

Application of The Temperature Shock Method (Heat Shock) on Pearl Oyster (*Pinctada maxima*) Hatcheries

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Abstract

The low production and quality of pearls produced from the cultivation process, one of which is caused by the less than optimal quality of pearl oysters. Spawning is a determining factor in hatchery activities. Therefore, in an effort to increase production, it requires strategies and improvements in the pearl oyster spawning process. This study aims to apply the temperature shock method as an effort to increase productivity and success rate of pearl oyster hatchery. The results of observations on gonad maturity in pearl oyster broodstock obtained data from a total of 200 broods consisting of 135 male broods and 75 female brooders aged 3.5 years, the percentage of perfectly gonadally mature broodstock was 11.85% and 12%, respectively a total of 25 individuals. The results of spawning pearl oyster broodstock through the temperature shock method of a total of 18 broods observed were 12 brooders or 66.7% which spawned perfectly. The results of the observation of the spawning process of pearl oyster broodstock showed that from 8 female broodstock $\pm 90,000,000$ eggs were obtained with a hatching rate of 70% with a spat harvest of $\pm 1,575,000$ individuals or 2.5% of the total hatched larvae final yield.

Keywords: spawning, temperature shock, pearl oyster

Introduction

Indonesia has various types of waters and has great potential for the development of marine aquaculture, especially pearl oysters. Pearl oysters that are widely cultivated in Indonesia are *Pinctada maxima* (Goldlip Pearl Oyster). This species is mostly found in the waters of Eastern Indonesia, such as Maluku, East Nusa Tenggara and West Nusa Tenggara (Cholik *et al.*, 2005). However, of the management potential, its utilization has only reached one percent (Wardana *et al.*, 2013).

Availability of quality seeds in a sustainable manner is a major challenge in the development of pearl oyster culture. One of the reasons for the low production and quality of pearls is the quality of pearl oysters as pearl producers that are less than optimal (Wardana *et al.*, 2014). Many studies on the genetic performance of pearl oysters have been carried out but have not been applied optimally by cultivators. Efforts to hatchery (artificial hatchery) is the right step to reduce dependence on nature and improve the quality of broodstock and spawning seeds (Astriwana *et al.*, 2008).

Therefore, to overcome this, it is necessary to improve both practical and sustainable research in terms of providing

superior broodstock as a seed producer, both in terms of technical cultivation and application of technology in the spawning process. This is the basis for applying the thermal shock method as an effort to increase the productivity of Pearl oyster hatcheries.

Methods

This study was conducted at PT. Horiko Abadi, Buleleng Regency, Bali Province. The method used is a survey method which is presented descriptively to make a systematic, factual and accurate picture. Data collection was obtained directly through interviews, observation and active participation in pearl oyster hatchery activities. The working procedure in pearl oyster hatchery includes hatchery preparation, spawning process, temperature shock application and observation of spawning results.

Seed preparation

The mother of pearl oysters used in spawning comes from the results of breeding and is in a mature condition of the gonads (TKG IV) or is at least 3-4 years old. The selected broodstock was then cleaned of adhering biofouling. The cleaned broodstock

were then fasted by separating males and females in plastic tubs measuring 50 x 40 x 40 cm equipped with aeration for one day. After the feeding process, the broodstock was left without water for about 30 minutes to 1 hour and then given natural food in the form of *Tetraselmis* sp. The broodstock is then given a temperature fluctuation treatment, namely decreasing and increasing the temperature gradually until it is ready to be stimulated in the hatching container.

Temperature drop

The temperature reduction is carried out in a tub measuring 80 x 40 x 40 cm with a water height of 30 cm from the initial temperature of 29°C to 24°C with the help of ice cubes so that the temperature reduction process runs faster. The broodstock was then soaked at 24°C for 10-15 minutes.

Donor Master Giving

Sperm donation is carried out using sperm from not-so-good mother pearl oysters. This is done by taking the male parent's sperm and then spreading it into the spawning container. The donated sperm spreads for 15-20 minutes and stimulates the release of sperm from other male parents and stimulates the release of eggs from the female parent.

Temperature Raise

The process of increasing the temperature is carried out in the same bath with the stimulation of decreasing the temperature. Water from the maintenance temperature of 29°C was increased to 37°C with the addition of seawater which had been heated to $\pm 80^\circ\text{C}$. The broodstock in the spawning tank were transferred to a tub whose temperature had been raised and then allowed to stand for approximately 30 seconds and then transferred back to the initial container with a normal temperature (28°C) with a ratio of 10 male and 7 female broodstock and left for approximately 30 minutes. During this period, physiological observations were made on mother pearl oysters.

Results and discussion

Mother pearl oysters are kept in the sea with a distance of approximately 600 meters from the shoreline which is applied using the long line method at a sea depth of 20-30 meters. The salinity of the maintenance

media water ranged from 33 to 34 ppt, the temperature ranged from 27 to 29°C, the pH ranged from 7.8 to 8.2. This agrees with Hamzah (2007), that the optimal temperature range for growth and survival of pearl oysters in aquaculture activities is between 28-29°C. The parent used was derived from the breeding of PT. Horiko Abadi with the aim of maintaining the quality of Pearl oysters. Parent selection is done to determine the condition of the broodstock ready to spawn. Parent is spawned when it reaches gonad maturity level IV (TKG-IV) which is indicated by the male gonads being milky white while the female gonads are egg yolk. Mother pearl oysters can spawn 2-3 times a year. This is in accordance with the statement of Aprisanto *et al.*, (2008), selection is done by opening the inner mantle and it will be seen at the base of the gonad whether there are sperm or eggs. Sampling was carried out using a wedge, forceps, and a spatula and the female parent would look yellowish in color and the male parent would look milky white. The results of the parent selection to determine the level of gonad maturity in pearl oyster broodstock obtained data from a total of 200 broods which were observed that the percentage of perfectly mature broodstock was 11.85% male and 12% female.

Table 1. The results of the selection of mother pearl oysters

| Type Parent | Amount(s) | | Age (years) | Length (cm) |
|-------------|---------------|--------|-------------|-------------|
| | Mature Parent | Gonads | | |
| Male | 135 | 16 | 3.5 | 14-15 |
| Female | 75 | 9 | 3.5 | 14-15 |

The process of spawning pearl oysters is done with the ratio between male and female broodstock is 1:2. The number of broodstock used in this spawning process amounted to 18 broods consisting of 12 females and 6 males derived from the results of parent selection and parent stock of PT. Eternal Horiko. The temperature shock method was applied in the spawning process to accelerate the stimulation for the mother of pearl oysters to be able to spawn. The temperature shock process is carried out by providing a stimulus for decreasing and increasing the temperature of the mother of pearl oysters. Decrease and increase in temperature is done to make pearl oysters stressed through changes in

environmental conditions so as to provide stimulation for spawning (Tomala, 2008). The results of observations of spawning of pearl oyster broodstock obtained data that of the 18 broods observed there were 12 brooders or 66.7% that spawned perfectly. A good sperm cell is characterized by the presence of a white liquid like smoke or looks cloudy in the water column of the spawning tub and a good egg will look like white fine grains of sand.

Table 2. The result of spawning pearl oysters with temperature shock

| Type Parent | Amount(s) | Spwan(s) | Not Spwan(s) |
|-------------|-----------|----------|--------------|
| Male | 12 | 8 | 4 |
| Female | 6 | 4 | 2 |

The hatching of pearl oyster eggs was carried out in a rearing tank with a time span of ± 18 hours at a water temperature of 30°C . The process of hatching eggs requires a stable environmental conditions, especially temperature and dissolved oxygen levels. Eggs that have hatched are marked by floating larvae that are pink and slightly shiny when exposed to a flashlight, and eggs that do not hatch are marked by eggs settling to the bottom or the bottom of the rearing fiber tub (Wardana et al., 2013). The results showed that from 12 broods, $\pm 90,000,000$ eggs were obtained with a hatching percentage of 70% with a spat yield of $\pm 1,575,000$ individuals or 2.5% of the total larvae hatching in the final harvest. This value is not much different from the results of Kotta's research (2018), namely at TKG IV (spawning ripe) Pearl oyster brooders can produce approximately 70,000,000 eggs with an HR value of 70% and an average yield of 2% of the total.

Conclusion

Environmental manipulation through the temperature shock method can affect the success of spawning in pearl oysters. The spawning results of pearl oyster broodstock from a total of 18 observed broodstock were 12 which spawned perfectly. The number of fertilized eggs from the spawning of 8 female parents was $\pm 90,000,000$ eggs with a hatching percentage of 70% with a spat yield of ± 1.575000 individuals or 2.5% of the total larvae that hatched in the final harvest.

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