Blue Swimmer Crabs
Emerging Species in Asia

Summary:
High market prices are driving interest in the aquaculture of blue swimmer crabs. Considerable research has shown that the crabs readily spawn in captivity, and larviculture is relatively easy, with high survival rates. During growout, P. pelagicus *exhibit high growth rates. Although cannibalism and nutritional challenges have been identified as problem areas, they can be addressed through appropriate management practices.*

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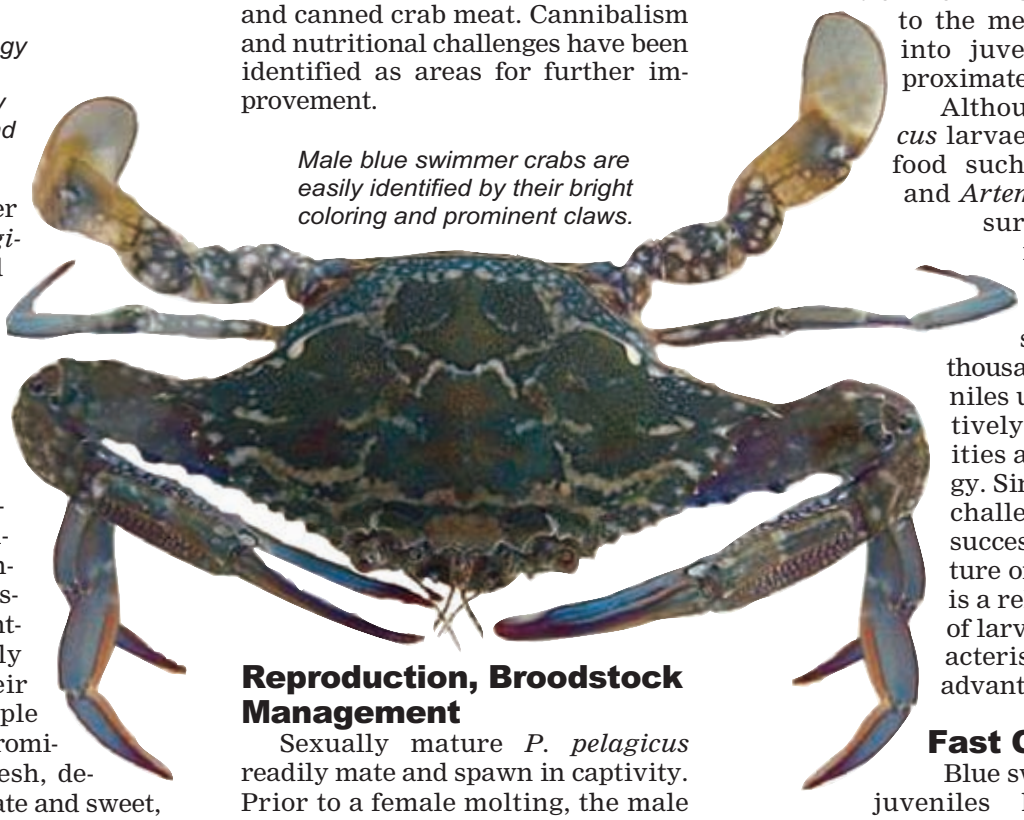
The blue swimmer crab, *Portunus pelagicus*, is a Portunid crab that is widely distributed throughout the Indo-Pacific. In this region, fishery harvests of the crabs have generally increased since the early 1950s and currently support important multimillion-dollar fishery industries. The much sought-after males are easily identifiable by their bright blue and purple coloring, and long, prominent claws. Their flesh, described as both delicate and sweet, has high demand in export markets.

Initial interest for the aquaculture production of these crabs began in Asia during the mid-1990s, when the highly virulent White Spot Syndrome Virus (WSSV) significantly affected the saltwater shrimp aquaculture industry. Although blue swimmer crabs can be carriers of WSSV, they are not as susceptible to its negative effects.

Emerging Species

In recent years, researchers including those at the authors' laboratory at James Cook University in Australia have examined the basic biology, culture techniques and economic feasibility of blue swimmer crab aquaculture in both pond and recirculating culture systems. While much information is still lacking, these investigations yielded key points pertaining to the aquaculture potential of *P. pelagicus*.

The crabs readily spawn in captivity and year-round in the tropics. Their larviculture is relatively easy. During growout, *P. pelagicus* exhibit high growth rates. In addition, the market has high prices for soft shells and canned crab meat. Cannibalism and nutritional challenges have been identified as areas for further improvement.



Male blue swimmer crabs are easily identified by their bright coloring and prominent claws.

Reproduction, Broodstock Management

Sexually mature *P. pelagicus* readily mate and spawn in captivity. Prior to a female molting, the male will pair with the female for a few days. When the female finally molts, copulation ensues, and the male deposits spermatophores on the female for egg fertilization.

After successful copulation, females can spawn and hatch out viable larvae six consecutive times without the need for further copulation. From one female, tens of thousands of larvae can be released after approximately 10 days of egg incubation. In the tropics, year-round spawning of mature *P. pelagicus* crabs is possible if proper nutrition is provided and adequate environmental parameters including a salinity range of 26-35 ppt and temperatures of 27-30° C are maintained.

Larviculture

The larvae of blue swimmer crabs are typically hardy with a relatively short developmental duration. High survivial rates of 20-50% are typical.

There are five successive larvae stages, including four zoeal stages and one postlarval megalopa stage. Under optimal conditions, the duration from first zoeal stage to the metamorphosis into juveniles is approximately 12 days.

Although *P. pelagicus* larvae rely on live food such as rotifers and *Artemia*, the high survival rates routinely observed can lead to the settlement of thousands of juveniles utilizing relatively simple facilities and technology. Since one of the challenges for the successful aquaculture of any species is a reliable supply of larvae, this characteristic is highly advantageous.

Fast Growout

Blue swimmer crab juveniles have much faster growth rates than other aquacultured crabs, such as the mud crab, *Scylla* species; and Chinese mitten crab, *Eriocheir sinensis*. As with all crustaceans, the growth of *P. pelagicus* is accomplished through successive molting, where

the crabs shed their hard exoskeletons, take up water to increase their size and grow new hard shells.

It takes approximately 14 molts for *P. pelagicus* to reach sexual maturity. The authors have observed in the laboratory that first-stage juvenile crabs can reach a market size of approximately 150 mm in carapace width within five months. However, this is highly temperature-dependent. To achieve such growth, temperatures should be maintained at 25-32° C.

Female Portunus pelagicus *can carry tens of thousands of eggs.*

Market

High market prices are perhaps the main driving force for the interest in the aquaculture of *P. pelagicus*. Traditional hard-shell *P. pelagicus* crabs can fetch U.S. $18.50/kg. There is also growing interest for the production of soft-shell crabs, which can fetch up to U.S. $55.75/kg.

Some aquaculture farms are specifically devoted to soft-shell production. Although the methods used to identify newly molted crabs range from high-cost, high-tech computerized monitoring systems to simple visual observations at regular intervals, the common aim is to select for quick freezing and local or overseas sales the newly molted crabs prior to their absorbing too much water.

Issues

The culture of blue swimmer crabs does present several challenges, including environmental, nutritional and behavioral issues.

Water Quality

Experiments by the authors have shown that *P. pelagicus* crabs have a high tolerance to ammonia-nitrogen and nitrate, but are particularly sensitive to nitrite. To maintain optimal growth, nitrite should be kept below 0.1 mg/l through both proper system design and good management practices.

Furthermore, evidence has demonstrated that *P. pelagicus* are relatively weak hypo-osmoregulators, which can lead to drastically reduced survival and growth if the crabs are cultured at salinities below 15 ppt. This is an important consideration for site selection and the design of *P. pelagicus* farms.

Nutrition, Feed

Despite the growing interest in the aquaculture production of *P. pelagicus*, a commercially available, species-specific diet has yet to be designed for the growout phase. Instead, farms utilize trash fish and/or pellets designed for penaeid shrimp, which may not be nutritionally optimal for this crab species.

It has been observed that as the crabs approach market size, many pellets go uneaten because the small pellets are difficult for the crabs to grasp, manipulate and ultimately ingest. This, of course, can contribute to increased production costs and deterioration in water quality.

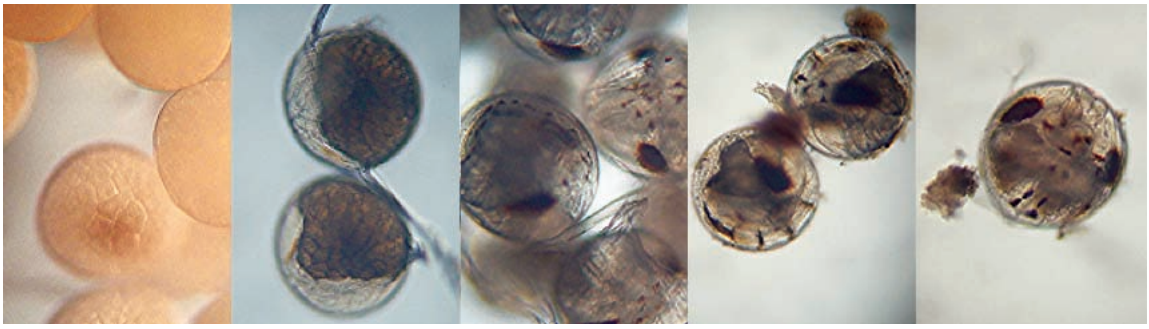
Currently, the Tropical Crustacean A.Q. Research Group at James Cook University is conducting research to quantify the nutritional requirements of *P. pelagicus* larvae, juveniles and broodstock. The aim is to design a species-specific diet to improve the survival and growth of larvae and juveniles, particularly at low salinities, and improve the reproductive performance and larval quality of the crabs.

The zoeal stages of P. pelagicus *appear similar with a long abdomen used for feeding (left). The final megalopa stage has large claws for feeding (right).*

Cannibalism

High cannibalism rates from the megalopa larval stage throughout the juvenile/adult stages of *P. pelagicus* are the most significant limitation for blue swimmer crab culture. The megalopa stage is characterized by the emergence of large claws that are capable of causing severe damage. This development commonly leads to higher mortality rates than in the less-developed zoeal stages, but cannibalism can be managed to some degree by ensuring food is never a limiting factor, providing appropriate shelter and reducing stocking densities.

Cannibalism predominantly occurs soon after the crabs molt, because when the hard protective exoskeletons are shed, the crabs become soft and therefore vulnerable to attack. Although cannibalism can be minimized during the nursery stages through a variety of methods, the controls may not be feasible during growout in large ponds. It therefore appears that the ultimate solution is the separation of individuals in compartments, which is commonly used during soft-shell crab production.



The egg development of blue swimmer crabs is characterized by final "eyed stages."