

## FINAL REPORT

State : Puerto Rico  
Grant Title : Maricao Fish Hatchery Operations and Maintenance  
Grant Number : F-35  
Period Covered : January 1, 2008 through June 30, 2012

### **INTRODUCTION**

The Maricao Fish Hatchery (MFH) has been in operation for nearly 80 years, and has seen many changes and improvements over this time period. For most of its early history, the hatchery was dedicated to experimenting with production of a variety of coldwater or warmwater species, or producing sportfish for reservoir stock enhancement at modest levels using rudimentary facilities and technology. The major shift in productive capacity and modernization of the hatchery took place with the remodeling of the facilities after Hurricane Georges (1998-2000). Among the improvements made were:

- The construction of three growout ponds
- The enlargement of the three oldest ponds
- A new storage building
- A new public rest room with access for person with disabilities
- A new dam with better water control capability
- A bridge connecting the lower and the upper part of the hatchery
- Upgrading water intake and supply system.

With six growout ponds and the improvements to the water system, fish production is performed practically all year round. Following the post Georges improvements, a nursery building was constructed and an emergency generator installed, adding additional capabilities to the MFH.

These improvements have augmented the hatchery production capacity and hence the amount of work and maintenance to be performed. Along with the improvements to the physical layout of the hatchery, significant changes to hatchery protocols and techniques were also implemented, following recommendations of scientists from state-side universities and also the University of Puerto Rico.

One of the goals of the restoration of the Maricao Fish Hatchery was precisely to provide the infrastructure necessary for university researchers to conduct investigations which would benefit recreational fishing and fisheries management on the island. In recent years, a number of research projects (Project F-41 Freshwater Sportfish Community Investigation and Management and Project F-53R Freshwater Sportfish Enhancement and Management) have used the MFH to study various issues identified as priorities by DNER, in support of science-based management of PR sportfisheries, including largemouth bass genetic manipulations, culture techniques for bigmouth sleeper, temperature and photoperiod manipulation of largemouth bass spawning times, evaluation of environmental conditioning of channel catfish broodfish, and spawning protocols for peacock bass, among others.

As a result of the combination of production of fingerling sport fish for stock enhancement, and applied research in support of science based management, the Maricao Fish Hatchery has become a cornerstone of freshwater sport fisheries management in Puerto Rico.

## **STUDY I**

### **Maricao Fish Hatchery Operations and Maintenance**

#### **Job 1 - Facilities Maintenance**

##### **OBJECTIVE 1**

*To maintain and improve hatchery facilities*

##### **a. Activities**

###### **1.1 Maintenance of ponds, water supply system, gabions and hatchery grounds**

Control undesirable vegetation in spawning pond (two times per month) and hatchery surroundings (once a week). Clean plastic liners, kettles and valves (after each harvest). Repair and clean sediment trap at the dam (as required). Maintain sidewalks, roads, landscaping and parking gate (once a week), dikes (two times per month), and repair gabions (as required).

- As scheduled

###### **1.2 Maintenance of structures**

Includes routine maintenance (daily), reparations (as required) and painting (2 times per year) of the following structures:

restrooms, office, nursery, experimental tanks and their roofs, photoperiod building, quarantine building, feed and materials storage building, electrical pedestal on the six growout pond kettles, and railing at each walkway above the kettles. Cleaning and sterilization of the nursery floor (as required).

- As scheduled (Except for 2011)

###### **1.3 Maintenance of concrete tanks**

Includes draining and cleaning (two times per month), repair (as necessary), and painting (once per year) five rectangular tanks (three 60' x 17' x 4' and two 60' x 21' x 5'), and twenty-four rectangular tanks (12' x 5' x 2 1/2').

- As scheduled (Except for 2011)

###### **1.4 Maintenance of equipment**

Perform maintenance on the following hatchery equipment:

two pick-up trucks, three utility vehicles (2 Mules and 1 Kubota), trimmers, lawnmowers, blowers, aerators, live hauler tank, water pumps, welder, electrical generator, manholes at the dam, tools, etc. (as necessary). Perform maintenance on the following nursery equipment: hatching jars, pumps, tanks, filters, glass aquaria, refrigerator, generator, air blower, piping, etc. (as necessary).

- As scheduled

##### **b. Achievements**

Activity 1.1 – 100 % completed

Activity 1.2 – 75 % completed

Activity 1.3 – 75 % completed

Activity 1.4 – 100 % completed

##### **c. Job Summary**

Maintenance was performed on the hatchery facilities according to established schedules and procedures. Grass and bushes were trimmed on a biweekly basis.

Plastic liners, kettles and valves were cleaned after each harvest. These plastic liners were installed in the six growout ponds in 1999 and were thoroughly repaired in 2008. The life span for the liners is estimated to be approximately 10-12 years and should be replaced promptly. The parking area and sidewalks were conditioned and repaired when necessary.

Concrete tanks were drained, cleaned and repaired as needed. Also, routine maintenance was performed on the hatchery equipment.

**d. Significant Deviations**

The year 2011 had unusual rain activity. Most of the year, it rained intensively, registering new precipitation records in many places in the Island. For this reason and due to the high humidity at the Maricao Fish Hatchery, it was not possible to paint all the structures and the concrete tanks as planned. This activity is planned to be done during the next grant segment (July 2012-June 2013).

**B – OPERATION**

**Job 2 - Operation of Maricao Fish Hatchery**

**OBJECTIVE 2**

*To achieve optimum hatchery production of fingerling fish*

**a. Activities**

**2.1 Water quality and pond preparation**

Measure and record dissolved oxygen and temperature (every day), secchi disk transparency, nitrite and pH of growout pond water (three times per week), measure and record dissolved oxygen and temperature (before stocking) at each reservoir or private pond stocking site (as required), pond fertilization (as required), and zooplankton sampling and identification in growout ponds (once per week).

- As scheduled (Except for 2008)

**2.2 Fish production**

Coordination of broodstock capture, broodstock capture and maintenance, broodstock reproduction, egg disease treatment, coordination of fingerling stocking, stockings of fingerlings, fry transfer to growout ponds, fingerling harvest and hauling to reservoir and tilapia and sunfish feeding (as required).

- As scheduled (Except for 2008)

**2.3 Data analysis and computerization**

Acquisition and computerization of water quality data, broodstock records, fingerling production and stocking records, analysis and integration of information

- As scheduled

**2.4 Annual Report**

Prepare annual report, by September 2012

- As scheduled

**b. Achievements**

Activity 2.1 – 92% completed  
 Activity 2.2 – 92% completed  
 Activity 2.3 – 100% completed  
 Activity 2.4 – 100% completed

**c. Job Summary**

Water quality was measured as proposed. To measure dissolved oxygen and temperature we use a YSI® Y85 D. O. meter. For water transparency we use a secchi disk. Generally, dissolved oxygen was within desirable levels (> 4mg/l). Lowest oxygen levels were found in 2011. Highest temperatures were in 2009; lowest were in 2008. Tables 1 to 5 present mean values, standard deviation and maximum and minimum values for selected water quality parameters, from January 2008 to June 2012, for MFH growout ponds. Nitrite levels are not shown in the table because they did not reach measurable levels.

**2008 (January – November)**

| <b>Parameters</b> | <b>Mean</b> | <b>S.D.</b> | <b>Maximum</b> | <b>Minimum</b> |
|-------------------|-------------|-------------|----------------|----------------|
| T°C               | 23.91       | 2.09        | 28.70          | 18.00          |
| D.O. (mg/L)       | 5.04        | 0.71        | 8.63           | 2.50           |
| pH                | 8.32        | 0.32        | 9.00           | 7.50           |
| Secchi Disk (ft.) | 3.88        | 1.06        | 5.00           | 2.00           |

**2009 (January – December)**

| <b>Parameters</b> | <b>Mean</b> | <b>S.D.</b> | <b>Maximum</b> | <b>Minimum</b> |
|-------------------|-------------|-------------|----------------|----------------|
| T°C               | 24.99       | 1.61        | 29.90          | 20.10          |
| D.O. (mg/L)       | 5.42        | 1.12        | 9.67           | 2.96           |
| pH                | 8.69        | 0.49        | 9.50           | 8.00           |
| Secchi Disk (ft.) | 3.99        | 1.09        | 5.00           | 2.00           |

**2010 (January – December)**

| <b>Parameters</b> | <b>Mean</b> | <b>S.D.</b> | <b>Maximum</b> | <b>Minimum</b> |
|-------------------|-------------|-------------|----------------|----------------|
| T°C               | 25.62       | 0.98        | 28.80          | 22.40          |
| D.O. (mg/L)       | 5.57        | 1.43        | 10.00          | 3.12           |
| pH                | 7.99        | 0.48        | 8.50           | 7.50           |
| Secchi Disk (ft.) | 4.12        | 0.98        | 5.00           | 2.00           |

**2011(January – December)**

| <b>Parameters</b> | <b>Mean</b> | <b>S.D.</b> | <b>Maximum</b> | <b>Minimum</b> |
|-------------------|-------------|-------------|----------------|----------------|
| T°C               | 24.72       | 1.85        | 23.80          | 19.40          |
| D.O. (mg/L)       | 5.44        | 1.26        | 10.46          | 1.71           |
| pH                | 9.44        | 1.16        | 10.90          | 5.00           |
| Secchi Disk (ft.) | 3.51        | 0.82        | 5.50           | 1.50           |

**2012 (January - June)**

| <b>Parameters</b> | <b>Mean</b> | <b>S.D.</b> | <b>Maximum</b> | <b>Minimum</b> |
|-------------------|-------------|-------------|----------------|----------------|
| T°C               | 23.74       | 1.95        | 27.90          | 19.80          |
| D.O. (mg/L)       | 5.72        | 1.00        | 9.64           | 3.40           |

|             |      |      |      |      |
|-------------|------|------|------|------|
| pH          | 7.78 | 0.82 | 9.00 | 6.00 |
| Secchi Disk | 3.08 | 0.77 | 4.00 | 1.00 |

In summary, water quality averages were within desirable limits for fish production, although on rare occasions dissolved oxygen fell below desirable levels. Emergency aeration was available to remedy this situation when it occurred. Since maintaining appropriate oxygen level is crucial, we have an aeration system for each pond and several others in stock.

Pond preparation was performed as required except for December 2008 when ponds were empty. For pond fertilization, we were using a combination of inorganic fertilizers (triple phosphate) and Alfalfa pellets to promote microorganism growth. We then assessed qualitatively zooplankton development, particularly the presence of important species like *Daphnia*. Adult largemouth bass were fed with tilapia fingerlings produced at the Hatchery.

During these years, fish production and stocking were performed without major complications. Broodstocks were captured at least once per year. In 2008, there was a situation in which a production cycle we had programmed was not initiated during the month of November, so fish culture was halted for the rest of the year. Despite this, the total amount of fish produced and stocked was higher compared to the other years (Figure 1). For 2012, only six months production and stocking are shown.

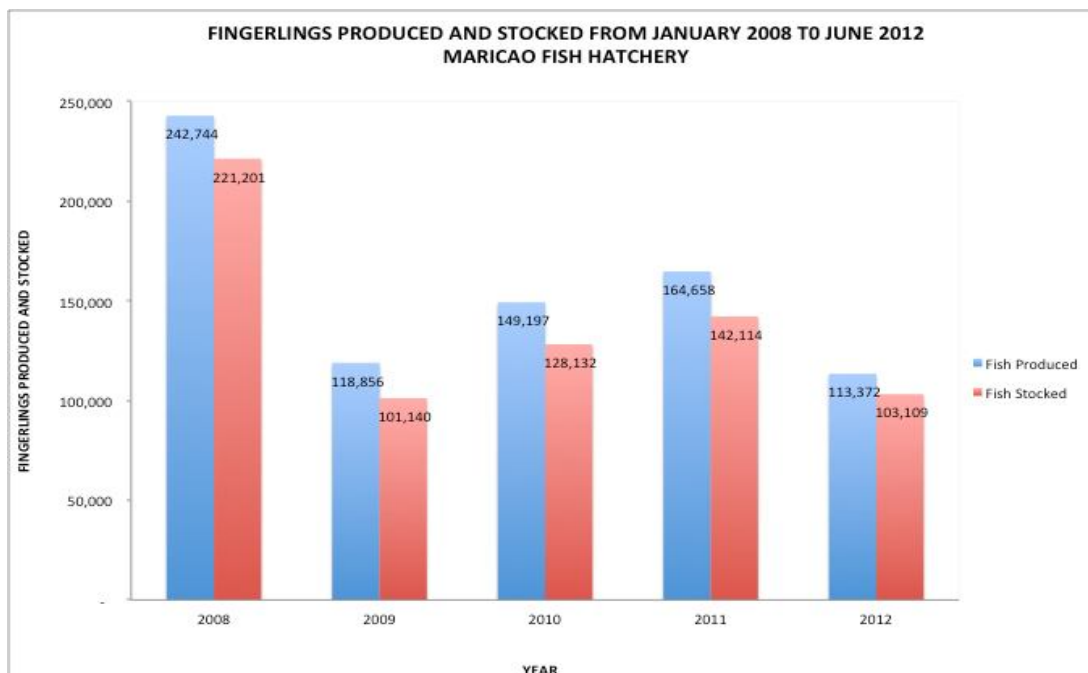


Figure 1. Fingerlings produced and stocked in Puerto Rico reservoirs from January 2008 to June 2012.

A total of **788,827** fingerlings were produced at the hatchery from January 2008 to June 2012. Of this quantity, approximately 93,398 were tilapias, which were mainly used to feed largemouth bass at the hatchery or were stocked in private ponds (requested by farmers). Nearly 695,696 were stocked in 15 reservoirs and private

ponds. Among the stocked reservoirs were Guajataca, La Plata, Lucchetti and Cerrillos where DNER manages sportfishing facilities, and fishing tournaments and other fishing activities are intensively performed by organized Fishing Clubs and non-affiliated anglers.

Table 6 shows the amount of fingerlings produced and stocked in the reservoirs managed by the PR-DNER during the study period. In Lucchetti and Cerrillos there is a healthy largemouth bass population for which reason no largemouth bass (in Cerrillos) or just a few, in the case of Lucchetti, were stocked. In Cerrillos, a forage species were stocked because overcrowding of largemouth had resulted in poor relative weights. Guajataca and La Plata were stocked by request of the Management Officials.

Table 6. Detailed fingerling stockings in PR-DNER managed reservoirs from January 1, 2008 to June 30, 2012.

| Location/<br>Reservoir | Quantity<br><i>M. salmoides</i> | Quantity<br><i>Lepomis spp.</i> |
|------------------------|---------------------------------|---------------------------------|
| Guajataca              | 75,863                          | 21,845                          |
| La Plata               | 49,328                          | 0                               |
| Lucchetti              | 3,000                           | 0                               |
| Cerrillos              | ----                            | 167,662                         |

From the total of stocked fingerlings, 389,402 (55.97%) were largemouth bass, 305,107 (43.86%) were sunfish (three different species) and 1,187 (0.17%) were tilapias. Figure 2 shows the number of largemouth bass, sunfish and tilapia stocked from January 2008 to June 2012.

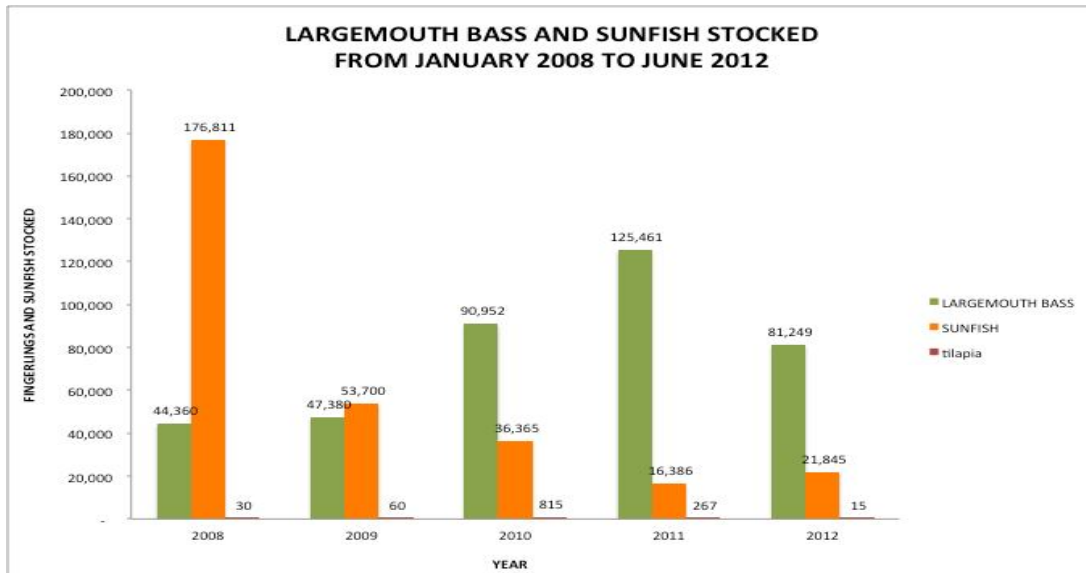


Figure 2. Largemouth bass, sunfish and tilapia stocked from January 2008 to June 2012.

#### d. Significant Deviations

In 2008, due to a lack of food and fertilizer, fish production was not performed during December and a decision was taken to stock sunfish fry that were in the growout pond,

at a smaller size than usual. In the same way, the water quality tests were not performed during that month.

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