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# Marine Ornamental Shrimp: STATUS AND PROSPECTS

By Junda Lin, Dong Zhang, and R. LeRoy Creswell

**P**ractically all of the over 3,000 species of marine fishes and invertebrates marketed in the aquarium trade industry are collected from coral reef ecosystems. Extensive and destructive collection of these animals can directly deplete the target species that already under threat from habitat loss or degradation and indirectly damage the delicate coral reef ecosystem. Over 18 species of marine tropical shrimps are collected for the aquarium trade (Fletcher et al. 1995). Many of these species are cleaner shrimps that remove parasites off fish, therefore play a vital role in coral reef ecology (Jonasson 1987, Debelius 1984, 1985, Wilkerson 1994). To attract fish, these shrimps establish "cleaning stations", perform characteristic swaying movements and signal with their long brightly colored antennae (Fletcher et al. 1995). Cleaner shrimps are small (a few cm as adults), delicate, and strikingly colorful. As adults, they are relatively easy to maintain in a marine aquarium environment (e.g. Strynchuk 1990, Wilkerson 1994). These shrimps are not abundant on coral reefs and their delicate nature makes

collection challenging. This disparity between supply and demand has resulted in premium prices ranging from several dollars to \$20 per shrimp.

Many attempts have been directed to the cultivation of these shrimps in recent years, mainly at species of *Lysmata* and *Stenopus* (de Castro and Jory 1983; Young 1979, Fletcher et al. 1995; Creswell and Lin

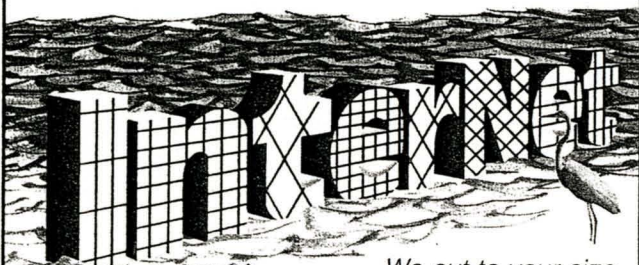
1997, Zhang 1997, Zhang et al. 1997a, 1997b, 1998a, 1998b, 1998c; Simoes et al. 1998). Some species are found to be not feasible for commercial aquaculture, at least at present time. For example, *Periclimenes pedersoni* (Peterson's cleaning

shrimp) and *P. yucatanicus* (spotted cleaning shrimp) are less popular in the aquarium trade market (small in size) and it is difficult to maintain the broodstock (Creswell and Lin 1997). Larviculture of *Stenopus hispidus* (banded coral shrimp, see below for details) and of *Lysmata grabhami* (scarlet lady shrimp) are difficult to complete with significant survivorship.

These shrimps are relatively easy to spawn in captivity. Like in

	GABA concentration									
	10 <sup>-3</sup>		10 <sup>-4</sup>		10 <sup>-5</sup>		10 <sup>-6</sup>		0 (control)	
	S	M	S	M	S	M	S	M	S	M
Day 4	19	—	84	29	78	25	89	32	85	16
Day 10	0	—	51	57	10	48	46	68	26	34
Day 14	0	—	36	—	0	—	23	—	8	—

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penaeid shrimps, eyestalk ablation can be used to shorten the molt interval and to stimulate gonad development in *Stenopus hispidus* (Zhang et al. 1997a), and maybe in other species as well. For these species, each female can produce several hundred to a couple of thousand eggs during each spawn and carries the embryos under her abdomen until the larvae hatch 10 to 15 days later (Fletcher et al. 1995; Simoes et al. 1998; Zhang et al. 1998b). The color of egg mass gradually change from green or dark green to creamy white or silver and the eyespots appear 4-5 days before larvae hatch (Wilkerson 1994, Dong Zhang, unpublished data). Within several to 48 h after hatching, the female shrimp molts, then mating and spawning can occur again (Fletcher et al. 1995; Zhang et al. 1998b). The shrimps can spawn throughout the year or much of the year in captivity. Therefore the potential for producing large numbers of these shrimps within a short time span is great.

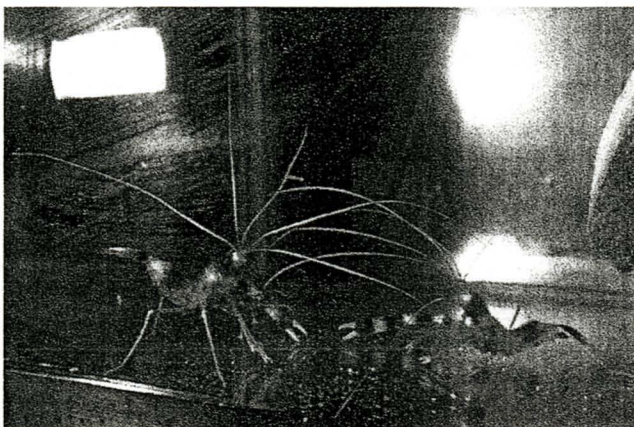
At least three species of *Lysmata* have been successfully cultured throughout their life cycles: *L. ambionensis* (cleaner shrimp (prawn)) and *L. debelius* (fire shrimp {prawn}) (Fletcher et al. 1995), and *L. wurdemanni* (Zhang et al. 1998a, 1998c). *Lysmata* species are simultaneous hermaphrodites with out-crossing, a previously unconfirmed sexual system in decapods (Wilkerson 1994, Fletcher et al. 1995; Bauer and Holt 1998). This reproductive system makes pairing of these species easy, as any two will do. However, handling

stress may trigger aggressive behavior between a pair of *L. debelius* (Fernando Simoes, pers. comm.).

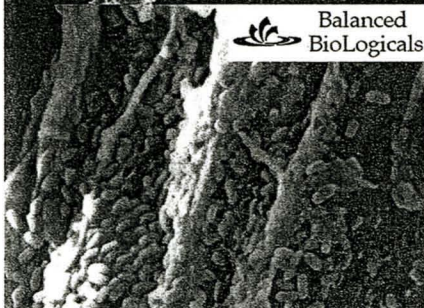
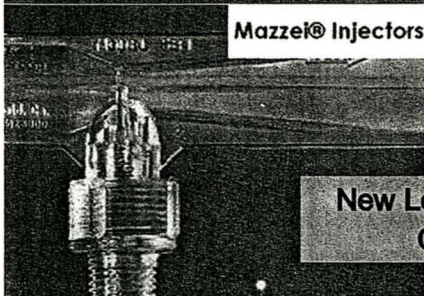
Larvae hatch as zoeas. There are seven zoea stages, followed by six mysis stages (Fletcher et al. 1995, Zhang et al. 1998c, unpublished data). Both *Artemia nauplii* and rotifer can be used to feed the shrimp larvae, with *Artemia nauplii* (optimal density at about 3/ml) resulting in faster growth (development) and/or better survivorship for the shrimps (Zhang et al. 1998c). About 100-150 *Artemia nauplii* should be provided to each *Lysmata* larva per day (Zhang et al. 1998c). The larval duration (from hatching to postlarva) varies from 25-40 days for *Lysmata wurdemanni* (Zhang et al. 1998c), 77-119 days for *L. debelius* and 140 days for *L. ambionensis* (Fletcher et al. 1995).

For *L. wurdemanni*, larvae grown in smaller vessels (4 l glass bottle) had higher survivorship than those in larger tanks (25-l and 70-l) (Zhang 1997). Live *Artemia nauplii*, frozen *Artemia*, bloodworms (polychaete), and pellet feed maybe used as feed for postlarvae and juveniles (Creswell and Lin 1997, Zhang et al. 1998c). Water with high salinity (30-35 ppt) and temperature (28-30 °C) promote growth of the shrimps (Creswell and Lin 1997, Zhang et al. 1998c). Larvae can be cultured to adults in a few months (Fletcher et al. 1995; Zhang et al. 1998b, 1998c).

Species of *Stenopus* are more popular in the aquarium and command higher prices. However, they are more difficult to culture. The sex is



Mating of banded coral shrimps, *Stenopus hispidus*. photographed by Christy Ambrose.



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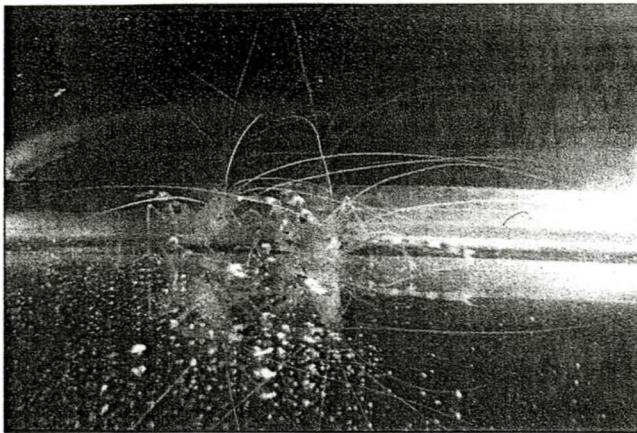
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separate. Females are generally larger with broader body and the third pair of pleopods (swimming legs) has more setae (Strynchuck 1990). In contrast to *Lysmata*, species of *Stenopus* have a pair of ferocious claws and may attack other shrimps, even a prospective mate (Debelius 1985, Strynchuck 1990). The pair forming may require elaborate techniques (Strynchuck 1990). The female is generally the aggressor. One effective way to pair a male and female without cannibalism is to place a male into the tank of a female when she molts (Strynchuck 1990). However, we have encountered little cannibalism in the pairing of the species in our studies. Mating and spawning can be divided into five steps for *S. hispidus* (banded coral shrimp) (Zhang et al. 1998b, Fig. 2) and *S. scutellatus* (golden banded coral shrimp, Figure 3) (Dong Zhang, pers. observ.). The only difference between the two species is that the copulation lasts for about 10 seconds in *S. hispidus*, but only about 5 seconds in *S. scutellatus*.



Mating of golden banded coral shrimps, *Stenopus hispidus*. (Photo credit: Christy Ambrose)

Larvae do not hatch as nauplii nor as protozoa, but the first zoea resembles the mysis stage of Penaeid shrimps (Seridji 1990). There are at least 9 larval stages (Lebour 1941). The biggest challenge for culturing these two species is the long larval duration: 119-210 days for *Stenopus hispidus* (Fletcher et al. 1995, Dong Zhang, unpublished data) and 43-77 days for *S. scutellatus* (Zhang et al. 1997b). The protocol to culture *Stenopus* species is similar to that for *Lysmata* species

described above. However, in contrast to *L. wurdemanni* larvae of *Stenopus* species survived better in larger tanks (25-l and 70-l) than in small 4-l glass bottle (Zhang 1997). Low concentrations of GABA ( $\mu$ -aminobutyric acid), a neurotransmitter, is found to stimulate molting and increase survivorship in the larvae of golden banded coral shrimp. Survivorship for all treatments is low for these larvae cultured in the 4-l bottles. Surprisingly, GABA of high ( $10^{-3}$  M) and intermediate ( $10^{-5}$  M) concentrations resulted in complete larval mortality of four replicates in each of the two trials. Currently, it is not feasible to commercially culture banded coral shrimp as the survivorship of a complete larviculture is very low (Creswell and Lin 1997). However, it is possible

to mass produce *S. scutellatus* as the survivorship of complete larviculture can be up to 50% (Zhang et al. 1997b).

Although it is feasible to culture several species of *Lysmata* and *Stenopus scutellatus*, some obstacles remain for the mass production. For example, there are considerable variations in larval production success and efficiency (larval duration). Sometimes eggs are prematurely aborted before hatching. Some larvae from captive broodstock have difficulty separating from the old exoskeleton during molting. We also found that larvae spawned from wild broodstock have higher survival rates and shorter larval duration than those from broodstock

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kept in captivity (fed with frozen *Artemia* and squid). Simoes et al. (1998) found that among the several diets fed to broodstocks of *Lysmata debelius*, average (s.d.) brood size produced for those fed with live *Artemia nauplii*, frozen *Artemia nauplii* (enriched with unsaturated fatty acids), frozen *Artemia* (without enrichment), and fresh mussel and polychaete are: (1766 (391), 1553 (224), 1019 (276), and 486 (254), respectively. However, for a related species, *L. ambionensis*, broodstock shrimps fed the enriched frozen *Artemia* produced similar number of larvae (average 496) as those fed with fresh mussel and polychaete (average 497). Identification of appropriate broodstock diet(s) for each shrimp species is needed to assure reliability and consistency of shrimp production.

**References**

Bauer, R. T. and G. J. Holt, 1998. Simultaneous hermaphroditism in the marine shrimp *Lysmata wurdemanni* (Caridea: Hippolytidae): an undescribed sexual system in the decapod Crustacea. *Marine Biology* 132:223-235.  
 Creswell, R. L. and J. Lin, 1997. Cultivation of ornamental marine shrimp for the salt-water aquarium industry. Technical Report to Florida Sea Grant.  
 de Castro, A. and D. E. Jory, 1983. Preliminary experiments on the culture of the banded coral shrimp, *Stenopus hispidus*. *J. Aquat. Sci.* 3(5):84-89.  
 Debelius, H. 1984. *Armored knights of the sea*. Quality Marine, Los Angeles, CA.  
 Debelius, H. 1985. *Cleaner shrimps of the genus Lysmata*. Freshwater and Marine Aquarium. July, p.27  
 Fleicher, D. J., I. Kotter, M. Wunsch, and I. Yasir, 1995. Preliminary observations on the reproductive biology of ornamental cleaner prawns. *Int. Zool. Yb.* 34:73-77.  
 Jonasson, M. 1987. Fish cleaning behaviour of shrimp. *J. Zool., Lond.* 213:117-131.  
 Lebour, M. V. 1941. The stenopodid larvae of Bermuda. In: Gurney, R. and M. V. Lebour. *On the larvae of certain Crustacea Macrura mainly from Bermuda*. *J. Limn. Soc. Lond. Zool.*, 41, pp:164-181.  
 Seridji, R. Description of some planktonic larval stages of *Stenopus spinosus* Risso, 1826:

notes on the genus and the systematic position of the Stenopodidea as revealed by larval characters. *Sci. Mar.* 54(3):293-303.

Simoes, F., F. Ribeiro, and D. A. Jones, 1998. The effect of diet on the reproductive performance of marine cleaner shrimps *Lysmata debelius* (Bruce 1983) and *L. amboinensis* (De Man 1888), (Caridea, Hippolytidae) in captivity. Book of Abstracts, *Aquaculture'98, World Aquaculture Society Meeting, Las Vegas, USA, February, 1998*.

Strynchuk, J. 1990. *An insight into the mating habits of the banded coral shrimp*. Freshwater and Marine Aquariums. October.

Wilkerson, J. D. 1994. *Scarlet cleaner shrimp*. Freshwater and Marine Aquarium. August.

Young, F. 1979. *Spawning and rearing of the banded coral shrimp*. Freshwater and Marine Aquariums. March.

Zhang, D. 1997. *Spawning and larval culture of three ornamental marine shrimps, Stenopus hispidus, Stenopus scutellatus, and Lysmata wurdemanni*. M.S. thesis, Florida Institute of Technology, Melbourne, Florida, 108pp.

Zhang, D., J. Lin, and R. L. Creswell, 1997a. *Effect of eyestalk ablation on molt cycle and re-*

*production of banded coral shrimp, Stenopus hispidus* (Oliver). *J. Shellfish Res.* 16:363-366.

Zhang, D., J. Lin, and R. L. Creswell, 1997b. *Larviculture and effect of food on larval survival and development in golden coral shrimp Stenopus scutellatus*. *J. Shellfish Res.* 16:367-369.

Zhang, D., J. Lin, and R. L. Creswell, 1998a. *Ingestion rate and feeding behavior of the peppermint shrimp Lysmata wurdemanni on Artemia nauplii*. *J. World Aquaculture Society*, 29(1):97-103.

Zhang, D., J. Lin, and R. L. Creswell, 1998b. *Mating and spawning of banded coral shrimp Stenopus hispidus in the laboratory*. *J. Crustacean Biology* 18(3):

Zhang, D., J. Lin, and R. L. Creswell, 1998c. *Effect of food and temperature on larval survival and development in the peppermint shrimp (Lysmata wurdemanni)*. *J. World Aquaculture Society*, 29(4):471-476.

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