

# Overview life cycle and breeding biology lobsters and cray fish

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- Of the various tropical spiny lobster species in the Indo-West Pacific region, ***Panulirus ornatus* and *P. homarus* are emerging as the favoured species for aquaculture.** This is based on a number of **factors including** market demand and pricing, availability of naturally settling seed (for on-growing), development of hatchery technology, suitability for captive grow-out and adaptability to a variety of production systems. Production to date is based only on naturally settled **pueruli**, which in some areas of Vietnam and Indonesia are particularly abundant and easily caught. In Vietnam, more than 1 500 tonnes of *P. ornatus* are farmed each year in sea cages.
- **The development of spiny lobster culture has been actively pursued for many decades, although advances have been slow to realise because of the protracted larval phase (around 300 days).**

- **Habitat and biology**
- Both *P. ornatus* and *P. homarus* are **reef dwelling species**, most abundant on coral and coastal fringing rocky reefs and the areas surrounding them.
- **They are found in depths of 1 to 50 m.** The juvenile and adult stages of both species **are omnivorous**, grazing primarily on small crustaceans, molluscs, worms and algae. They are generally **nocturnal**, most active from dusk through to dawn. Both are highly social, preferring to congregate in groups in hollows, caves and crevices within and beneath the reef structures.

- ***P. ornatus* matures in its second year post puerulus, when the size is >1 kg, while *P. homarus* matures at around 12 months post puerulus when the size is about 300 to 500 g. In both species mating involves the deposition by the male of a white spermatophore, released from gonopores at the base of the fifth walking legs (pereiopods), onto the sternum of the female.**
- This spermatophore may persist for several days, and when the female is ready the spermatophore is scratched open with the posterior pereiopods to release non-motile sperm, which are drawn into a **temporary breeding chamber formed by the tightly curled abdomen.**

- Eggs are released at the same time from gonopores at the base of the third pereopods and also drawn into the breeding chamber by a current created by the beating abdominal appendages (pleopods). **Fertilisation occurs in the mix and fertilised eggs become attached to long ovigerous setae on the pleopods.**
- Each female can produce several hundred thousand eggs per spawning, well over a million in larger individuals, and may spawn more than once during summer. *P. ornatus* have been known to undergo spawning migrations to locate themselves on the edge of the continental shelf to release larvae. Egg incubation takes ~3 to 4 weeks.

- Hatching occurs at night, and the **first stage phyllosoma larvae** (<2 mm carapace length) are released. The planktonic phyllosoma larvae are capable of moving vertically to a preferred depth, but are otherwise at the whim of ocean currents. **In both *P. ornatus* and *P. homarus* the phyllosoma develop through 11 distinct stages involving up to 20 successive moults (instars) until the final stage which may have a carapace length of >25 mm.**

- **The final stage phyllosoma metamorphoses into the puerulus, which is a free-swimming and initially transparent stage that looks like a lobster and lasts for 2-3 weeks, seeking suitable habitat on or near coral reefs.** The puerulus is a non-feeding stage that lives off accumulated energy reserves. Once suitable habitat is located, the puerulus, which is now pigmented, settles to the bottom, moults to the first juvenile stage and takes on a benthic habitat.

- **Hatchery production of lobster larvae** (phyllosoma) is technically challenging because of the protracted duration of larval development, the large number of moults involved and the delicate nature of the larvae. Japanese research and development of hatchery technology is the most long-standing at over 100 years, but in recent times the most significant developments have come from Australia and New Zealand. Small numbers of pueruli have been produced in research hatcheries and several groups (government and private) are now commercialising their technology.
- Commercial hatchery production of spiny lobster juveniles is expected to become existent over the next 10 years, which is expected to enable significant expansion of the grow-out industry.



# Cray fish life cycle and breeding

- *Procambarus clarkia* (red swamp crawfish)
- Although captive fisheries for introduced *Procambarus clarkii* exist in several other countries (such as China, Spain, and Portugal), there is no place where crayfish are more highly regarded socially and have had as much impact to the economy of a region than in the **southern United States**.
- *P. clarkii* is found in lentic and lotic freshwater habitats: **sluggish streams and lentic habitats, swamps, ditches, sloughs and ponds**, etc., especially in vegetation, leaf litter, etc. It avoids streams and ditches with a strong flow, where it is replaced by other species. It exhibits territorial behaviour and is aggressive with its own species. **It burrows during periods of drought or cold. It is benthic and omnivorous, feeding on insects, larvae, detritus, etc., with a preference for animal matter.**

- The life cycle of this burrowing crawfish is well suited to the annual sequence of spring flooding and summer dry period common to large river systems and floodplains in the southern USA where it is most abundant.
- **Mature animals mate in open water, and although spawning can take place in open water, the burrow provides protection while the eggs and offspring are attached to the abdomen.**

- Egg development in mature females usually begins prior to burrowing and maturity is completed in the burrow. At maturity, the eggs are expelled through the oviducts, fertilized externally with sperm that has been stored in the seminal receptacle, and are then attached to the swimmerets on the tail (abdomen).
- **Although crawfish can survive in a high humid environment within the burrow, standing water is necessary for spawning.** The number of eggs laid varies with size and condition of the female and will usually range from 200 to 500 eggs. Hatchlings remain attached to the female's swimmerets through two moults, after which they become free and can forage on their own.

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- It is a fast-growing species; in adequate conditions larvae are born after 21 days of incubation (5 mm long at 2 days), growing to 2 cm one month later and up to 80 mm of length in 3 months (around 20 gm). It is an eurythermal species (10-22 °C to >30 °C) and inhabits all types of water, with a preference for hard water