THE EFFECTS OF COLOURS OF LIGHT IN RELATION TO GROWTH AND SURVIVAL OF JUVENILE GIANT CLAM *TRIDACNA DERASA*

Gunarto Latama
Faculty of Marine and Fishery Sciences, (Fakultas Ilmu Kelautan dan Perikanan) Hasanuddin University. Jl. Perintis Kemerdekaan Km. 10. Tamalanrea, Ujung Pandang, 90245, South Sulawesi. Indonesia

ABSTRACT

Growth and survival rates of juvenile *T. derasa* were tested in the laboratory in relation to blue, violet, green, red, and day light (3 replications). Blue light supported the highest absolute growth and survival rates followed by green, red, and day light (control). The lowest average growth and survival rates were found in ultra violet light. The values in ultra violet light were significantly different from growth and survival in juveniles exposed to other wave lengths.

INTRODUCTION

According to Braley (1992) the family Tridacnidae consist of 8 species in two genera, (*Hippopus hippopus* and *H. porcellanus*; *Tridacna gigas, T. derasa, T. maxima, T. squamosa, T. crocea*, and *T. tevoroa*). *Tridacna derasa* is the second biggest giant clam and has been intensively utilised in the Indo-Pacific region due to the high value of the shell and the edible abductor mussel (Villanoy *et al.* 1988; Pasaribu, 1988; Lewis *et al.* 1988).Today this species has been listed as a protected species by the Indonesian Government (Pasaribu 1987). Furthermore, *T. gigas* is has been listed as a threatened species (IUNC 1983 in Nash *et al.* 1988).

Tridacnids depend on zooxanthellae (dinoflagellates, *Symbiodium sp.*), which live in the mantle (Fitt and Trench, 1981 in Fitt 1988). The zooxanthellae depend on light for photosynthesis so high turbidity of the water can limit their growth (Lucas *et al.* 1989). Juvenile *T. gigas* had high mortality after exposure to darkness for 6 days (Mingoa 1988) but little is known about adaptation of giant clam to the colour of light. In this study I wanted to test if different wave lengths of light affected growth and survival of juvenile *T. derasa*.

MATERIALS AND METHODS

Juvenile *T. derasa* (43.82 $\pm$ 0.06 mm average shell length $\pm$ sd) were produced at the Marine Station of Hasanuddin University, Baranglompo Island, Ujung Pandang. A total of 15 fibreglass cylinders (70 cm diameter, 80 cm height) were filled with 200 litre filtered sea water, salinity 32 ‰. An air lift circulated the water continuously. The juveniles were placed on a tray with gravel 15 cm below surface of the water level. Each treatment consisted of 3 replications using 10 individuals exposed to light from 2 x 20 Watt tubes. The tubes emitted blue, green, red, and ultra violet light. Daylight was used as a control. The intensity of light depended on the colour (Table 1). Fertiliser (ZA, 5 µ M) was given every day. Absolute growth was measured when the treatment was terminated after two months. Mortality was checked every day and dead specimens removed.

Table 1. Light intensity in relation to wave lengths of light sources

Colour	Intensity (Lux)
A. Blue	7.135
B. Green	14.245
C. Red	9.670
D. Plain ultra violet	3.240
No artificial light	6.875

RESULTS

Growth

A significant effect of the colour of light was only found between UV light and other wave lengths ($P < 0.05$). The absolute growth is shown in Table 2.

Table 2. Absolute growth after 2 months in different colours of light (average ± sd.)

Treatment	Length (mm)
A. Blue	5.19 ± 2.94
B. Green	4.21 ± 0.30
C. Red	3.15 ± 0.38
D. Plain ultra violet	0.75 ± 0.59
E. No artificial light	3.36 ± 0.15

Survival

The highest survival rate was found in blue light, but only the ultra violet light was significantly different from other wave lengths ($P>0.05$) (Table 3).

Table 3. Average survival rate after 2 months

Treatment	average %	t-test
A. Blue light	100	(A-B), (A-C) (A-E),(A-D)*
B. Green light	88	(B-C),(B-D)*
C. Red light	83	(C-D)*
D. UV light	55	-
E. No artificial light	99	(E-B), (E-C) (E-D)*

DISCUSSION

The rate of photosynthesis of the symbiotic algae depends on the wave length of the light. Chlorophyll$_a$ functions at wavelength between 430 and 670 nm but blue to orange light is absorbed better than green to yellow light. In accordance, blue light tended to yield the best growth and survival rates of juvenile giant clam. The low growth rates obtained in red and ultra violet light were expected since these colours are outside the range of wave lengths absorbed by chlorophyll$_a$.

Light intensity influenced the survival of juvenile *T. gigas*. Mingoa (1988) found that high mortality occurred in low intensity of light. Unfortunately, the light intensity could not be standardised during the present experiment. However, there was no obvious effect of light intensity on survival. Blue light and day light had low intensities compared to the red and green light sources, but survival was 99-100% compared to 83-88% respectively.

ACKNOWLEDGEMENTS

I thank Dr. Jorgen Hylleberg for encouragement, and staff of Lab. Marine and Fishery sciences, Hasanuddin University for provision of hatchery facilities. Drs. Gudrun Thorarinsdottir and Tomas Cedhagen helped with literature, and TMMP sponsored my participation in the 9th meeting of this programme

REFERENCES

Braley, R.D., 1992. The giant clam: hatchery and nursery culture manual. - ACIAR Monograph No. 15, 144 p.

Fitt, W.K., 1988. Role of Zooxanthellae in the mariculture of giant clams. Pages 166-167. J.W. Coplan and J.S. Lucas (eds.). Giant clam in Asia and Pacific. - ACIAR Monograph no. 9. 274 pp.

Lewis, A.D., T.J.H. Adams and E. Ledua, 1988. Fiji's giant clam stocks-A review of their distribution, abundance, exploitation and management. Pages 66-72 in J.W. Coplan and J.S. Lucas (eds.). Giant clam in Asia and Pacific. - ACIAR Monograph no. 9. 274 pp.

Lucas, J.S., W.J. Nash, C.M. Crawford, R.D. Braley, 1989. Environmental influences on Growth and survival during the ocean-Nursery rearing of giant clams, *Tridacna gigas* (L.). - Aquaculture, **80**:45-86.

Mingoa, S.S.M, 1988. Photoadaptation in juvenile *Tridacna gigas*. Pages 145-150. J.W. Coplan and J.S. Lucas (eds.). Giant clam in Asia and Pacific. - ACIAR

Monograph no. 9. 274 pp.

Nash, W.J., R.G. Pearson and S.P. Westmore, 1988. Histological study of reproduction in the giant clam *Tridacna gigas in* the North-Central Great Barrier Reef. Pages 89-94. J.W. Coplan and J.S. Lucas (eds.). Giant clam in Asia and Pacific. - ACIAR Monograph no. 9. 274 pp.

Pasaribu, B.P., 1988. Status of giant clam in Indonesia. Pages 44-46 *in* J.W. Coplan and J.S. Lucas (eds.). Giant clam in Asia and Pacific. - ACIAR Monograph no. 9. 274 pp.

Villanoy, C.L., A.R. Juinio & L. A. Menez, 1988. Fishing mortality rates of giant clams (Family Tridacnidae) from the Sulu Archipelago and Southern Palawan, Philippines. - Coral Reefs **7**(1): 1-6.