

The Status of Spiny Lobster Aquaculture with Emphasis on the Potential of the Pacific Spiny Lobster in Panama

HUSBANDRY EQUIPMENT EDUCATION & ACADEMIA

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World spiny lobster fisheries total 70,000 metric tons, with most coming from the countries of Australia, Brazil, the Bahamas, Cuba, Nicaragua and the US. The prominent species is *Panulirus argus* found throughout the Caribbean, which makes up half of the total world harvest worth \$400 million per year, selling near 13\$ per kg.

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The US imports 10, 000 tons of spiny lobsters per year, and harvests 3,500 tons more, worth US \$25 million, with 85% coming from Florida and the remainder from a larger species with 2x the value, *Panulirus interruptus* from California. Although it takes two years to reach the legal harvest size of 3 inches in carapace length in Florida, the fishery is very well managed and has only decreased slightly on average over the past 20 years.

In contrast to the US, the green spiny lobster (*P. gracilis*) found along the pacific coast of Panama, like many of the worlds fisheries, has been overexploited for decades and has been described as on the verge of collapse. Lobster landings for Panama can only be derived from export data, as catch statistics are unavailable. Approximately 10% of the total lobster fishery of Panama comes from the Pacific side. The Atlantic side of Panama has two main areas for lobster harvest (*P. argus*), Guna Yala, producing about 92 tons for export, and the remainder of the total of about 1800 tons being from the Caribbean Bocas del Torro area.



In reference to the Coiba Islands off the coast of Pacific Panama, which is a marine protected area but where laws are largely ignored, Smithsonian scientists from the Tropical Research Institute in Panama City had this to say: "The number of surveyed lobsters in both archipelagos was surprisingly low (85 in Las Perlas and 67 in Coiba), and average densities were dismal (4.1 ± 8.8 ind. ha⁻¹ and 5.3 ± 7.6 ind. ha⁻¹, respectively) (Internet source: "Population Assessment of the Pacific Green Spiny Lobster *Panulirus gracilis* in Pacific Panama" ,Guzman et al, 2008).

Spiny lobsters in the Gulf of Chiriqui on the pacific side are hard to find. Although the author has been diving over the course of 4 years for a total of about 20 times in a reef area of Chiriqui Bay, lobsters have never been seen in the wild. Adult lobsters are still occasionally available near coastal towns for sale by the side of the road, however, spiny lobsters are normally not offered for sale in the supermarkets of the second largest city of David, Chiriqui Province, Panama.

Although there is only anecdotal information available on the very few small spiny lobster aquaculture operations in the Caribbean, spiny lobsters grown in cages and nets along the coast of Vietnam are reputed to be worth \$70 million per year. Unlike the more aggressive northern clawed lobster, spiny lobsters are gregarious and can be housed together in aquaculture systems and have a higher growth rate when housed communally rather than singly. A few species have been grown in aquaculture systems at densities from 20-100/m², with shelters aiding growth and survival.

Perhaps the greatest hindrance for the advancement of spiny lobster aquaculture is the prolonged larvae cycle. The larval cycle of the Pacific Panama lobster is from 3-6 months while that of *P. ornatus* from Australia is from 6-8 months. This requires an obvious tremendous time commitment compared to the larval cycle of shrimp which is typically 2-3 weeks. In addition, other problems associated with spiny lobster aquaculture are low growth rates, poor FCRs, a long time to harvest size (typically 2 years at least for the Caribbean area) and the lack of availability of an acceptable feed pellet.



Figure 1. *P. gracilis* at stocking weighing 10.3 g on average and over 7 months later at 94g.

Typical spiny lobster feeds used in aquaculture research are high in protein (48-61%). The greatest amount of study on feeds has been conducted on three different spiny lobster species. In one study, *P. ornatus* was fed about 3% of biomass/day on multi protein prepared feeds, and yielded an outstanding growth rate up to 9g/wk. Growth of juvenile *P. cygnus* has been reported elsewhere to be 2.2 g/wk at 60 g. In another study,

biomass for *P. argus* in aquaculture systems reached 18 kg/m², growing to a size of 450 g in one year from larvae, and to 1.4 kg in 2 years. Although the biomass and growth of *P. argus* is considered remarkable, the FCR of 10-15 obtained may be cost prohibitive, as feed is estimated to be 60% of the variable costs for lobster farming.

A growth trial using the Pacific Lobster, *P. gracilis*, in an aquaculture system in Panama.

An attempt was made to grow the Pacific Spiny Lobster, *P. gracilis*, in a land based, aquaculture system which has never been done before with any success. On September 28, 2015, live juvenile lobsters were purchased from a local fisherman near Boca Chica, Chiriqui Bay, Panama at 10.3 g average weight. Animals were stocked at 41 ind/m³ into a zero water exchange system near Boquete, Panama after a brief acclimation. Over the course of the next 4 months, lobsters were fed a variety of prepared and raw feeds with average weights and feed conversion ratios (FCR) calculated monthly with widely varying results. Although diverse proteins are consumed in the wild, there were vast differences in FCRs calculated for the variety of feeds offered, meaning that these lobsters can digest and assimilate marine proteins differently. At the end of the four months lobsters averaged only 27 g, with FCRs varying from 2 to 43, and regular mortality of 3-6% per month. Runts were typically culled out by cohorts, as the sizes of lobsters became more uniform over time. At the last sampling only one or two lobsters were noticeably smaller.

Alternatively, on 20-May-16 after incorporating the results for the best feed options from the previous three months, lobsters were again sampled for monthly growth and grew 3.7 g/wk for four weeks, reaching an average of 71 g each, with an FCR of 4.6 and a biomass of 2.3 kg/m³. Four weeks later, with feed types and amounts slightly adjusted again, lobsters grew at 4.7 g/wk to 94 g with an FCR of 4.8 and biomass increasing to 2.8 kg/m³ (Figure 1).

Survivals were 100% during the last two months of sampling. This is not only the first time this lobster species has been grown in an aquaculture system but the first time in a zero water exchange system as well.

Conclusion

Fishery management of the spiny lobster ranges from a huge success in the US, to desperate on the pacific side of Panama. Although spiny lobster aquaculture has a few important obstacles, information provided here shows an immediate need coupled with an obvious possibility. The Pacific Spiny Lobster (*P. gracilis*) can be grown using a closed, land based aquaculture system in Panama, 600 m above sea level, 15 miles from the ocean. Regular updates on *P. gracilis* farming in Panama can be found at www.newaquatechpanama.com.