

**Developing Marine Fish Hatchery and Nursery  
Culture to Expand Florida's Aquaculture Industry  
Year 1**

**Final Report**

**FDACS Contract No. 007187**

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

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**Submitted by  
MOTE MARINE LABORATORY**

**July 21, 2004  
Mote Technical Report # 944**

## BRIEF PROJECT OVERVIEW

This progress report covers the period from July 16, 2002 through December 31, 2003. The overall goal of this project is to develop the hatchery and nursery culture technology to produce marine fish for aquaculture production in Florida. This project is focusing on improving the techniques to culture Florida Pompano (*Trachinotus carolinus*). Research teams at Mote Marine Laboratory (MML), Florida State University (FSU) and Florida International University (FIU) are working together to address the following objectives:

1. Develop spawning protocol
2. Determine an optimal conditioning diet for broodstock
3. Determine appropriate live feeds for larval rearing
4. Develop larval rearing protocols
5. Develop nursery culture protocols
6. Determine pompano rearing costs
7. Disseminate Project Results

## PROJECT ACCOMPLISHMENTS

### *Objective 1: Develop spawning protocol*

#### *MML Research Team*

##### Broodstock Systems

In 2003, a light and temperature controlled broodstock holding facility was constructed at Mote Marine Laboratory's main campus. Two broodstock tanks (17,385 liter) were used to hold pompano broodstock beginning in January (Figure 1). Each broodstock holding system was equipped with a bead filter for solids filtration, a fluidized bed for biofiltration, a UV unit, and a heater/chiller to control temperature (Figure 2).



Figure 1. Broodstock tanks.



Figure 2. Broodstock filtration system.

With additional program funding from Mote Scientific Foundation and the William G. and Marie Selby Foundation, the construction of the marine broodstock facility at the Mote Aquaculture Park was completed. This state-of-the-art marine broodstock facility will enable us to investigate new technologies in water filtration for marine aquaculture production systems. At this facility, two broodstock tanks (4.57 meter diameter by 1.53 meter working water depth or 25,320 liters/tank) have been designated for future pompano broodstock research. Each tank is located in a separate room with independent temperature and photoperiod control, as well as independent filtration. Additional filtration areas are under construction and are expected to be completed in 2004. These buildings are anticipated enable us to operate the saltwater systems at 0% discharge. Snook were stocked in the broodstock systems in late February and April and juvenile pompano were stocked in two of the systems in May.

### Broodstock Collection and Transport Efforts

In 2003, a total of 123 pompano were obtained for broodstock maturation research. These broodstock ranged in size from 388g to 1650g upon capture. In January, ten of the collected pompano broodstock were successfully transported by truck in holding tanks from MML in Sarasota to FIU in Miami.

Beginning in February, all pompano broodstock at MML were pit-tagged to track growth and sex distribution. All subsequent broodstock held at MML and fish transported to FIU were pit-tagged for identification purposes. In mid-April, a second group of 15 pompano broodstock were transported from MML to FIU. The remaining broodstock were maintained at MML and used for maturation and spawning research.

In fall 2003, MML conducted further collection efforts to locate mature wild pompano broodstock. This effort was based on literature reports that indicated pompano spawn in both the spring and in the fall. Fall sampling and additional information provided by Florida Marine Research Institute (FMRI) staff, revealed that fall pompano spawns are unlikely to occur in the Sarasota area. Collection efforts then ceased in November.

### Hormone-Induced Spawning Trials

In Spring 2003, MML conducted a series of induced spawning trials that examined the use of HCG (Human Chorionic Gonadotropin) and Ovaplant (time-release GnRH (gonadotropin releasing hormones) implant. Four successful hormone-induced spawns were conducted using HCG (Human Chorionic Gonadotropin) from mid-March to mid-May. In March, MML staff collected 39 wild pompano broodstock. Although the fish did **not** show obvious signs that they were ready to spawn at collection, we injected them with HCG in order to prevent regression of the ovaries and testes. Twelve hours after injection, the pompano broodstock were sexed and females were injected with a resolving dose of HCG. Egg diameter measurements revealed that the females were not fully developed (egg diameter = 200-300  $\mu$ ); however, spawning behavior was observed one day after injection in a pair of fish. Two days later a small number of larvae were obtained from egg collectors and stocked into the larval experimental system.

Two spawning attempts were made using Ovaplant hormone implants (4/15/03 to 4/16/03 and 6/13/03). The first trial was conducted in mid-April and compared the success of an induced spawn using Ovaplant hormone implants to one using HCG injections. On 4/15/03, a total of 9 fish were obtained from the wild for spawning (4 “confirmed” males, 2 “confirmed” females, and 3 fish of undetermined sex). All fish were injected with HCG as a primary injection in order to stop regression of the gonads due to the stress of capture. The confirmed females and those fish of undetermined sex were further injected with an Ovaplant implant at a dosage of 150  $\mu$ g/fish and were placed in a tank having approximately 29 broodfish (captured in prior collection efforts). The confirmed males from this collection were placed in a separate broodfish tank for later use. No eggs were received on April 16<sup>th</sup> from the injected females of this spawn.

On 4/16/03, a total of 3 fish were obtained from the wild for spawning (1 female and 2 “confirmed” males). These fish were only injected with HCG as both a primary and secondary injection; and were placed in the brooder tank holding the “confirmed” males captured during the spawning attempt the day prior.

On 4/17/03, eggs were observed in the egg collectors of both the Ovaplant brooder tank (injected on 4/15) and the HCG brooder tank (injected on 4/16). Eggs retrieved from the HCG tank egg collectors and the Ovaplant tank egg collectors were stocked into separate incubators. The difference in the amount of eggs from the brooders injected with HCG and those injected with

Ovaplant differed greatly. The one fish injected with HCG released an estimated 14,620 eggs during spawning, while the two fish injected with Ovaplant implants released an estimated total of 3,060 eggs during spawning (Figure 3). The percent fertilization for the eggs released from the HCG injected fish was approximately 97%, while fertilization rate of the eggs from the fish injected with Ovaplant was approximately 86% (Figure 4). Larvae from both egg batches died during incubation. This sudden egg mortality was believed to be due to excessive water turbulence in the incubation system. No further egg releases were observed among either the Ovaplant or HCG injected fish from in this trial.

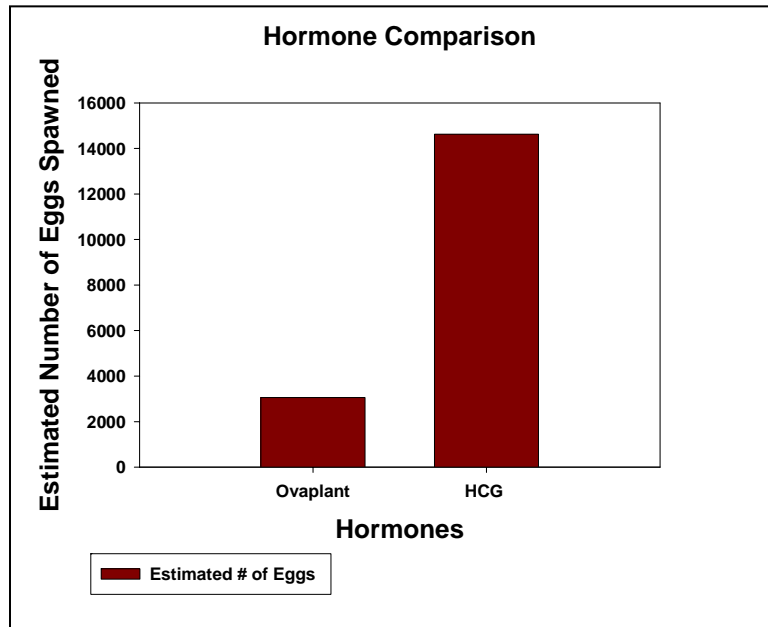


Figure 3. Comparison of the total estimated number of eggs released from hormone induced spawning using Ovaplant implants and HCG.

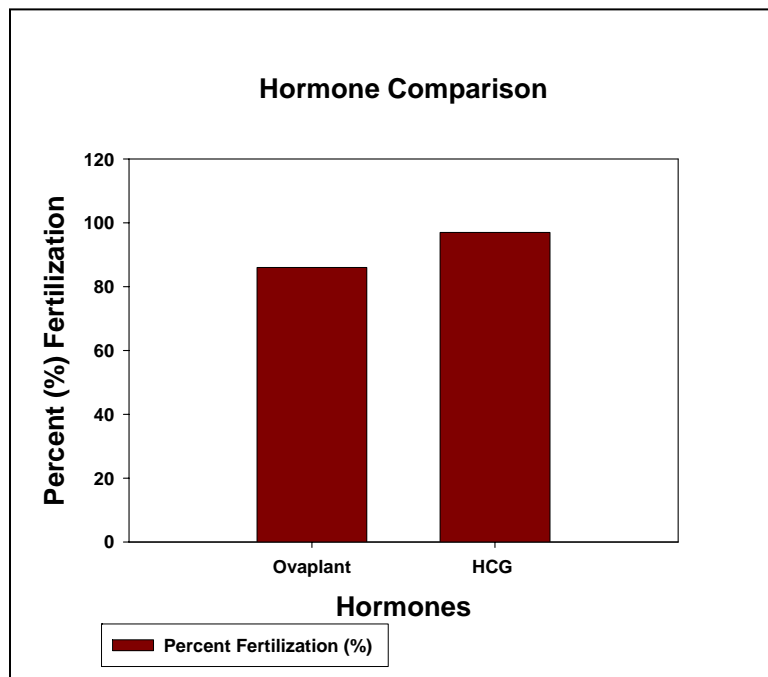


Figure 4. Comparison of the percent (%) fertilization among eggs released from hormone induced spawning using Ovaplant implants and HCG.

The second trial (6/13/03) examining induced spawning using Ovaplant was conducted with 39 fish (25 females/14 males) that were being held for long-term maturation studies. All fish were sampled and all females were injected with 150 µg/female of Ovaplant. These fish had an average weight of 750.82 g and an average length of 31.2 cm. Approximately, 48 hours after injection, a small spawn occurred. No trials were conducted with the larvae from this spawn.

Our results clearly indicate that HCG can be efficiently implemented into a spawning protocol using wild caught brooders. The limited success from the Ovaplant trials indicate that it may not be an effective hormone to induce spawning in Florida pompano. Potential reasons for the low success of the Ovaplant in these trials may be due to the hormone dosage. The dosage amount used in these trials (150 µg/female) was chosen because it was the lowest dosage available by the supplier (Syndel©). This hormone dosage was originally intended for fish weighing 5-10 kg. When we spoke with the supplier, they thought that this item should not have any adverse affects on the pompano brooders, which are much smaller (0.6-1.5kg) than fish that have been successfully induced with Ovaplant. Although we considered reducing the size of the implant, it was not feasible because the implant are pre-packaged in a rotary clip, which is required in order to inject the hormone. Future comparisons of hormone induced spawning with pompano need to be carried out with hormones that can be packaged and delivered to the fish in the appropriate dosages.

### ***FIU Research Team***

#### **Maintaining Pompano Broodstock in Large Outdoor Tanks**

Pompano broodstock that were transferred to FIU from MML were kept in a circular pool (50,000 liters, 26' in diameter) at 12 ppt salinity, ambient temperature around 20°C. At FIU the broodstock were maintained on mixture of frozen shrimp and squid fed to satiation twice daily. Water was saturated with dissolved oxygen, over 10 ppm, and no additional air was supplied. Water salinity increased to 19 ppm by replacing 20% of pool water with unfiltered open seawater on February 5, 2003. The system was recirculated through a sand filter (or DE filter), cartridge filter, then UV system until March 20, 2003. The highest ammonia level of 4.0 ppm was recorded during this time period. The pool water was replaced with well water (23.5°C, 28 ppt salinity, pH 7.1, 0.8 ppm total ammonia, and 0.4 ppm hydrogen sulfide) for 3 days starting March 20, 2003. The system then was maintained semi-flow through replacing 10% of water every 3 days with 3-day-treated well water. At the end of the 3-day-treatment with a strong aeration, well water contained nearly undetectable levels of ammonia and hydrogen sulfide at pH 8.6, ambient temperature and salinity. This water replacement regimen maintained the pool water chemistry at pH 8.4, around 0.4 ppm total ammonia, and near 0 ppm hydrogen sulfide at ambient temperature and salinity. As the pool was situated outdoors and covered by a layer of shade cloth, water temperature and salinity fluctuated, especially following periods of heavy rain (Figure 5). The dissolved oxygen levels fell to about 70% saturation, even following additional aeration.

Following approximately five problem-free months, we began noticing some issues in mid-March. Some physical injury of unknown causes affected several fish overnight on March 16, 2003 with symptoms including lost scales, swollen eyes, and dark skin pigmentation coupled with signs of hemorrhage. Most fish, except one, improved their condition within one-week period. One fish with severe skin lesion was separated from the group, and sacrificed on March 19, 2003. In retrospect, we suspect that this event may have resulted from a security breach at our facility, although other explanations may be possible.

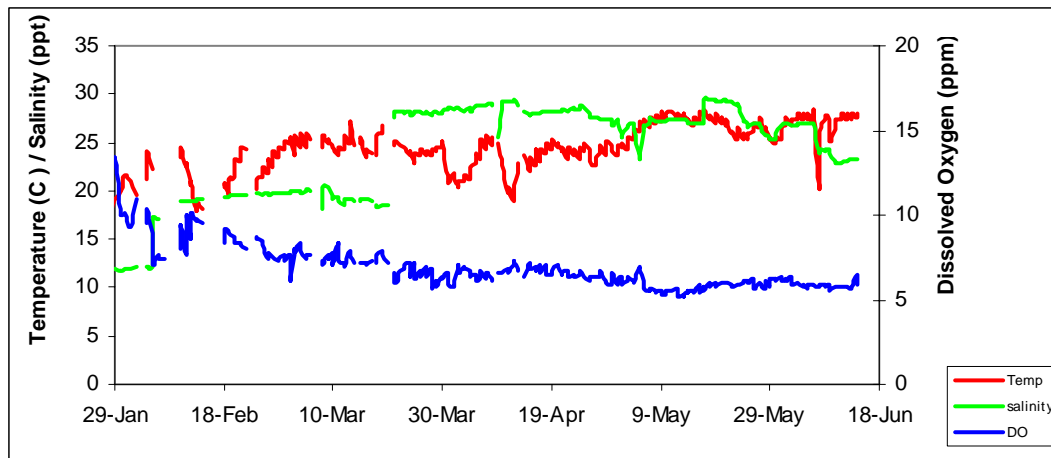


Figure 5. Water temperature, salinity, and dissolved oxygen in the pompano tank at FIU (January 29 to June 14, 2003).

Despite suboptimal water conditions, the first batch of pompano did relatively well at FIU feeding approximately 4% of body weight (about 30g/fish) per day during February. They increased feeding to about 75g/fish by the end of April (Figure 6). Feeding rate, however, decreased after the addition of the second batch of fish on April 29, 2003.

Pompano again exhibited reduced appetite starting May 5, 2003. One fish with skin lesions was separated on May 8 into a small tank (6' diameter, 1,700 liters), but died on May 16 without taking any food during isolation. The following day, May 17, one fish was found dead in the fish tank, and the feeding rate declined further (Figure 4). Around this time, a behavioral change in school of pompano was noticed. Later necropsy indicated that the fish found dead inside of the large tank had gill parasites, possibly *Oodinium*. Uneaten food left in the tank mainly due to reduced appetite compounded the water quality issue. The amount of water available with acceptable water chemistry was limited only to encounter the water loss from cleaning pool bottom, maintaining filters, and evaporation. All fish but one died between June 13 and 15 of 2003. One survivor was moved to a small tank, and treated with 10 ppm nitrofurazone.

All fish were measured in lengths and weights, and then the stages of gonadal maturation were recorded as GSI (% gonad weight per body weight). Blood serum from 8 animals (2 females, 5 males, and 1 immature fish) was collected for further analysis. Among 11 males, one had running milt and two were about to release their milt freely. These males had GSI between 0.6 and 1.0. Two out of seven females had GSI over 1.2; ovary from a female with GSI of 1.6 contained oocytes approximately 100  $\mu\text{m}$  in size. The GSI obtained may not represent healthy fish with good appetite since most fish examined had become emaciated. Interestingly, large females (n=2) over 1 Kg body weight had less mature ovaries suggesting that they allocated more energy on growth than reproduction. This suggests that current diet composed of frozen shrimp and squid may not deliver sufficient energy to support both growth and reproduction, although it is equally plausible that the compromised health of our broodstock fish.

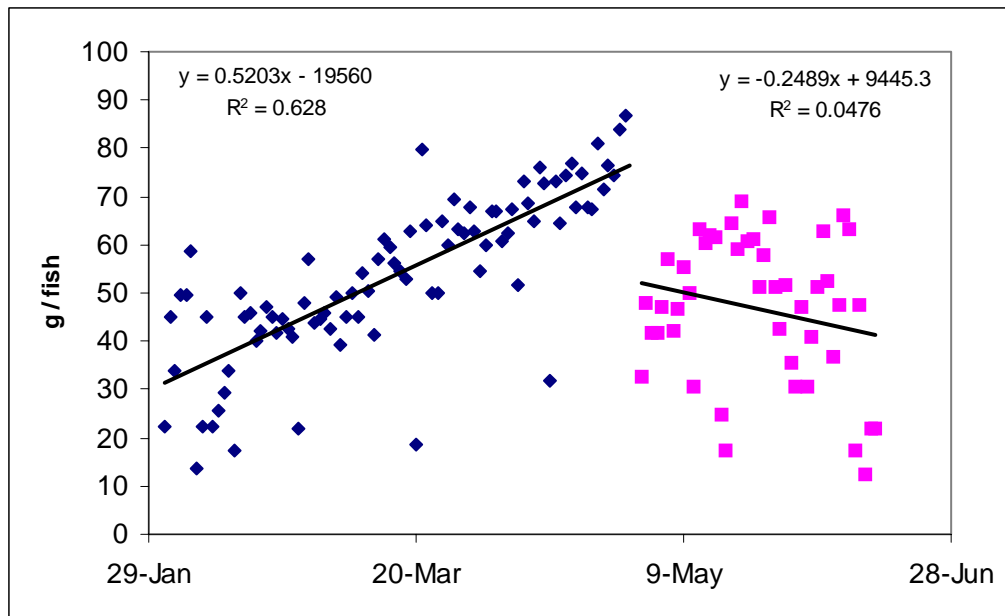


Figure 6. Amount of frozen feed (shrimp and squid) consumed by each pompano at FIU between January 29 and June 14, 2003.

### ***Objective 2: Determine an optimal conditioning diet for broodstock***

#### ***MML Research Team***

In mid-May MML began weaning wild caught broodstock off of a fresh diet (frozen squid, shrimp, kaplin, and mackerel) and onto a commercial diet (Melick brooder feed 5.0 mm). The broodstock were sampled routinely during this time period for growth data. The results from this data demonstrated that the wild caught adult brooders can be weaned over to a commercial pellet broodstock diet. Although there was a lull in broodstock growth during the transition from a fresh diet to a pellet diet, the broodstock growth continued its increasing growth trend once the weaning was complete (Figure 7). By mid-June, all broodstock were being maintained on the commercial broodstock diet. This weaning process was achieved with the introduction of pompano brooders that were reared from wild caught juveniles being fed a commercial diet. The wild caught juveniles previously mentioned, were captured at approximately 26 g and readily accepted a commercial diet upon their introduction to MML's culture tanks. Once these fish weighed approximately 350-400 g they were pit-tagged, sexed, and integrated into the existing broodstock populations. The monitored growth data of the wild caught juveniles also demonstrated a positive growth trend while being fed a commercial pellet broodstock diet (Figure 8).

### ***Objective 3: Determine appropriate live feeds for larval rearing***

#### ***FSU Research Team***

An automated production system and enrichment station was constructed to produce S and SS-type rotifers. The number of rotifers available was sufficient to conduct larval fish feeding trials and FSU maintained both types of rotifers in culture in anticipation of conducting a feeding trial comparing growth and survival on rotifer and copepod larval diets. In the experimental trials rotifers served as the control diet and copepod nauplii served as the treatment diets. The goal of this effort was to compare different copepod species at different naupliar densities to determine their effectiveness as larval pompano diet. The rearing protocol for *Centropages hamatus* has been developed and the FSU team is continuing to work out rearing protocols for other copepod prey species.

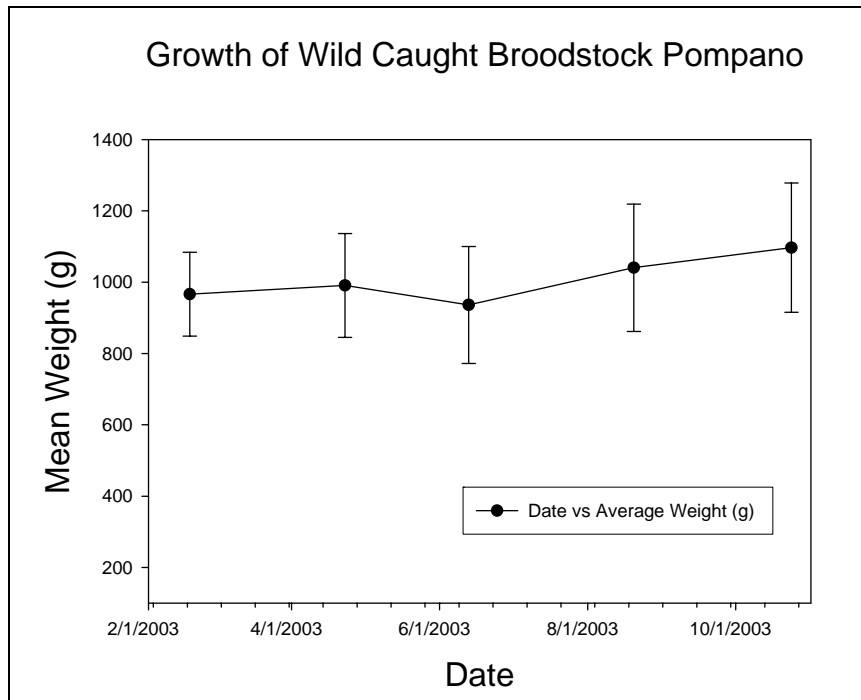


Figure 7. Growth of wild-caught pompano broodstock held in maturation tanks from February to October 2003.

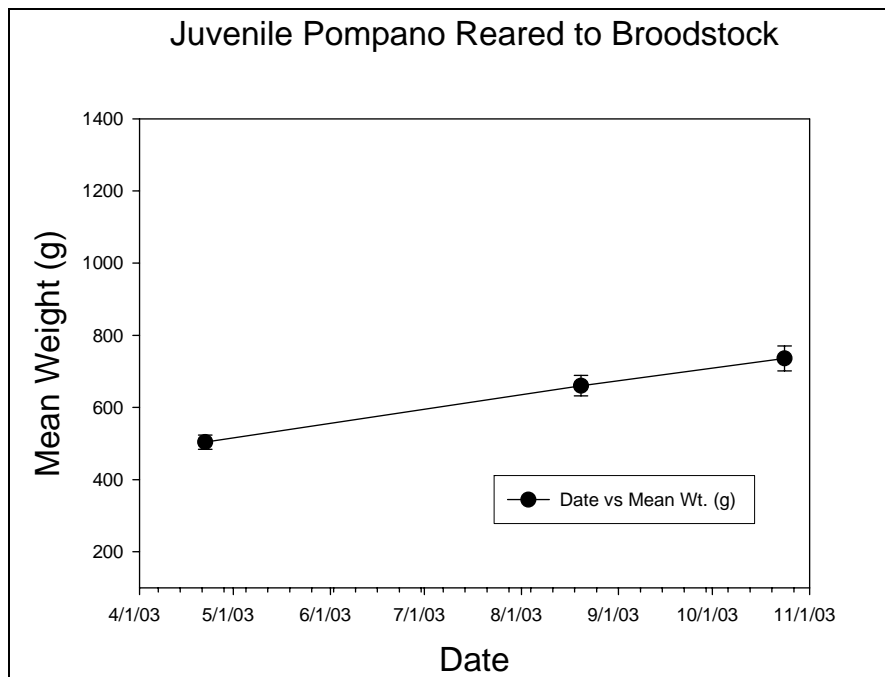


Figure 8. Growth of broodstock that were caught as juveniles and reared to broodstock size.

A self-contained experimental culture system for conducting laboratory-scale rearing trials with larval fish was designed, constructed and tested at FSU Marine Laboratory. The system included 24 2-liter test chambers. The water is filtered, aerated, and sterilized using UV bulbs. The

temperature of the water can be controlled using heaters and a chilling system. The experimental system was used to successfully conduct one feeding trial with pompano larvae supplied by Mote during the 4<sup>th</sup> quarter. The age of the larvae at the time of arrival at FSU Marine Lab was approximately 1.5 days after hatch (DAH). Surviving larvae were stocked in the system and a trial was run for 7 days. Overall system performance was excellent with the current design providing precise control over lighting cycles, temperature, aeration, water exchange rates, and uniformity of system parameters among all the experimental larval rearing containers.

From the 4 successful spawns in 2003, two shipments of approximately 1000 larvae/shipment (at 1 DAH) were transported from MML to FSU. Upon arrival at FSU, transport survival was only 15%. Twenty-four hours later, survival was only 10%. The experiment was terminated after 7 days due to continued high daily mortalities. A suspected cause of the high mortality rate is transportation shock, possibly exacerbated by elevated salinity. The shipping container was received in damaged condition indicating rough handling by the transportation company. However, even gentle handling of apparently intact larvae seems to induce a state of shock that may eventually lead to death. In Year 2, we will evaluate new techniques to improve transport survival for larval pompano.

#### ***Objective 4: Develop larval rearing protocols***

##### ***MML Research Team***

The best spawn in 2003 occurred in April. The large number of larvae produced in this spawn allowed us to stock both the larval rearing experimental (Figure 9) and production systems. The larvae in the experimental systems showed poor survival; however, the larvae survival was much higher in the larger (3300-liter) production systems. This spawn yielded an estimated 78,900 larvae at 3 days after hatch (DAH). It appears that eggs and young larvae need to be handled very carefully. However, once you are past the first 5-7 days post hatching, larvae are hardier and begin to exhibit rapid growth. The growth rates of the pompano larvae from Day 2-45 are presented in Figure 10. At first size grading (40 DAH), juvenile fish were counted and 4780 pompano were transferred to nursery culture tanks.



Figure 9. Experimental larval rearing system.

**Pompano Larval Growth (2-45DAH)**

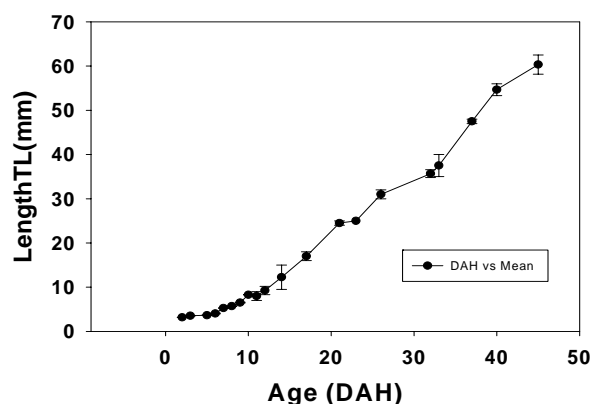


Figure 10. Growth of larval pompano in production tanks from days 2-45 after hatch.

In July, half of the juvenile fish cultured in three production tanks were moved into a second culture system to conduct a second high- and low-salinity experiment.

## Objective 5: Develop nursery culture protocols

### MML Research Team

From December 2002 through March 2003, we conducted an experimental trial to compare the growth of wild caught juvenile pompano and permit at two different salinities (5-7 ppt versus 28-30 ppt). Water quality parameters (DO, pH, salinity and temperature) were measured 4 times daily and the fish were examined periodically for signs of stress or disease. Feeding rates were modified based on the percent of uneaten food and the pellet size was adjusted for growth. Each population was routinely sampled for growth on a monthly basis. The results of these experiments demonstrated that there was no significant difference in growth among either the pompano or permit juveniles cultured in the two different salinities (see Figures 11 and 12).

From August to October 2003 a second salinity trial was performed to replicate the earlier experiment trial (December to March Trial). This trial compared the pompano growth of pompano reared at a high salinity (30-32ppt) and a low salinity (5-7ppt) ; however, this trial differed from the first one because we used captive bred pompano juveniles from the April 2003 spawn. By using hatchery reared pompano, the examination of both younger fish and larger populations per replicate could be examined. The results of this study demonstrated that there was no significant difference in growth among the pompano cultured in the different salinities (Figure 13).

Although results from the salinity trials demonstrate comparable growth trends among high and low salinity culture systems, juveniles reared at low salinities did exhibit some health problems and it was difficult to main optimal water quality conditions. These low salinity tanks, routinely had higher ammonia and nitrite readings, and as a result seemed to experience more frequent bacterial problems (i.e., *Aeromonads*, *Vibrio*, etc.).

In late September, approximately 1509 juvenile pompano were transferred to the Agriculture Research Service project at Harbor Branch Oceanographic Institute in Ft. Pierce, Florida. As of December 2003, a total of 3200 fingerling pompano were still in production systems at MML.

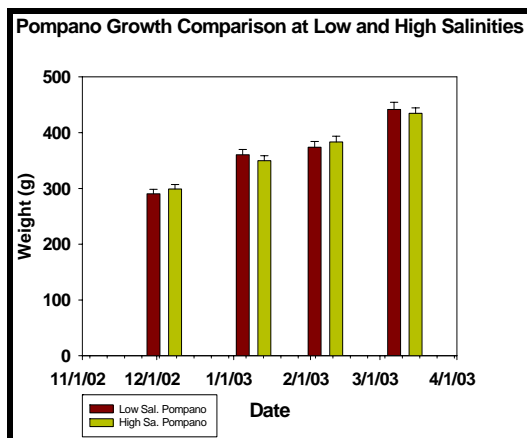


Figure 11. Pompano growth at low (5-7 ppt) and high (28-30 ppt) salinities.

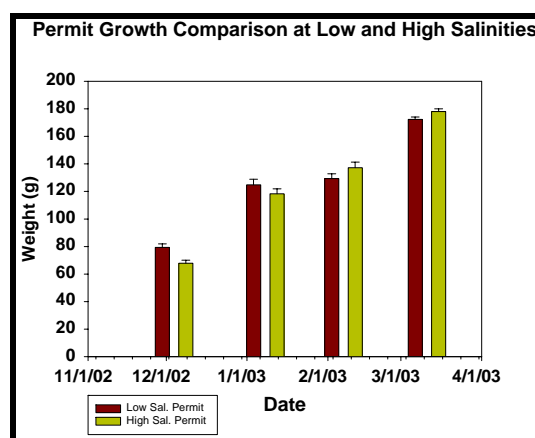


Figure 12. Permit growth at low (5-7 ppt) and high (28-30 ppt) salinities.

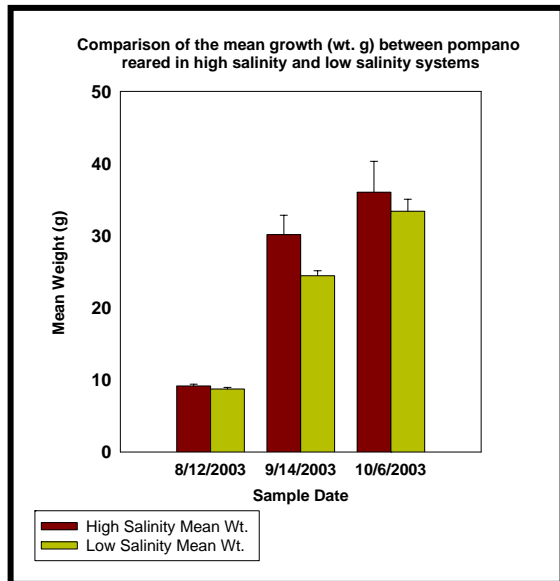


Figure 13. Pompano growth at low (5-7 ppt) and high (28-30 ppt) salinities.

### ***Objective 6: Determine pompano rearing costs***

#### ***MML Research Team***

The estimated production costs are based on a single pompano production run at MML from April to June 2003. Culture time for group of fish is projected from 0 DAH to 50 DAH. The assumed estimated larvae batch is 78,900 larvae at 3 DAH with ending product of 4,780 juveniles (weight = 2.64 g and mean length TL = 54.6 mm at harvest) at 50 DAH.

The pompano larval and nursery culture activities were conducted in recirculating systems housed in a greenhouse environment. The culture system consists of three 2.44 m diameter tanks (3,300 L/tank) that share a common filtration sump. Filtration consists of a bead-filter, for solids filtration; fluidized bed, protein skimmer, and UV sterilizer. The system operates with a water loss of approximately 10 %/week. The water temperatures during production range from 25-28°C and are maintained at a salinity of 30-32 ppt from 0 DAH to 50 DAH. Larval feeding consisted of a diet of rotifers at first feeding and later evolves to a diet of *Artemia*. The rotifer culture tanks consist of 5 flat bottom-cylindrical tanks (990 L/tank). The tanks are kept at a temperature of 27-30 °C and a salinity of 18-23 ppt and are provided ambient aeration via electric blower. The rotifer cultures are maintained on a 5 day rearing cycle and all tanks are batch fed three times a day. The estimated cost of producing rotifers for the time period needed for larvae pompano (1 DAH to 9 DAH) is summarized in Table 1. The *Artemia* culture systems consisted of 6 cone-bottomed cylindrical tanks (90 L/tank) supplied with ambient air aeration via electric blower. The tanks are maintained at a culture temperature of 27-30 °C and a salinity of 30-36 ppt. Upon each day of *Artemia* feeding, three tanks are used for hatching cysts and three tanks are used for newly hatched nauplii enrichments. The estimated cost of producing *Artemia* for the larval pompano (10 DAH to 12 DAH) is summarized in Table 1.

Larval and nursery feeding regimes followed the schedule and rations conducted during MML's April 2003 production run. Rotifers are fed from 1 DAH to 9 DAH at a feeding ration of 15 rotifers/ml twice a day (10:00am and 4:00pm). *Artemia* are fed from 9 DAH to 12 DAH at a feeding ration of 3 *Artemia*/ml twice a day (10:00 a.m. and 4:00 p.m.). The larvae accept microparticulate diet from 12 DAH to 20 DAH and later accept larger pelleted diets from 20 DAH to 50 DAH. The microparticulate diets used are INVE products: proton 1, 2, & 3, and

NRD 1, 2, 3, & 4. The commercial pellet diets used are manufactured by Melick Aquafeeds and are formulated for black sea bass (Table 2). The commercial diet rations fed, range from 2-10% of the fishes' average body weight. As the fish grow, the percentage body weight offered at each feeding will lower. The estimated cost of feeds for the time period of 12 DAH to 50 DAH is summarized in Table 1.

Water maintenance for this plan is based on the maintenance protocols followed during MML's pompano production of April 2003 from 0 DAH to 50 DAH. Total water loss is estimated at 10%/ wk. Water lost during maintenance is replaced with seawater produced from freshwater mixed with commercial aquarium salt manufactured by Instant Ocean. Maintenance includes the backwashing of bead-filters and water changes. Bead-filters are backwashed once to twice a week, giving a loss of 227.1 L at each backwashing. A 50% water change for the whole culture system may happen once every 1-1.5 months. Calculated in the larvae and nursery culture salt demands is the required salt amount to initially fill the larvae culture system and bring it to a salinity of 30-36 ppt, as well as the maintenance needs (Table 1). The estimated rearing costs reported in Table 1 are based on the average material cost per week (7 days). The following items or costs were not included in the estimated production costs (labor, shipping costs, culture tank systems, electricity, and freshwater well cost).

Table 1. Estimated Production Cost for approximately 4,780 juvenile pompano to 50 DAH.

<b>Live Feeds Culture Costs</b>			
<b>Rotifer Production</b>			
	<b>Item</b>		<b>Rearing Costs for</b>
	<b>Usage/Wk</b>	<b>Cost /wk</b>	<b>1DAH to 9DAH</b>
	Algae Paste	26 L	\$1,040.00
	Enrichments (Seclo)	1 Kg	\$36.14
	Salt	187.5 Kg	\$156.10
			\$1,232.24
			<b>\$1,584.27</b>
<b>Artemia Production</b>			
	<b>Required</b>		<b>Rearing Costs for</b>
	<b>Quantity/Wk</b>	<b>Cost /wk</b>	<b>9DAH to 12DAH</b>
	Artemia Cysts	7Cans	\$288.90
	Enrichments (Seclo)	0.42 Kg	\$15.18
	Salt	21	\$468.00
			\$772.08
			<b>\$305.18</b>
<b>Larvae and Nursery Culture Costs</b>			
<b>Manufactured Diets and Water Maintenance</b>			
			<b>Rearing Costs for</b>
	<b>Item</b>		<b>13DAH to 50DAH</b>
	Salt		\$401.40
	Microparticulate Diet		\$322.01
	Commercial Pellet Diet		\$240.00
			<b>\$963.41</b>
<b>Total Estimated Cost</b>			<b>\$2,852.86</b>

Table 2. The Melick Aquafeeds pellet diet formulated for black seabass fed from 20 DAH to 50 DAH.

<b>Melick Aquafeeds Commercial Pellet Diet</b>				
<b>Item</b>	<b>Size</b>	<b>% Protein</b>	<b>% Fat</b>	<b>Format</b>
Extruded Fingerling Pellets	1.5mm	46	18	Floating/Sink
				80%/20%
Extruded Starter Crumbles	#0	50	20	Sinking
	#1	50	20	Sinking
	#2	50	20	Sinking
	#3	50	20	Sinking
	#4	50	20	Sinking
	1.0mm	50	20	Sinking

### ***Objective 7: Disseminate Project Results***

In 2003, MML routinely hosted tours that demonstrated to legislators, local interest groups, other research scientists and aquaculture students the goals and progress made on the pompano project. Coinciding with tours, many presentations were also conducted in 2003 and others are planned for 2004. Dr. Kevan Main gave presentations at the Aquaculture Review Council (ARC) meetings in Tampa (October 2002) and in Key West (June 2003) to update the Council on our recent progress with this project. MML staff Jim Michaels and Dr. Kevan Main will be presenting a paper at the 5<sup>th</sup> International Conference on Recirculating Aquaculture in July 2004 in Roanoke, Virginia (see Appendix I). This presentation will discuss “An overview of the Mote Marine Laboratory Aquaculture Park”. Patrick Tracy (FSU) presented a poster at the 2004 World Aquaculture Society Conference in Hawaii entitled “A laboratory-scale recirculating culture system for conducting rearing experiments with marine fish larvae” (see Appendix I). As we continue to make progress on this project, we will continue to make more presentations in 2004. In year 3 of the project, we will develop a pompano culture manual.

# APPENDIX I

Abstracts from Papers to be presented in 2004

# Poster Presentation for World Aquaculture 2004

## A LABORATORY-SCALE RECIRCULATING CULTURE SYSTEM FOR CONDUCTING REARING EXPERIMENTS WITH MARINE FISH LARVAE

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A self-contained experimental culture system for conducting laboratory-scale rearing trials with larval fish was designed, constructed, and tested at the Florida State University Marine Laboratory. Operational criteria for the system design required that the system deliver seawater to culture vessels at adjustable flow rates, control system water temperature, maintain water quality, and aerate system water. The design also had to: have the flexibility to accommodate different experimental configurations, require limited maintenance, be of compact size, and be able to function as an independent system.

The system consists of a fiberglass coated wet table (L=305 cm, W= 84 cm, H= 100 cm), a tabletop water distribution system, and an undercarriage supporting the system's recirculation equipment. The current tabletop configuration uses 24 three-liter rearing vessels on the table surface. A water distribution line mounted atop the wet table delivers seawater to each rearing vessel via independent feeder lines. A bypass line on the main distribution line together with control valves on each feeder line regulates water flow to each rearing vessel. Water discharged from each rearing vessel flows onto the table and returns to the collection sump by gravity feed. Equipment contained on the undercarriage includes the collection sump (120 L) with internal protein fractionator powered by a submersible pump, an aeration reservoir (120 L) containing two air diffusers, two 300 watt submersible heaters and a temperature probe, a pump to drive water through the system, inline particle filters (50, 25, 10, 5, 1  $\mu$ ), an inline chiller (1/6 hp), a dual stage temperature controller, and an ultraviolet sterilizer. The system was designed to operate in a limited space in a laboratory setting using the existing overhead lighting and air generation capability. The footprint of the finished system is approximately 2.6 m<sup>2</sup>.

The system has been used successfully to conduct larval rearing trials with Florida pompano, *Trachinotus carolinus*. A duplicate system was constructed and used to conduct rearing trials with Southern flounder, *Paralichthys lethostigma*. System performance was excellent in both trials providing control over temperature, aeration, water exchange rates, and uniformity of system parameters among all rearing vessels used in the trials. Temperatures were maintained within +/- 1° C, oxygen kept at saturation levels, and pH remained stable at acceptable values. Flow rates to each rearing container were adjusted to achieve 10 volume exchanges per day. Manual salinity adjustments were necessary in the rearing trial with Florida pompano conducted at 25° C due to salinity increases caused by evaporation. An onboard salinity monitoring and adjustment system could be integrated into the system design with minimal difficulty. System maintenance during rearing trials was limited to emptying the protein foam collection cup and changing particle filters as necessary.

# Poster Presentation for the Fifth International Conference on Recirculating Aquaculture - July 2004

## AN OVERVIEW OF THE MOTE MARINE LABORATORY AQUACULTURE PARK.

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Mote Marine Laboratory is developing marine and freshwater recirculating aquaculture production systems at their new 80-hectare facility, Mote Aquaculture Park, in Sarasota, Florida. This facility, located 17 miles away from the coast, includes large-scale marine broodstock and live feeds production systems, and marine larval, nursery and growout research systems. Pilot-scale commercial freshwater recirculating systems have been operating at Mote Aquaculture Park since May 2002. An overview of the Aquaculture Park including marine research projects and freshwater sturgeon commercial demonstration projects will be presented.

Marine research projects include snook, red snapper and queen conch culture systems for stock enhancement and pompano culture systems for commercial demonstration. These projects will utilize state-of-the-art technology to minimize water and effluent requirements.

The freshwater commercial demonstration sturgeon project is developing recirculating culture systems and husbandry techniques applicable to growing sturgeon on a commercial scale in Florida's subtropical climate. Production goals for this project include holding approximately 200 tons of standing stock, producing 75 m.t./year of fish, and 4.7 m.t./year of caviar. This production will use approximately 75 gpm of ground water. Technology used in these systems include drum filters for solids removal, moving bed bioreactors for nitrification, drop filters for solids removal/nitrification, U.V. systems for disinfection, and oxygen cones and hooded oxygenators for oxygenation. Several potential denitrification strategies will be discussed. This sturgeon project will have zero effluent water discharge off site through the use of infiltration ponds and spray-field application for the system effluent.