

A Fishers Operated Pilot-Scale Queen Conch (*Aliger gigas*) Hatchery and Nursery Facility for Restoration and Sustainable Seafood Supply in Puerto Rico

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

Une Pépinière de Lambis (*Aliger gigas*) a L'échelle Communautaire Dirigée par les Pêcheurs de L'association de Pêche de Naguabo, Puerto Rico Pour la Restauration de L'environnement

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EXTENDED ABSTRACT

The queen conch, *Aliger gigas*, is one of the most important fishery species in the Caribbean and is in a state of steady decline due to overfishing and habitat degradation across its geographic range – the Caribbean Sea, The Bahamas, the Gulf of Mexico, Florida, and Bermuda. The heritage of conch is deeply rooted in the island cultures and the species has great social and economic importance. In addition, as grazers they play a key ecological role in seagrass habitats. In the U.S. Caribbean, because the species is under threat, The Queen Conch Resources Fishery Management Plan (CFMC, 1996; CFMC, 2013) was established as a regulatory program to help rebuild conch populations in Puerto Rico and U.S. Virgin Islands. For Puerto Rico this includes a minimum harvest size of 9 in (22.9 cm) in shell length or a 3/8 in (9.5 mm) lip thickness. Daily bag limits are 150 conch per licensed commercial fisher or 300 per vessel. The closed season is during the peak reproductive months (August 1 to October 31) in the jurisdictional waters of Puerto Rico (0-9 nm) and conch harvest has been prohibited in the U.S. EEZ surrounding Puerto Rico since 1997. The Puerto Rico Department of Natural and Environmental Resources (DNER) manages the state conch fishery and the Caribbean Fishery Management Council manages the federal conch fishery.

In Puerto Rico, conch (known as ‘carrucho’) is one of the main fishery species and the majority are consumed locally with little export. The average commercial landings for 2016-2017 were ~300,000–350,000 lbs (DNER) and fishers currently receive \$9 to \$14 per lb (Espinoza, unpubl. data). Even with regulations in place the conch populations in the state and federal waters of Puerto Rico have continued a steady decline from overfishing and habitat loss first reported in the 1980s (Baker et al., 2016). This decline, along with closed seasons, competition with less expensive imports, and disruption of the shallow conch habitats from frequent storms such as hurricane Maria in 2017, have severely impacted the fishery and the fishing communities of Puerto Rico. Queen conch is thus a prime candidate for restocking efforts and for a pilot-scale aquaculture hatchery and nursery facility in Puerto Rico. These efforts should help to address fishery restoration and sustainable food supply needs.

In 2019, Florida Atlantic University Harbor Branch Oceanographic Institute, Conservación ConCiencia, and Naguabo Fishing Association initiated a fishers-operated Queen Conch Hatchery partnership project located at the Fishing Association on Húcares Beach (funding through Saltonstall-Kennedy NOAA Fisheries grant NA19NMF4270029). The aim of the project is to use aquaculture to produce 2,000 conch per year for restoration of queen conch juveniles in seagrass nursery habitats for future fishing and to strengthen breeding populations.

By June 2021, the 8' x 18' Puerto Rico Queen Conch Hatchery, was designed, renovated and plumbed with aquaculture tanks and systems (Fig. 1). The hatchery seawater system is comprised of a 2,000 gallon reservoir tank, filtration system (100, 25, and 5 micron bag filters), and UV-sterilization. Every two to three weeks the seawater is pumped into the reservoir tank from the bay next to the Fishing Association. Since the hatchery opened in June 2021, there have been a number of successes including Association fishers' commitment to the project. This activity includes participation in the installation and operations of the hatchery, collection of egg masses from their known fishing grounds, and bringing the eggs to the hatchery for incubation and hatching. The fishers have also been identifying nursery habitats for restoration opportunities. The fishers receive a stipend to conduct these tasks, which augments and diversifies their livelihoods.

With the establishment of running seawater and hatchery systems in place, the hatchery was thoroughly tested from June to December 2021. The first small sections of egg masses were collected by the Association fishers in June and continued to be collected through December 2021. The fishers collected two to three egg masses approximately two times per month from the southeast side of Puerto Rico at depths of 50-120 feet. These egg masses were typically collected during their fishing trips. In the hatchery, the egg masses incubated in a recirculating saltwater system. On the fourth day, each egg mass hatched in a 68-L larval tanks. There are five larval tanks where the conch veligers (larvae) were cultured for 21-28 days and fed microalgae. The first batch of queen conch successfully metamorphosed in July 2021, after one month of hatchery operation. The competent larvae were provided either seagrass detrital blades or *Laurencia*, red seaweed, extract as the cue for metamorphosis. The metamorphosed conch were grown in shallow screen trays in a recirculating tank system. They



Figure 1. The Puerto Rico Queen Conch Hatchery located at the Naguabo Fishing Association. Hatchery includes egg incubator, larval tanks, metamorphosis system, microalgae culture, sink, and microscope table. Systems include filtered and UV-sterilization seawater, aeration, and freshwater.

were fed flocculated diatoms and epiphytes on detrital blades. Throughout the hatchery season (June to Dec 2021), techniques were refined and multiple batches of larvae were cultured, which made it possible to produce small batches of juveniles (100 - 200 per batch) each month. As the juvenile conch grew larger, they were supplemented with a gel-diet that was comprised of *Ulva* seaweed, shrimp chow, and gelatin. The goal will be to continue to grow the juvenile conch in the outdoor recirculating nursery system for 12 months (7 – 8 cm shell length) and then release them in juvenile seagrass habitats.

A detailed queen conch aquaculture training manual in English (Journal of Shellfish Research: Davis and Cassar, 2020) and in Spanish (Food and Agriculture Organization: Davis et al., 2021) were used for training of local fishers, staff, and interns on how to grow conch in the Puerto Rico Hatchery. With the knowledge and proof that early-juvenile seed conch can be produced at the Naguabo Queen Conch Hatchery location, there has been a strong interest from others to transfer this project model to other locations in Puerto Rico and elsewhere in the Caribbean region.

KEYWORDS: Queen Conch, Aquaculture, Restoration, Fishers, Puerto Rico

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