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Effect of substrate types on fecundity and nauplii production of ablated *Penaeus monodon* Fabricius

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The survival, spawning, fecundity and nauplii production of ablated *Penaeus monodon* females reared in flowthrough broodstock tanks with white coralline and black sand substrate for 62 days were assessed.

The survival of prawns in broodstock tanks after 62 days was not significantly different between the two treatments in both experimental runs. Female prawns were observed to have generally lower percentage survival (15.38% to 80.00%) than males (33.33% to 95.00%) as similarly observed in other *P. monodon* maturation experiments. This may be attributed primarily to additional stress during eyestalk ablation, regular ovarian observations, spawning and processes such as tagging and measuring of spent spawners. Other causes of mortalities were moulting stress and cannibalism of weak and/or newly moulted prawns. The similar trend in mortality rates in both substrates suggests that the variation in substrate material for the broodstock tanks is not the likely cause of prawn mortality.

Maturation rate of the prawns is reflected by their total number of spawnings. Spawning rates were observed to be higher during the second run (48 and 50 total number of spawnings) as compared to the first run with 28 and 29 spawnings. This can be due to more frequent ovarian examinations during the second experiment (nightly compared to three times a week during the 1st experiment). Maturation to spawning was generally observed to peak three weeks from ablation, with a minimum of 6 days. Only 16.67-51-72%, 14.28-33.33% and 0-33.33% were able to spawn for the second, third and fourth time. Subsequent spawnings usually occurred at an average of nine days from first spawning. There were no significant differences observed between the rematuration rates under the different treatments.

The cumulative daily number of nauplii produced under the two treatments shows the difference in the total number of nauplii for 62 days during experiments 1 and 2 (Figure 1). Peak nauplii production, as reflected by sharp increments in Fig. 1, was generally observed on the third week after ablation. Ablated female in tanks with white substrates consistently yielded significantly higher ($P < 0.05$) total nauplii production and average hatching rate (3.0 and 6.8 million nauplii; 34.61% and 46.36% hatching rate for experiments 1 and 2, respectively) than those exposed to the black substrate (1.9 and 5.0 million nauplii; 15.77% and 32.34% hatching rate for experiments 1 and 2, respectively). As a result of the nightly sampling over a 62-day period during the second experiment, a tank with 30 females and 20 males produced 6.8 million nauplii in contrast to only 3.0 million from a comparable tank with three times a week sampling during the first experiment.

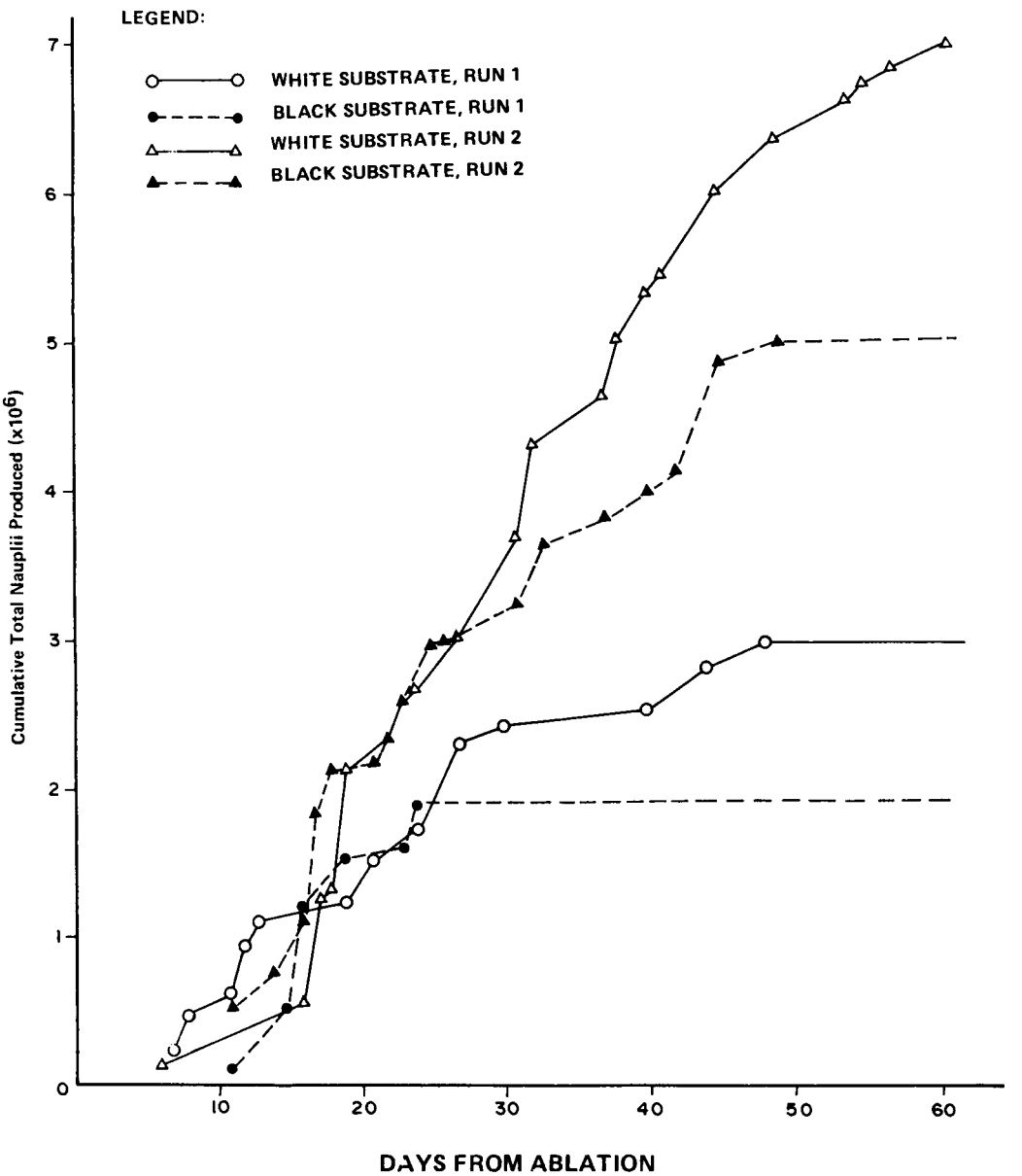

Figure 1. Cumulative total number of nauplii produced by *Penaeus monodon* exposed to black and white substrates during experiments 1 & 2 for a duration of 62 days each.

No significant differences in the physico-chemical parameters were observed throughout the experiment. Alkalinity ranged from 94-136 ppm $CaCO_3$, pH from 7.0-8.2, while salinity was maintained between 28.6-33.6 ppt. Because of the flowthrough and well-aerated water system, toxic compounds such as nitrite (0-0.471 ppm) and ammonia (0-0.512 ppm) were maintained at low levels, while dissolved oxygen (6.29-6.84 ppm) was adequately provided. This strongly indicates that neither prawn mortality nor the difference in nauplii production and hatching rate under the two treatments can be attributed to these parameters.

It is likely that some properties of the substrates affected the broodstock such that the quality of eggs, as shown by the hatching rate, and consequently nauplii production, varies in the two treatments. Differences in the color of the substrates may result in the variation of light quality. While the white substrate maximally reflected light of various wavelengths, the black substrate absorbed the entering light.

Differences in the size of substrates used in the upper fine layer may also have affected the activity of the prawn. Due to the bigger size of the black sand, prawns were not observed to burrow in the substrate. In contrast, prawns in the white coralline which had smaller size diameter, sometimes burrowed though most of the time they stayed on the substrate. Moreover, the 2-4 mm diameter of coralline substrate is a good size for the biological cleaning of the water.

At present, the land-based broodstock tanks in SEAFDEC utilize the white coralline substrate (2-4 mm diameter of upper layer) because of: higher hatching rate of eggs and nauplii production obtained from ablated *P. monodon;* convenience in siphoning out debris and excess food that tend to accumulate in the tank; and contrast provided by the white substrate (prawns being darkly pigmented) during nightly observation of ovaries.