

**Development of a Fishermen Operated Pilot-Scale Queen Conch (*Lobatus gigas*)
Hatchery and Nursery Facility for Sustainable Seafood Supply
and Restoration of Wild Populations in Puerto Rico**

**Desarrollo de un Criadero y Vivero Piloto de Carrucho (*Lobatus gigas*)
Operado por Pescadores, para la Producción Sostenible de Mariscos
y Restauración de Poblaciones Silvestres en Puerto Rico**

**Développement d'une Écloserie de Lambis (*Lobatus gigas*) et d'une Aire d'Alevinage Expéri-
mentale Dirigée par des Pêcheurs Pour l'Établissement D'une Production de Produits de la Mer
Durable et le Rétablissement des Populations de Lambis à Porto Rico**

MEGAN DAVIS^{1*} and RAIMUNDO ESPINOZA²

¹Florida Atlantic University — Harbor Branch Oceanographic Institute
5600 US 1 North, Fort Pierce, Florida, USA,

[*Mdavi105@fau.edu](mailto:Mdavi105@fau.edu)

²Conservación ConCiencia

1607 Avenida Juan Ponce de León, San Juan, Puerto Rico 00912, USA
Rai@conservacionconciencia.org

EXTENDED ABSTRACT

Introduction

The queen conch *Lobatus gigas* is an important fisheries species in the Caribbean that has been overfished. In the U.S. Caribbean, The Queen Conch Resources Fishery Management Plan (CFMC 1996, CFMC 2013) established a program to help rebuild conch populations in Puerto Rico and U.S. Virgin Islands. For Puerto Rico this includes a minimum harvest size of 22.9 cm (9 inches) shell length or a 9.5 mm (3/8 inches) lip width. The daily bag limits are 150 conch per licensed commercial fisher or 300 per vessel. There is a closed season (August 1 to October 31) in Puerto Rico's jurisdictional water (0 - 9 nm) during the peak reproductive months and harvest has been prohibited since 1997 in the U.S. EEZ off Puerto Rico. The Puerto Rico Department of Natural and Environmental Resources manages the state conch fisheries and NOAA Fisheries and the Caribbean Fisheries Management Council manages the federal conch fisheries.

The majority of the conch (also known as "Carrucho") fished in Puerto Rico are consumed locally with very little to no exports. The average commercial landings for 2013 - 2015 were 304,723 lbs. (NOAA Fisheries, Southeast Regional Office) and the price that fishermen receive is about \$6.00 per lb to as high as \$9.00 per lb. Even with these regulations in place the conch populations in Puerto Rico's state and federal waters have continued to steadily decline from overfishing and habitat loss since the 1980's (Baker et al. 2016). This decline along with closed seasons, competition with less expensive imports from other countries, and disruption of conch habitats from hurricanes such as Maria have severely impacted the fisheries and the fishing communities of Puerto Rico. Queen conch is thus a prime candidate to culture in a pilot-scale aquaculture hatchery and nursery facility in Puerto Rico with the aim of fisheries restoration and sustainable food supply.

Goal, Objectives and Methods

The overall goal of the 2-yr project (September 1, 2019 to August 31, 2021; S-K NOAA Award NA10NMF4270029) is to assist with restoration of queen conch fisheries in Puerto Rico by producing conch in a fishers-operated conch aquaculture facility (see Table 1 for estimated production schedule). This will be accomplished through the following four objectives:

Objective 1 — Build and operate a pilot-scale conch hatchery and nursery facility at the Puerto Rico Fishermen's Association in Húcares Beach, Naguabo. This is one of the top producing Fishermen's Associations in Puerto Rico and has over 20 members. The fishermen that are members of the Association will be engaged in this aquaculture project from conception and will be trained to operate the hatchery and nursery facility. The Association's President has designated space for establishing this conch aquaculture facility. The hatchery culture of queen conch will take place during the spawning seasons in Year 1 (May to November 2020) and Year 2 (May to August 2021). The hatchery-reared conch juveniles will be grown until they are ready for release in Year 2 (Objective 2). The building of the interior hatchery facility and exterior nursery facility will be completed in Year 1. The culture techniques to grow queen conch from the egg stage to larvae to juveniles will follow methodologies described in Davis (2005).

Objective 2 — Release hatchery-reared juvenile conch into the Luis Peña Channel Natural Reserve in Isla de Culebra and other appropriate locations for restoration purposes. The fishermen will assist with the release of approximately 2,000 hatchery-reared juvenile conch in Year 2 of the project for the purpose of enhancing conch spawning populations in the Natural Reserve. When these conch grow to maturity they will increase the number of egg masses produced in the Reserve

and other locations and form the nucleus for future conch generations that will spread offspring into other conch nurseries.

Objective 3 — Open the pilot-hatchery and nursery facility to other fishers, community members, students and visitors to learn about the importance of queen conch aquaculture, biology, conservation and fisheries. A live webcam will be used to broadcast hatchery and nursery activities. Other public dissemination includes presentations, trade articles, peer-reviewed publications, websites, social media, newspaper articles, and radio, and TV interviews. A queen conch aquaculture manual will also be completed. These outreach and dissemination activities will take place throughout Year 1 and Year 2 of the project.

Objective 4 — Produce a plan that recommends other areas in Puerto Rico for conch hatcheries and potential grow-out areas. This project will serve as a model approach, the template of which can be transferred to other fishing communities in Puerto Rico. In coordination with the local communities and government agencies, we will visit locations in Puerto Rico to determine sites where conch hatcheries and grow-out areas could be developed. The concept of a regional hatchery for the U.S. Caribbean will also be explored during this project. This objective will be addressed in Year 2 of the project.

Results

During the first quarter of the project (September to November 2019) several activities associated with the kick-off of the project were accomplished. We received our annual research permit from the Puerto Rico Department of Natural and Environmental Resources (DNER). In September we met with the fishers at the Naguabo Fishermen's Association and discussed the various aspects of the project such as egg collection, biology of the queen conch, fishers hatchery training, and timeline of activities. We also presented the project to the marine science students and professors at the University of Puerto Rico Humacao. We will include student interns from the University to assist with the project.

From September to November the hatchery floor plan for the queen conch pilot scale aquaculture facility was designed (Figure 1), supplies were identified, and the estimated production schedule (Table 1) and seawater requirements were determined. The reservoir tanks will hold a total of 3,800 liters and will be used for the hatchery and nursery systems. The larval system will be static water and the egg mass incubation, metamorphosis, and juvenile mass incubation tanks will be on recirculating systems. The estimated average use of water on a daily basis is 380 liters. Based on the size of the facility it is anticipated that 2,000 juvenile conch will be produced over the 2-year period for restock-

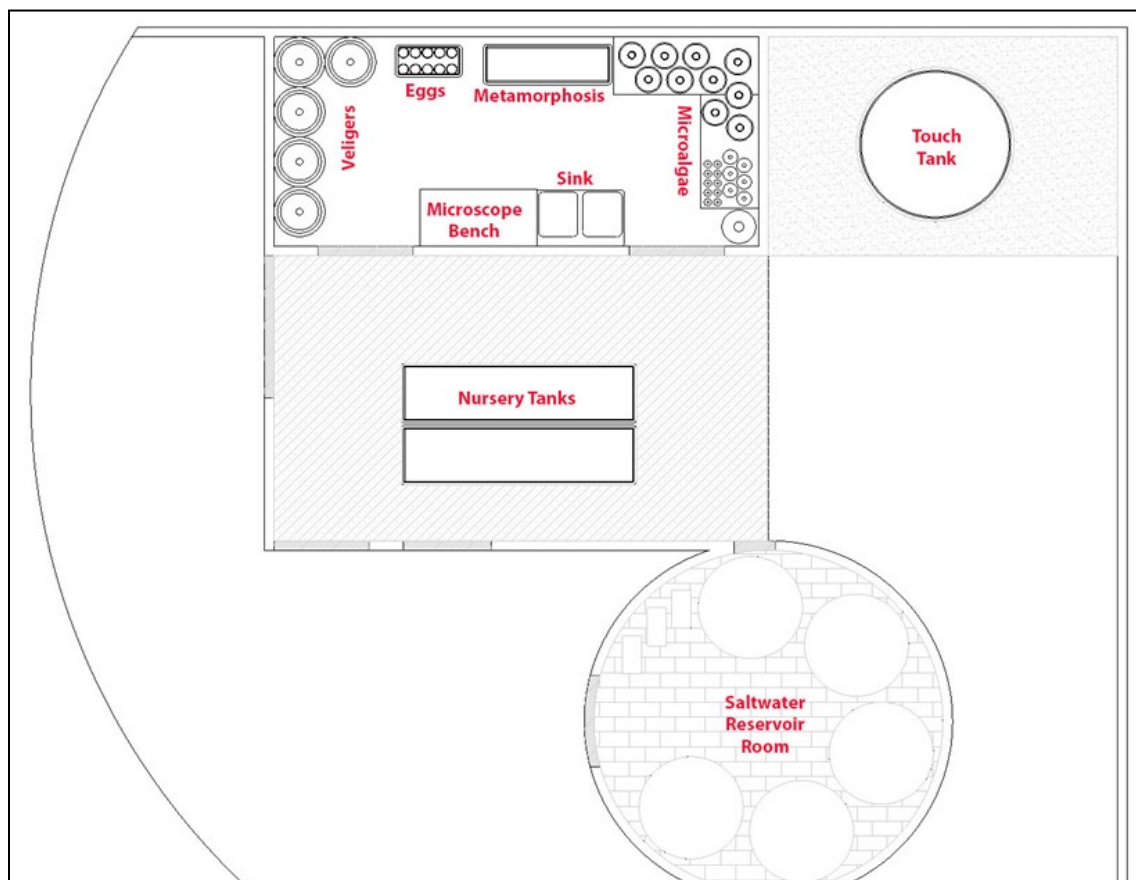


Figure 1. Floor plan layout of the queen conch pilot-scale hatchery facility in Naguabo Fishermen's Association, Puerto Rico.

ing. After consultation with the Environmental Protection Agency (EPA) it was determined that an EPA NPDES permit is not required for the discharge water from this hatchery due to the low daily discharge amounts, lack of chemical discharge, and low biomass of conch being produced (< 100,000 lbs.).

Discussion

This queen conch aquaculture project will serve as a model, which can be transferred to other fishing communities in Puerto Rico and elsewhere. The project will aid sustainable fisheries practices through aquaculture and restoration by working with the fishers, using the commercial Fishermen's Association's working waterfront, helping provide diversified incomes for the fishing communities and promoting aquaculture practices. These practices will help to ensure that the conch populations are available for future fishing and to aid food security for Puerto Rico and elsewhere in the Caribbean region.

KEYWORDS: Queen Conch, *Lobatus gigas*, aquaculture, fishers, Puerto Rico

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Table 1. Estimated production schedule for the queen conch hatchery for 2020 - 2021. The breeding season is June to November. The target number of juvenile conch to produce is 2,000.

| Stage | No. | Time | Size (SL) | Stocking Density | Survival | No. of Tanks | Size of Each Tank |
|----------------|--------|----------------------|---------------------|---|----------|---------------------------------------|--------------------|
| Egg Mass | 36 | 3-4 days until hatch | | 1 / container | | 1 incubation tank with 10 containers | 75 L |
| Larval Culture | 14,400 | 3 weeks | 300 - 1,200 microns | Start with 100/L; 10/L by metamorphosis | | 5 conical tanks | 68 L |
| Metamorphosis | 7,200 | 3 weeks | 1.0 - 4.5 mm | 3,500/m ² | 50% | 2 rectangular tanks with screen trays | 0.5 m ² |
| Nursery | 5,400 | 10 months | 70 mm | 1,700/m ² ; reduce to 600/m ² or less | 75% | 6 rectangular tanks with sand | 1.5 m ² |