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Creating a Puerto Rico queen conch hatchery for stock enhancement

by Megan Davis and Raimundo Espinoza

FT. PIERCE, FL – The queen conch, *Lobatus gigas*, is a large molluscan gastropod (18-23 cm shell length (SL), 7"-9"; 2.3 kg, 5 lbs) that has spines on each whorl of the spire and a glossy deep pink flared aperture (see Fig. 1).

They are found in the shallow seagrass beds and sandy flats of Florida, the Bahamas, Bermuda, the Caribbean Islands, and the northern coasts of Central and South America (see Fig. 2).

The queen conch is known by various common names throughout the region such as caracol rosado (Mexico, Honduras, Columbia), carrucho (Puerto Rico), cobo (Cuba), lambi (Hispaniola, French Antilles), karko (Netherlands Antilles), and caracol de pala (Venezuela).

The life cycle of the queen conch

(see Fig. 3) begins with the female and male copulating during the summer months. The female lays up to nine egg masses per season with each egg mass containing approximately 500,000 eggs (see Fig. 4).

The embryos are ready to hatch from the egg mass strands in 3-4 days (see Fig. 5) and the planktonic veligers (larvae) feed on phytoplankton for about three weeks (see Fig. 6).

After metamorphosis, the juveniles remain buried for the majority of their first year (see Fig. 7).

As herbivorous gastropods, the juvenile and adult conch feed on a variety of epiphytic algae and diatoms associated with macroalgae such as *Batophora oerstedii*, seagrass *Thalassia testudinum*, and the sandy substrate.

During the first couple of years, the juvenile conch add length to their shell (see Fig. 8). As the flaring lip begins to form, the sub-adult conch begin to migrate to deeper water near the reef tract to form spawning aggregations.

They complete their lip flare at



about 3 years old and they are sexually mature at 4-5 years old when their lip has a thickness of ≥ 15 mm (0.59 in) (see Fig. 8).

Queen conch are estimated to have a life-span of 25-40 years; at this stage their lips are very thick (24-28 mm (0.94-1.10") or thicker) and they are often called samba conch.

The queen conch is deeply rooted in the island culture due to its great social heritage and strong economic importance as a fisheries species in the Bahamas and the wider Caribbean.

The queen conch is a prized delicacy and has long been harvested both for food and for its beautiful shell (see Fig. 9). It is

one of the most important benthic fisheries in the Caribbean region, second only to spiny lobster.

Although a commercial fishery for queen conch has existed for many years, beginning in the 1970s through present day a combination of factors including overfishing, hurricanes, and coastal pollution have led to a dramatic decrease of the species throughout its geographic region (see Fig. 10).

In the US Caribbean, the Queen Conch Resources Fishery Management Plan established by the Caribbean Fisheries Management Council (1996 and 2013) put this program in place to help rebuild conch populations in Puerto Rico and the US Virgin Islands.

For Puerto Rico, this includes a minimum harvest size of 22.9 cm (9") shell length or a 9.5 mm (3/8") lip thickness. The daily bag limits are 150 conch per licensed commercial fisher or 300 per vessel.

There is a closed season (Aug. 1 to
See HBOI REPORT, page 14



Fig. 1. Shell of adult queen conch, *Lobatus gigas*.

Megan Davis photo

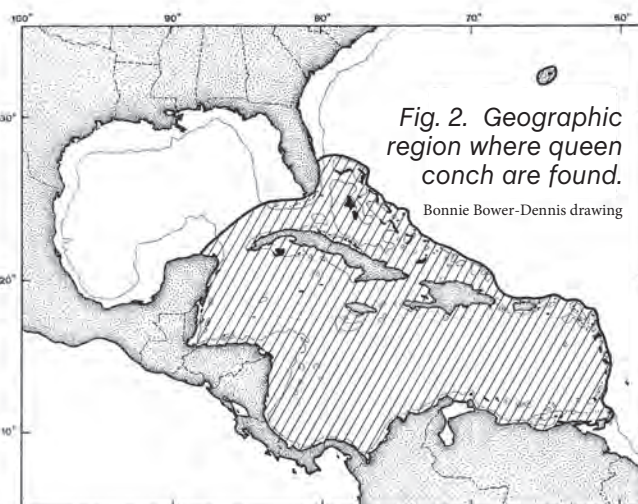
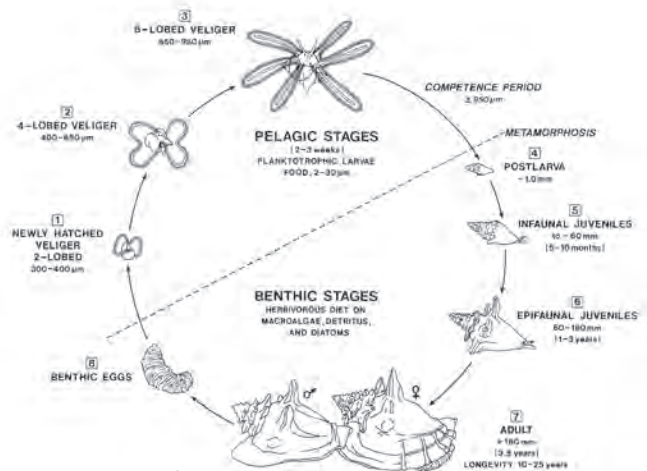


Fig. 2. Geographic region where queen conch are found.

Bonnie Bower-Dennis drawing



Bonnie Bower-Dennis drawing

Fig. 3. Queen conch life cycle stages from eggs to adult conch.

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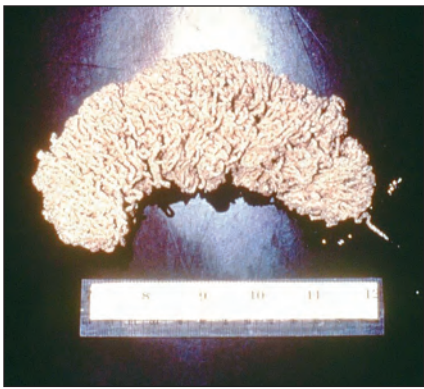
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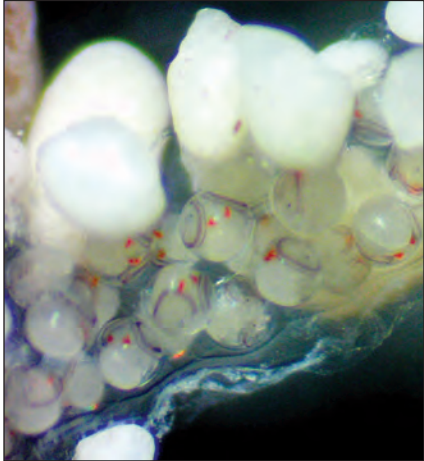
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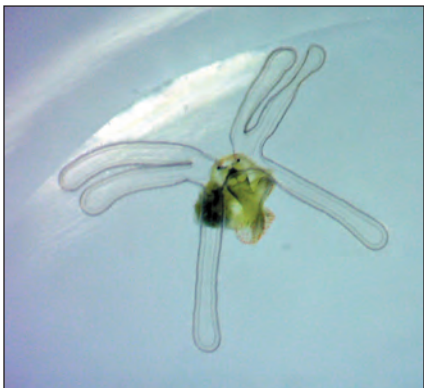
LeRoy Creswell photo

Fig. 4. Queen conch sand covered egg mass contains approximately 500,000 eggs.



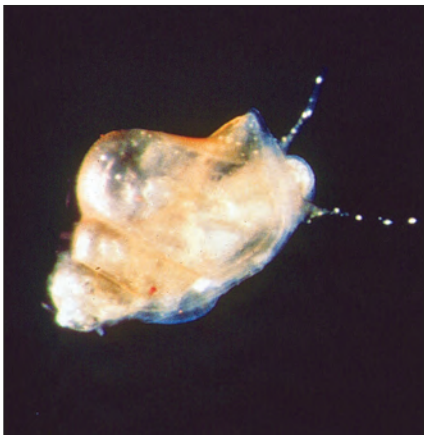
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Fig. 5. Sand-covered egg mass strand showing capsulated veligers ready to hatch. The velar lobes are well defined, the foot has reddish orange pigment, and the eye spots are visible.



Megan Davis photo

Fig. 6. Queen conch larvae with 6-lobes (15-21 days old; 900 μ m).



LeRoy Creswell photo

Fig. 7. Newly metamorphosed queen conch (1.2 mm)



H. Forrest Thomas photo

Fig. 8. Range of queen conch sizes and development stages from juveniles to fully-lipped adult.



Megan Davis photo

Fig. 9. Queen conch shells at local Caribbean market.



Megan Davis photo

Fig. 10. Queen conch shell midden in the Bahamas.



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Raimundo Espinoza photo
Fig. 13. Megan Davis discussing conch hatchery project with Naguabo Commercial Fishing Association fishers.



Fig. 14. Raimundo Espinoza discussing hatchery project with Naguabo Commercial Fishing Association fishers.

Megan Davis photo

to the marine science students and professors at the University of Puerto Rico Humacao. We plan to include student interns from the university to assist with the project.

We designed the hatchery and nursery floor plan for the 32 m² (340 ft²) queen conch pilot scale aquaculture facility (see Fig. 15) and supplies have been identified.

In December 2019, the facilities were renovated to include floor drains and raised cement floors (see Figs. 16, 17).

The hatchery will be equipped with tanks and supplies, and plumbing and electricity over the next several months and it will be ready for operation in June 2020.

The fishers will be trained to culture conch and operate the hatchery and nursery facilities. A queen conch manual will be produced in Spanish.

The estimated conch production schedule has been determined (see Table 1).

The larval system will be static water and the egg mass incubation, metamorphosis, and juvenile tanks will be on recirculating systems.

Small portions of egg masses will be collected from the wild and brought into the hatchery to be incubated for 3-4 days. The larval cycle is approximately 21 days.

The larvae, also known as veligers, will be fed phytoplankton (*Isochrysis galbana* and *Chaetoceros gracilis*) daily and their water will be exchanged every 48 hours. When the veligers are competent for metamorphosis they will be induced to metamorphosis with a cue such as *Laurencia* extract, hydrogen peroxide or seagrass detrital blades.

The juvenile conch will be cultured in tanks with sand substrate until they are 6-8 cm shell length. This is the size at which they will be released into the field using a stock enhancement strategy.

Aquaculture, along with conservation of breeding populations and fisheries management, are ways to help ensure longevity of the species.

This queen conch aquaculture project in Naguabo, Puerto Rico 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 stock enhancement by working with the fishers, using the Commercial Fishing Association's working waterfront, helping provide diversified

incomes for the fishing communities, and promoting aquaculture practices.

These practices will help to ensure
See HBOI REPORT, next page

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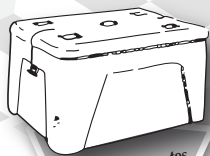
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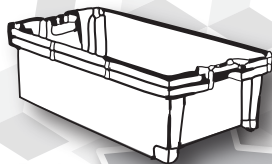
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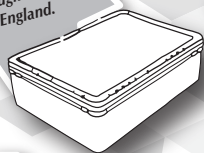


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that the conch populations are available for future fishing and to aid food security for Puerto Rico and elsewhere in the Caribbean region.

Megan Davis, PhD, is a research professor at Florida Atlantic University Harbor Branch Oceanographic Institute, Fort Pierce, FL, and can be reached at mdavi105@fau.edu. She has 40 years of queen conch aquaculture experience and has designed and operated seven experimental conch hatcheries in Florida, Turks and Caicos Islands, and the Bahamas. She was co-founder of the commercial-scale conch hatchery in the Turks and Caicos Islands and as chief

scientist she developed large scale conch aquaculture techniques.

Raimundo Espinoza, is the executive director, Conservación ConCiencia, San Juan, Puerto Rico, and can be reached at rai@conservacionconciencia.org. He collaborates closely with commercial fishers, NGOs, and governments across the Caribbean and Latin America to create opportunities to further conservation actions. He has been advising and collaborating with local communities on sustainable development efforts, fisheries, and conservation projects in Puerto Rico and throughout Latin America for nearly 20 years.

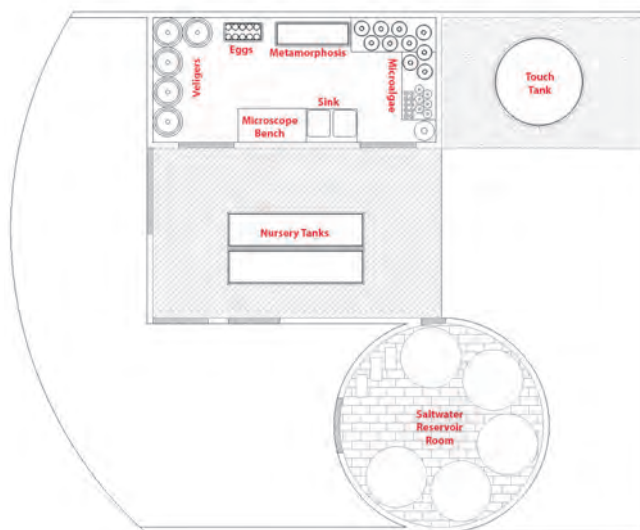


Fig. 15. Floor plan layout of the queen 32 m² conch pilot-scale hatchery and nursery facility at Naguabo Commercial Fishing Association, Puerto Rico.

Kathy Russ drawing

Fig. 16. Megan Davis reviewing the hatchery renovation plans at Naguabo Commercial Fishing Association with contractor.

Raimundo Espinoza photo



Fig. 17. Raimundo Espinoza discussing preparations of hatchery renovation at Naguabo Commercial Fishing Association.

Megan Davis photo