1998, the standardized sampling design was again modified and employed at release sites and at “remote” sites where snook had not been released, but were still considered good snook habitat (See 3rd Interim Report). The effectiveness of this new sampling design greatly increased catches of both juvenile and adult snook. These efforts are advancing our knowledge and understanding of the status of hatchery snook in the wild and ultimately providing a means to determine optimal release strategies for snook stock enhancement in Florida.

Between January 1, 1999 and March 1, 1999 standardized sampling has continued for hatchery snook in Sarasota Bay. All release sites were sampled in January and again in March. In February a remote standardized sample was employed. In January, 292 snook were captured at release sites and of these 15 (5.14%) were tagged. In February, 206 snook were captured in “remote” sites and 2 (0.97%) were tagged. In March over 220 snook were captured at the release sites and 18 (8.18%) were tagged.

Pilot studies of stock enhancement in Florida were continued in Sarasota Bay with the fourth experimental release of juvenile snook in April 1999 (Table 1). Optimal release site was tested focusing on micro-habitat within and around four different stream systems in Sarasota Bay. Stratified habitat within and around the streams were chosen for release. Additionally, releases were performed within mangrove ditches while others were released along mangrove shorelines near open water. Recapture results will determine maximum survival rates, and optimal growth among the release treatments. Migrational patterns to and from the release sites will also help clarify optimal release sites for juvenile snook.

Post-release sampling since the April 1999 release was conducted in May and June, 1999. Accounting for both replicate release lots at a site, sampling occurred 14 d and 7 d after the lot 1 and lot 2 releases respectively. All snook captured were counted, measured, and checked for the presence of CWT’s and VIE’s. Untagged snook were released while tagged hatchery snook were returned to the laboratory for CWT extraction and detailed examination. Water quality was measured at a minimum of three of the capture locations. Measurements included temperature, salinity, dissolved oxygen, pH, and turbidity. Other habitat was also described including, substrate, surrounding structure, water depth, current, and if the catch area was shaded or not.
Associated species were also counted and maximum and minimum lengths were estimated. Recapture efforts in May and June, 1999 were focused at the release sites. Since the release in April 1999, standardized sampling occurred between May 6, 1999 and May 20, 1999. 164 snook were captured and of these 43 were tagged (26.22% hatchery fish). A second standardized sampling effort at the release sites between May 27, 1999, and June 10, 1999, and yielded 314 snook with 76 tagged snook (24.20% hatchery fish). A size structure of wild and hatchery snook captured in the standardized samples before and after the release are described in Figure 1. CWT extraction and decoding will be conducted throughout the summer of 1999 as hatchery fish are recaptured. Analysis of these results will performed following these activities.

3b. Beach Sampling
With the advent of the snook spawning season, Mote researchers have begun to sample the beach populations of adult snook for presence of tagged hatchery snook. Sampling efforts were initiated on May 31, 1999 at Casey Key and Siesta Key beaches. 29 adult snook were check for CWT’s and VIE’s; none were tagged. On June 4, 1999, 52 adult brood snook were captured and checked although none were tagged. On June 14 and 15, 1999, in New Pass, 131 snook were also checked for tags; none were tagged. Therefore, 212 adult snook have been captured and checked for the presence of tags this summer. Beach sampling of adult snook in Sarasota Bay will continue throughout the summer. It has been three years since the first hatchery snook were released into the Sarasota Bay waters and neighboring waters. The largest recaptured hatchery snook to date are 18 - 22 inches long. Although no hatchery snook have been documented to participate in the spawning activities, the largest of the released hatchery snook are within the sizes captured on the beaches. This leads us to believe that it is just a matter of time before hatchery snook are documented participating in spawning activities. We will provide periodic updates as significant events occur.

2. Additional Activities
2a. Fishing Shows
Other notable activities have included MML participation in major fishing shows held in Southwest Florida. During these, informational booths were manned by MML and contained informative flyers about the project. Videos were played containing footage of research involving spawning adult snook, larval rearing, juvenile rearing, tagging, releasing juvenile snook into Sarasota Bay waters and recapture activities. Live tanks were also displayed which contained juvenile snook tagged with fluorescent VIE material similar to stocked fish. Many contacts with interested anglers were made during these shows.

2b. Snook Tournament
On December 4-5, 1998, the first ever snook catch-and-release fishing tournament was held at Mote Marine Laboratory. The tournament was held (1) to promote angler awareness and enthusiasm of the stock enhancement program, (2) allow stock enhancement researchers to further develop a working relationship with local fishermen, (3) allow researchers to collect important dispersal information on the tagged and released snook in Sarasota Bay and its surrounding waters (4) allow researchers to collect important angling CPUE data of the hatchery snook, (5) allow
researchers to collect contribution rates of hatchery snook from different areas of Sarasota Bay and its surrounding waters, and (6) allow researchers to collect growth and condition data from both wild and hatchery fish.

The Captain's Meeting started at 6:00pm on December 4, with Dr. Ken Leber explaining why the tournament was conceived, and a little bit on the background of the Snook project at Mote Marine Laboratory (MML). Dr. John Miller from NCSU, Steve Serfling of Mote Aquaculture, Bill Halstead from DEP/SERF, and Officer Terry Noll from the DEP/FMP, Cliff Ondercin, Dennis Medved, and Roger DeBruler Jr. from MML and Tournament Volunteers were present. Sixteen of the nineteen anglers were present.

Bill Halstead issued four Special Authorization Permits to the following anglers:

Dave Robinson of Sarasota
Todd McKinnis of Tampa
Jonnie Walker of Sarasota
Tom Corbin of St. Petersburg

Weigh-in Stations:

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<tr>
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<td>LITTLE ROBERTS BAY</td>
<td>Justin Bowlees</td>
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<td>Dennis Medved</td>
</tr>
<tr>
<td>NOKOMIS</td>
<td>Cliff Ondercin</td>
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Researchers at MML, Midnight pass, and Roberts Bay stations measured snook, checked them for the presence of tags, and recorded other important information on the snook caught by the anglers. No anglers checked in at Long Bar or Nokomis stations. MML and Midnight Pass stations were manned for the entire tournament by the following:

MOTENUUUNELABORATORY
Roger DeBruler Jr. from 7:00pm December 4th to 4:00 pm December 5th.

MIDNIGHT PASS
Cliff Ondercin from 7:00pm December 4th to 6:00 am December 6th.
Serri Potter from 6:00am to 4:00pm on December 5th.

During the tournament, 37 fish were caught and recorded by our weigh-in stations. A total of 30 snook were caught, two of which were tagged. The largest tagged fish was 11.5 inches FL and the largest overall snook was 22 inches FL. All non-tagged snook were released unharmed back into the water from which they were caught. Seven Red drum were also caught, none with tags, all released unharmed.

SPONSORS LIST:
Mr. CB’s SALTWATER OUTFITTERS
ECONOMY TACKLE
NEW PASS BAIT SHOP
HART’S LANDING
BOAT/US MARINE CENTER
E&B DISCOUNT MARINE
WEST MARINE

Winners List:

MOST TAGGED SNOOK CAUGHT

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<td>SECOND PLACE</td>
<td>JONNIE WALKER (OF SARASOTA)</td>
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<td>THIRD PLACE</td>
<td>MARYLEE ZARRANZ (OF HIALEAH)</td>
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LARGEST SNOOK CAUGHT

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<tr>
<td>THIRD PLACE</td>
<td>JOANN WALKER (OF SARASOTA)</td>
</tr>
</tbody>
</table>

VOLUNTEERS

- Sherri Potter
- Rebecca Schroepfer
- Greg Lose
- Justin Bowlees
- Justin’s brother
- Vicki Fritz

OVERALL

The tournament went very well. The anglers had a great time. Only one child entered the tournament. The help and participation from the Florida Department of Environmental Protection in Tallahassee, St. Petersburg, Port Manatee, all the Sponsors, and all the Volunteers was instrumental in setting up this tournament. This tournament is planned again for the Fall of 1999.
C. Culture of High Priority FinFish Species: Common Snook (*Centropomus undecimalis*)

In preparation for continued studies testing the potential of snook stock enhancement in Florida waters, researchers in the Mote Aquaculture program have made significant progress. This snook production work is funded by FDEP through this project. During this report period, 9,510 juvenile snook from the summer, 1998, spawns were successfully tagged and released into Sarasota Bay and its surrounding waters (see above). Recently, snook larvae production efforts were renewed for the summer months of 1999. On May 30 - June 1, 1999, wild snook eggs and sperm were collected from adult snook spawning off of Casey Key Beach, Midnight Pass, and Turtle Beach. Fertilized eggs were returned to the Mote Aquaculture Facility for grow-out. Egg quality was poor, however, and Mote researchers again collected wild eggs and sperm on June 14-June 16, 1999, from New Pass. Fertilized eggs from this excursion were of excellent quality with high abundance. Tanks were stocked at the Mote Aquaculture facility and grow-out has been successful to date. Mote researchers are planning to continue to collect eggs and sperm from the wild fish in Sarasota Bay throughout the summer.
IV. Assist the Department with Strategic Planning

In line with the short and long-term objectives of strategic planning for the Department’s marine stock enhancement program, several steps have been made toward (1) improving the effectiveness of the Department’s marine stock enhancement program, (2) adapting and refining the aspects of a “Responsible Approach to Marine Stock Enhancement” (Blankenship and Leber, 1995) that have not yet been fully implemented in Florida, and (3) identifying and prioritizing potential marine fish species for stock enhancement in Florida.

- Ken Leber has been working closely with the Florida Department of Environmental Protection Stock Enhancement program to further our partnership in stock enhancement.

- Ken Leber has continued to work on long-range planning of stock enhancement goals and objectives for the State of Florida.

- Ken Leber has worked closely with senior biologist C. Neidig to help develop and refine a more quantitative assessment of the impact of red fish releases in Miami’s Biscayne Bay.

- A publication was submitted to the Bulletin of the National Research Institute of Aquaculture in Japan by co-authors Mike Tringali and K. Leber entitled “Genetic Considerations During the Experimental and Expanded Phases of Snook Stock Enhancement”. This paper addresses the refinement of snook genetic objectives and protocols for stock enhancement research and development in Florida, and was presented at the 17th annual UJNR symposium at Ise City, Japan, in November 1998.

- In attempts to improve the effectiveness of stock enhancement releases of red fish in Florida, K. Leber has assisted in the planning, research design, and implementation of red fish releases in habitats outside of Biscayne Bay. A comparative study has been set up to determine hatchery-released redfish survival and growth in habitats with existing populations of wild redfish vs. in habitats where natural recruitment of redfish has been historically low (i.e. Biscayne Bay). Particular attention has been paid towards implementing a successful design, developed in Hawaii, to enable a rapid refinement and improvement of the impact of hatchery releases in the wild. This work has also involved the assistance of senior biologist, Nathan Brennan, in the planning, tagging, and release processes, and the assistance of additional personnel from the MML staff and interns.

- Ken Leber attended the annual meeting of the World Aquaculture Society in Sidney, Australia, in April 1999. He presented a paper describing the scaling marine hatchery releases to match environmental habitats. Coauthors were from MML, FDEP.
• Ken Leber organized and submitted a proposal to the Sea Grant Technology Program in April 1999. Proposed activities include stock enhancement of Bay scallops (*Argopectin irradians*) in Sarasota Bay. Collaborators in this project are MML, FMRI, FDEP at Port Manatee, and University of South Florida.

• Ken Leber also attended regular staff meetings at the SERF facility to assist as needed in planning and coordinating ongoing stock enhancement efforts.
Table 1. 1999 hatchery snook release information. Information from lot 1 is contained on this page.

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Lot 2 Subtotal: 4892
Grand Total: 9510
Biscayne Bay Red Drum Stock Enhancement
A Department of Environmental Protection & Mote Marine Laboratory Partnership

Carole L. Neidig
Senior Biologist

Center For Fisheries Enhancement
Mote Marine Laboratory
1600 Ken Thompson Pkwy
Sarasota, Florida 34236

MML Ph: 941-388-4441 Fax: 941-388-4242

DEP FISH TAG HOTLINE: 1-800-367-4461

Catch A Non-Tagged Red Drum in Biscayne Bay?
We Need the Fish Carcass (If fish is between 15-27" TL) - or a Fin Clip! Carcass: 1) Record "information, 2) Place carcass in plastic bag, keep on ice or freeze, drop off as soon as possible - SEE BELOW.

If fish is Released:
Fin Clip: 1) Record "information, 2) Clip 1-2 inches of second dorsal (back) fin, 3) Place on foil and fold foil over fin clip, 4) Place foil packet in plastic bag, keep on ice or freeze, drop off as soon as possible - SEE BELOW.

Catch A Tagged Red Drum in Biscayne Bay?
1) Record "information, call: FISH TAG HOTLINE: 1-800-367-4461.
2) If you keep your catch (15-27" TL) - We Need the Fish Tag & Carcass!
* Tag number, total length, date, capture location, name, address, and telephone number

-Carcass and Fin Clip Collection Centers -
Carcasses and Fin Clip Kites are Available Upon Request - 305-608-0569

A-C Fish N Bar
Dude Rat and Tackle
High Tail-E
Ship & Shore Marine Store
7325, 3rd Aven 30710 S Federal Hwy. 20930 014 Old Rd 541 West Ave
Homestead, FL 33030 Homestead, FL 33030 Miami, FL 33169 Miami Beach, FL 33139
305-247-2221 305-677-6866 305-263-0840 305-554-457
APPENDIX

B

"REDFISH REBOUND"
by SUSAN COCKING
APPEARED IN FEBRUARY 19TH MIAMI HERALD
Redfish rebound

Outreach, other changes rejuvenate restocking effort

I saw their faces. Now I'm a believer.

There are red drum in Biscayne Bay — legal-sized —18 to 27 inches long. I not only saw schooling redfish; I caught them — five of them, on Feb. 4. My fishing companion, Harrison Bresee of Florida Sea Grant, caught three. Others have been quietly catching them, too. And so can you.

The eight-year-old program to restock Biscayne Bay with hatchery-reared redfish — which achieved dubious results in the past — is enjoying a resurgence. More than 140 tagged reds were released to the Florida Department of Environmental Protection’s Port Manatee hatchery by November and January. That is an astronomical number when you consider that, from 1990 to 1998, a total of 600 tags were returned out of more than 1.6 million fish released into the bay.

The difference is in the way the DEP and its partners at Sarasota’s Mote Marine Laboratory are running the program. Previously, scientists released costly fingerlings from 1 to 1½ inches long into the bay: 1 million, compared to 433,000 in the 3-to-5-inch category and 184,000 in the 6-10-inch slot.

Scientists figured the fish would reproduce and produce in the bay and that anglers would catch them and return the identification tags, but the littlest fish had invisible reamer tags, of which none were returned. The amount of legal-sized fish caught (bearing visible reamer tags) was less than 1 percent of the number released. Tournament posters, T-shirts — even monetary rewards — did little to improve tag returns. The University of Miami and Florida International University, which grew out many of the Port Manatee hatchery’s fry and then released the fingerlings into the bay, got out of the business last year.

Nobody knew exactly what was happening to the fish. Theories ranged from consumption by bigger fish and birds — bolstered by the recovery of 20 regurgitated tags at Miami’s Pelican Harbor Seabird Station — to an inhospitable habitat caused by too-salty water and too few oyster bars.

Bill Halstead, manager of the Port Manatee hatchery, refused to give up. Bresee got together with Mote director of fisheries Ken Leber, an expert at tracking school fish, and they came up with the idea of releasing fish into specific habitats.

“We sat down and looked at what we could get out of Biscayne Bay,” Halstead said.

The result of that meeting is a yearlong, $160,000 contract between Mote and the state to continue the hunt for reds.

Since early 1998, the DEP has released more than 2,000 of the larger-sized reds into the bay. The areas were two locations — Black Point and Homestead Bayfront Park — instead of being scattered over 19 sites as had been done previously. The sites were selected because they historically had the most tag returns.

All the recent releases have visible tags fastened with stainless steel instead of monofilament so they don’t pull out. Tags bear a number when you consider that, 60 sonic tags — devices the size of monitor screens fastened with stainless metal — have been fastened to tagged fish.

But the main improvement in the program was assigning 14-year-veteran Mote fisheries biologist Carole Neidig to the full-time job of angler outreach. She goes fishing with local salts, uses their boats to track the sonic-tagged fish and Cajoles workers at bait and tackle shops to help her collect fish carcasses for study.

Said Halstead: “She has established a relationship with the people catching these fish and has enlisted their help. They’re falling all over themselves to help her.”

Neidig has found out a lot about the movements and habits of tagged redfish in Biscayne Bay over the past couple of months.

Redfish, she says, favor “mangrove roots; shaded, protected areas; holes in mud bottom; grass beds; the presence of blue crabs, shrimp and oyster bars. They don’t bite during slack tide.”

The eight reds Bresee and I caught were along some spoil islands just south of Black Point. Once the incoming tide picked up speed, the fish devoured free-lined live shrimp cast between obstacles. The fish ranged in size from 17 to 22½ inches. All had been released into the bay in October and November when they were 12 to 18 inches long.

Using the hydrophone, we picked up beeps from redfish No. 357 in a mangrove-enclosed bay north of Black Point. Bresee and captain Cliff Kunde tried to catch the sonic-tagged red but were unsuccessful.

“No. 357 was released in a marsh area north of Black Point,” Neidig said. “He has moved all over the damn place — three miles north and two miles south.”

What Neidig, Halstead and Leber really want to know is whether red drum are reproducing in the bay.

Last October, an angler caught a 31-inch red — large enough to spawn and too big to keep legally — at Black Point. The angler managed to snap a photo, but the Coast Guard told him to put the fish back into the water before he could record the tag number. Halstead keeps the photo in an album at the hatchery.

Said Halstead: “We’ve not yet had a fish in our possession that was reproductively mature. Through DNA analysis, we have not identified a fish that is the offspring of a hatchery-reared fish.”

Neidig plans to keep looking.

If you go

If you catch a legal-sized (18-to-27-inch) redfish in Biscayne Bay, go ahead and filet it carefully for dinner, but save the carcass for Mote researcher Carole Neidig. She needs the heads and internal organs for study. Call Neidig at 305-808-0589 or take the fresh carcass to one of these locations: High Tail Inn, 20254 Old Cutler Road, Miami (305-233-0847); Don’s Bait & Tackle, 20710 S. Federal Highway, Homestead (305-247-6616); A-OK Fish & Bait, 723 S. Krome Ave., Homestead (305-248-2221); or Ship & Shore Marine Store, 541 West Ave., Miami Beach (305-534-4137).

If the fish is too small to keep, record the tag number, length, capture date and location before releasing it, and call 800-367-4461.

If the fish is too large to keep, call Neidig immediately.
APPENDIX

C

INSTRUCTIONS FOR ANGLERS
BISCAYNE BAY RED DRUM STOCK ENHANCEMENT
A Department of Environmental Protection & Mote Marine Laboratory Partnership

Catch A Non-Tagged Red Drum in Biscayne Bay?
We Need the Fish Carcass (If fish is between 18-27" TL) - or a Fin Clip!
Carcasses: <Daily Recreational Bag Limit - 1 Per Person Per Day>.
1) Record *information. 2) Place carcass in plastic bag. 3) Keep carcass on ice or freeze, drop off as soon as possible - SEE BELOW.

If Fish is Released.

Fin Clip:
1) Record *information. 2) Clip 1-2 inches of second dorsal (back) or the ventral point of the caudal (tail) fin. 3) Place on foil and fold foil over fin clip. 4) Place foil packet in plastic bag, keep on ice or freeze, drop off as soon as possible. -SEE BELOW

Catch A Tagged Red Drum in Biscayne Bay?
1) Record *information, call: FISH TAG HOTLINE: 1-800-367-4461. 2) If you keep your catch (18-27" TL) - We Need the Fish Tag and Carcass!

* tag number, total length, capture date, time and location, name, address, and telephone number

~~ Carcass and Fin Clip Collection Centers ~~
A-OK Fish 'N' Bait
732 S. Krome Ave.
Homestead, FL 33030
305 - 248-2221

High Tailin-It
20264 Old Cutler Rd.
Miami, FL 33189
305 - 247-6616

Don's Bait and Tackle
30710 South Federal Hwy.
Homestead, FL 33030
305 - 233-0848

Ship & Shore Marine Store
541 West Ave.
Miami Beach, FL 33139
305 - 534-4137

Carcass and Fin Clip Kits are Available Upon Request - 305-608-0569

WE APPRECIATE YOUR PARTICIPATION!!
APPENDIX D

DATA CARD FOR ANGLERS
INCLUDED IN GENETIC FIN CLIP PACKET
NAME: ____________________________

STREET: ____________________________

CITY: ___________________ STATE: ___ ZIP CODE: ______

PHONE: (____) ______________________

COMMENTS: ________________________

RETURN TO LOCATION ON LIST OR C.NEIDIG-ASAP. THANKS!

TAG HOTLINE: 1-800-367-4461

BISCAYNE BAY RED DRUM INFORMATION COLLECTION
CAPTURE DATE: _____/____/99 TIME: _____:____ AM / PM
LOCATION:(LAT.&LONG and/or DESCRIBE): _________________

TOTAL LENGTH: _______ in  TAG NO: _________________

CIRCLE: KEPT / RELEASED

PROVIDING: CAPTURE INFO. ONLY / FIN CLIP / CARCASS

PLEASE INCLUDE NAME, ADDRESS, & PHONE NUMBER

STATE REGULATION - ONE RED DRUM PER PERSON PER DAY - 18" - 27" TL
APPENDIX E

FIELD DATA FORM
## Biscayne Bay Red Drum Stock Enhancement Project - MML/FDEP

### Red Drum Collection and Sonic Tag Identification

**Date:** 1/1/99  
**Crew:**

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<th>Time</th>
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<th>Longitude</th>
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**Site Description:**

**Coll. Gear** | **Bait / Lure** | **IAT #** | **CWT** | **TL (cm)** | **Fin Clip** |
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**Fish Condition:**

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**Comments:**

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**Site Description:**

**Coll. Gear** | **Bait / Lure** | **IAT #** | **CWT** | **TL (cm)** | **Fin Clip** |
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**Comments:**

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**Note:**

- HL = Hook & Line  
- TR = Trammel Net  
- CN = Cast Net  
- OT = Other

**Form:** 3 & 3bk 02/08/99

*Red Drum Tracking - No Collection - Reverse Side*
### Biscayne Bay Red Drum Stock Enhancement Project - MML/FDEP

#### Red Drum Tracking - No Collection

**Date:** / /99

**Crew:**

**Page No.:**

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<th>How Many?</th>
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**Site Description:**

Tide | Wind | Depth (M) | H₂O Temp (°C) | DO (PPM) | pH | Salinity (PPT)
|------|-------|-----------|--------------|----------|----|----------------|

**Comments:**

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**Site Description:**

Tide | Wind | Depth (M) | H₂O Temp (°C) | DO (PPM) | pH | Salinity (PPT)
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**Comments:**

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**Comments:**

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