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UNITAS MALACOLOGICA

From the Editor

The article in this supplement was intended for *Tentacle* 17. By an inexcusable oversight I failed to include it. It is now published as a supplement to *Tentacle* 17. I offer my most humble apologies to the authors.

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MARINE MATTERS

How basic research on giant clam defenses can influence restocking decisions

By Peter Todd & Loke Ming Chou

It is generally acknowledged that basic research is important for wildlife conservation, and we have found this to be especially true for giant clams. For instance, last year in *Tentacle* (Todd & Guest, 2008) we discussed how juvenile giant fluted clams, *Tridacna squamosa*, aggregate into clumps, potentially increasing fertilization success during spawning or providing protection against predators. This has two implications for clam restocking: 1) clams should not be separated during culture as they will continue to try and aggregate, thus expending energy that could be used for growth, and 2) clams should be placed in clusters when they are transplanted from aquarium tank to reef (Huang *et al*., 2007).

More recently, we have shown through experiments and subsequent models that scutes (scaly projections on the shells of *Tridacna squamosa*) provide protection against crushing predators such as crabs (Han *et al*., 2008). Crab chela and clam scute strength were measured with force gauges and the resulting data used to create two predator-defense models. In the first, scutes help provide a size refuge, reducing the number of predators large enough to seize and crush the prey. In the second model, the scutes force the crab to open its chela wider in order to grasp the clam; this leads to enough decrease in power to prevent the crab from breaking the scutes, and thus the shell. Both models show clearly that clams are vulnerable when small and therefore measures should be taken to protect them while young, either through caging or delayed release into the wild.

Interestingly, scute growth exhibits positive allometry (Chan *et al*., in press). This is unexpected as scutes should provide some protection even at very early life stages. To examine the relationship between shell morphology and predation in more detail, we are now conducting experiments to see whether scute growth rate can be increased by exposing juvenile clams to predator conditioned water. If juvenile *T. squamosa* can be manipulated to produce larger scutes earlier, their grow-out time might be shortened, freeing up precious aquarium space.

Giant clams are well known for their colourful mantles that vary tremendously within a species. This polymorphism, and any potential camouflaging effect of the mantle colours (Fig. 1) should reduce attack frequency. (Although attacks do not

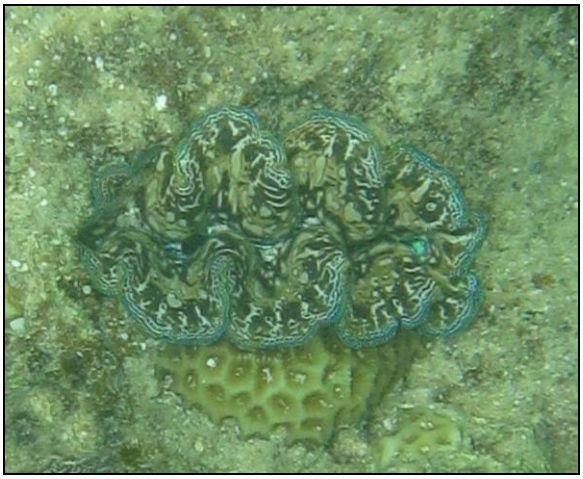

Fig. 1. Cryptically coloured *Tridacna crocea*.

often result in mortality, they do interfere with both photosynthesis and filter-feeding due to rapid mantle withdrawal and valve contraction). By examining 573 images of the giant boring clam, *T. crocea*, we were able to confirm that *T. crocea* is colour/pattern polymorphic and that morph frequency is size-related (Todd *et al*., in review). Furthermore, mantle colours (red/blue/green values) extracted from a subset of the images correlate positively with substrate colours, indicating background matching (crypsis). We predict that similar results would be found for other species and suggest, when restocking, effort should be made to match clam with substrate.

It is a sad fact that the elaborate defenses of giant clams are unlikely to help them survive the sustained fishing pressure and habitat deterioration that is depleting populations throughout the Indo-Pacific. Nevertheless, knowledge of their defense strategies can help managers fine-tune restocking programmes—their best chance for survival in many areas.

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Huang, D., Todd, P.A. & Guest, J.R. 2007. Locomotion and aggregation in the fluted giant clam (*Tridacna squamosa* L.). *Journal of Experimental Marine Biology and Ecology*. 342: 269-281.

Todd, P.A. & Guest, J.R. 2008. Giant clam conservation and research in Singapore. *Tentacle* 16: 24.

Todd, P.A., Lee J.H. & Chou L.M. In review. Polymorphism and crypsis in the boring clam (*Tridacna crocea*): potential strategies against visual predators. *Hydrobiologia*.

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