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Growth and Maintenance of Abalone Seeds (*Haliotis Squamata*) with Seaweed Feed at Balai Perikanan Budidaya Laut Lombok

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ABSTRACT

Abalone is a seafood commodity with high economic value, because it is a food that is rich in protein and has aesthetic value in its shell. Market demand continues to increase in several Asian countries. The majority of the abalone industry still relies on natural products, resulting in continued exploitation of abalone. Abalone cultivation is the right choice to prevent extinction due to exploitation. One of the cultivation activities is raising abalone seeds, so this activity aims to understand the management of raising abalone seeds (*Haliotis squamata*) so that they produce quality seeds. This activity was carried out from March 13th until May 6th 2024 at BPBL Lombok, Sekotong. Data collection techniques use secondary data and primary data. Abalone seed rearing management includes several stages, including preparation of rearing tanks, namely cleaning fiber tubs and sterilizing the tubs, spreading seeds 1-2 cm in size, 2 months old with a density of 500 fish/basket, management of feeding *Gracilaria* sp., *Sargassum* sp. and *Ulva* sp. given *ad libitum*, the results of measuring the growth of abalone seeds have increased with absolute weight growth of 2.87 gr, absolute length growth of 0.59 cm, and SGR growth of 1.04 % per day, as well as seed SR value of 95.7 %, water quality management and checking water quality parameters during maintenance and handling pests that can attack abalone seeds.

INTRODUCTION

Indonesia is an archipelagic country with the sea area wider than its land area, with sea areas covering 3.1 million km^2 or around 62% of the country's total territory. The existence of this vast sea makes Indonesia superior in the fisheries and marine sector (Zulkarnain *et al*., 2013). One of the products from the Indonesian fisheries and marine sector is abalone, which is a marine product commodity with high economic value, because it is a food that is rich in protein and has aesthetic value in its shell. So, market demand increases in Asian countries such as Japan, China, Taiwan and Indonesia. There are several species of abalone that live in Indonesian waters, one of which is *H. squamata* which is distributed in the southern waters of Java, Bali, Sumbawa and Australia (Bachry *et al*., 2020). In addition, the eastern waters of

Indonesia, like South Sulawesi, North Sulawesi, Southeast Sulawesi, Maluku, Papua, Seribu Islands, Madura, Sumbawa, Flores, Lombok and Bali are also abalone catching areas (Bulan *et al*., 2020).

Abalone is a type of shellfish known as the seven-eyed shellfish which belongs to the Gastropoda class (Ridwanuddin *et al.*, 2022), a type of mollusk without an operculum (Wardi, 2022). There are 7 types of abalone species found in Indonesia, one of which is the *Haliotis squamata* species which has the potential to be developed Arta *et al*. (2021). The majority of the abalone industry still relies on natural products, while production from the cultivation industry is still small with high market demand which has led to continued exploitation of abalone, resulting in population decline in several exploitation areas. A study by Maliao and Jensen in 2004 highlighted the problem of declining abalone populations due to overexploitation. So, conservation measures are needed to keep the abalone population from becoming extinct in several exploitation areas (Sinaga *et al*., 2015). Abalone cultivation is the right choice to prevent extinction due to exploitation. So, it can produce abalone seeds in a sustainable and controlled manner (Loekman, 2017). The cultivation process consists of several stage starting from preparing the broodstock, spawning, raising larvae, nursery and rearing (Kurniawan and Buda, 2016).

Balai Perikanan Budidaya Laut (BPBL) Lombok is one of the centers that cultivates abalone *Haliotis squamata*. One of the cultivation activities carried out at BPBL Lombok is raising abalone seeds. The availability of abalone seeds can prevent extinction and increase abalone production in Indonesia, both at sea and on land. Therefore, it is important to carry out this activity with the aim of knowing the management of raising abalone (*Haliotis squamata*) seeds located at the BPBL Sekotong, West Lombok. So that, this activity can be useful in increasing insight and understanding how to manage the maintenance of abalone (*Haliotis squamata*) seeds at the BPBL.

METHODS

This activity was carried out on March 13th – May 6th, 2024 at one of the government's research centers, namely Balai Perikanan Budidaya Laut, Sekotong, Gili Genting Hamlet, West Sekotong, West Lombok Regency, West Nusa Tenggara. The tools used in this activity are aerators, stationery, filtering tools, fiber tubs, sample bottles, vernier calipers, cellphone cameras, feed baskets, abalone seed rearing baskets, water pumps, brushes, rubber floor wipers, shelters, spatulas, scales and jars. Meanwhile, the materials used are sea water, chlorine, seeds of abalone species *Haliotis squamata*, *Gracilaria* sp., *Sargassum* sp. and *Ulva* sp.

The data collection technique used during activity is use primary data and secondary data. Primary data is data obtained from the field as a result of observations that have been carried out during the implementation of activity. This primary data includes direct observation, interviews, documentation and active participation. Meanwhile, secondary data is data obtained from literature studies which functions as reinforcement for the primary data that has been obtained. Secondary data includes various literature, journals, articles and others. The formula used in the observation parameters carried out during maintenance to obtain the required data is as follows:

- Absolute Weight Growth

The formula for calculating absolute weight growth according to Mulqan *et al*., (2017) is as follows:

$$\Delta W = Wt - Wo$$

Where:
ΔW = Absolute weight (gr)
Wt = Average weight at the end of rearing (gr)
Wo = Average weight at the start of rearing (gr)

- Absolute Length Growth

The absolute length growth formula according to Mulqan *et al*., (2017) is as follows:

$$\Delta L = Lt - Lo$$

Where:
ΔL = Absolute length (cm)
Lt = Average length at the end of rearing (cm)
Lo = Average length at the start of rearing (cm)

- Specific Growth Rate (SGR)

The SGR calculation formula according to Mulqan *et al*., (2017) is as follows:

$$SGR = \frac{\text{Ln Wt} - \text{Ln Wo}}{T} \times 100$$

Where:
SGR = Specific growth rate (%/day)
Wt = Average weight at the end of rearing (gr)
Wo = Average weight at the start of rearing (gr)
T = Rearing duration (day)

- Survival Rate (SR)

The Survival Rate calculation formula according to Ririhena *et al*., (2021) is as follows:

$$SR = (Nt \div No) \times 100\%$$

Where:
SR = Survival Rate (%)
Nt = Number of fish at the end of rearing (fish)
No = Number of fish at the beginning of the study (fish)

Water quality measurements are carried out once a week during abalone seed maintenance, which is done by taking water samples from the tank using a water sample bottle. Then the water sample were taken to the Fish and Environmental Health Laboratory to be checked for water quality. The parameters measured are temperature, salinity, pH, dissolved oxygen (DO), and ammonia. In addition, to reduce waste from feed and feces, siphoning and water changes are carried out periodically. Iskandar *et al*. (2022) added that the water exchange system can produce water circulation in the cultivation media and maintain water quality.

RESULTS

Absolute Weight Growth

The results of absolute weight growth of abalone seeds can be seen in the following Figure 1.

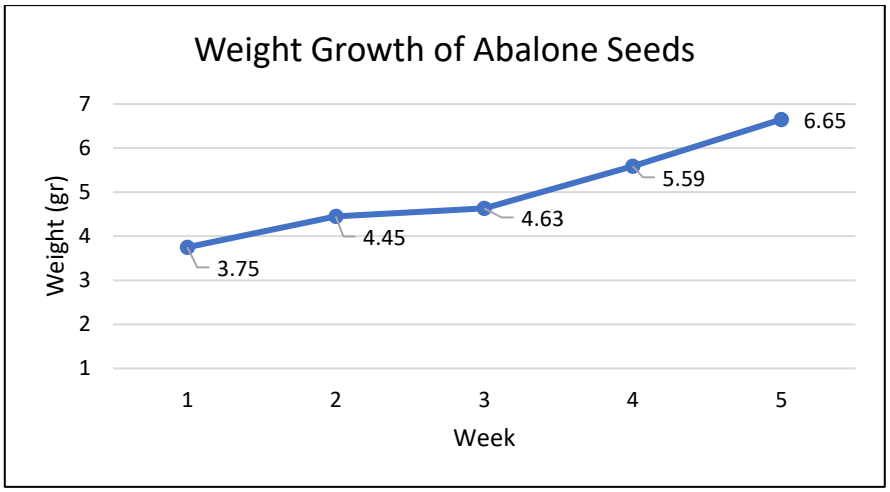

Figure 1. Graph of Abalone Seed Weight Growth During Rearing

Absolute Length Growth

The results of absolute length growth can be seen in the following Figure 2.

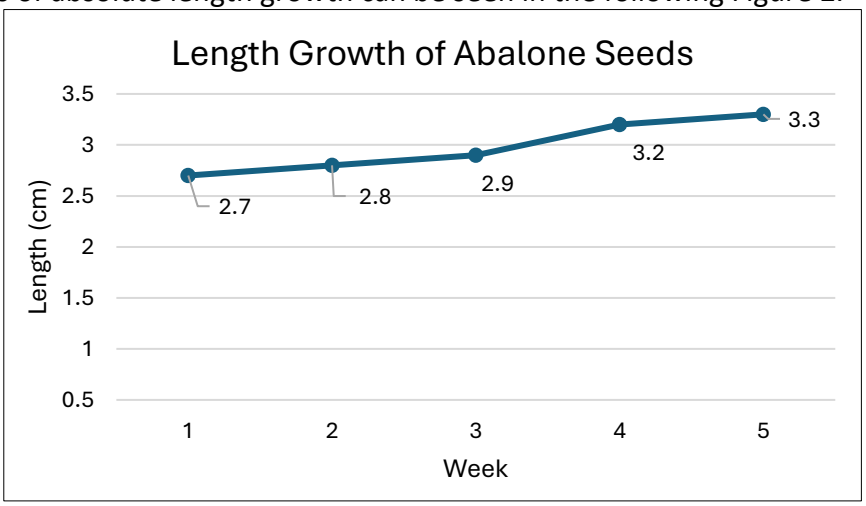

Figure 2. Graph of Abalone Seed Length Growth During Rearing

Specific Growth Rate (SGR) & Survival Rate (SR)

The results of SGR and SR are presented in Table 1 as follows.

Table 1. Specific Growth Rate and Survival Rate

Parameters	Value
SGR	1.4 % per day
SR	95.7 %

Water Quality

The results of water quality measurement are presented in Table 2 as follows.

Table 2. Water Quality

Parameters	Value
Temperature (°C)	24.5 – 26
Salinity (ppt)	31 – 33
pH	8.1 – 8.3

Parameters	Value
DO (mg/l)	1.6 – 5.2
Ammonia (mg/l)	0.03 – 0.08

DISCUSSION

Media Preparation and Spreading Seeds

The tub used when rearing abalone seeds is a fiber tub with dimensions of 1 x 3 x 0.8 m high. Before the fiber tub is used to maintain seeds, the tub will first be cleaned of dirt or moss stuck to it using a brush on the walls and bottom of the tub, the tub will then be irrigated and given chlorine which has been dissolved in 5 liters of water with 100 grams of chlorine and left for approximately 1 up to 2 days. Abdi *et al.* (2021) stated that preparing the tub begins with cleaning the tub with a brush to remove dirt and scale that sticks to the walls and bottom of the tub. After that, sterilization was carried out using a chlorine solution and strong aeration for 24 hours. The dry clean tank, then filled with 1200 liters of water again, and aerated. After that, the basket containing the Shelter and abalone seeds is then put into the rearing tub with a total of 4 baskets in 1 fiber tub.

After preparing the tubs, the next step is spreading the abalone seeds. The abalone stocked is abalone that is 2 months old from hatching with a size of 1 – 2 cm. The seeds that have been selected will be transferred into a nylon net basket containing a shelter as a substrate for the abalone seeds to stick to the prepared rearing tank. The stocking density of abalone seeds in baskets is 500 in one basket.

Seed Maintenance and Growth

Feeding is very important for the survival of the seeds, the food given to abalone seeds is seaweed. The feed used for abalone is *Gracilaria* sp., *Sargassum* sp. and *Ulva* sp. by feeding ad libitum. This is in line with the opinion of Eko *et al*. (2016) that abalone is a herbivorous animal that eats macroalgae and microalgae such as green, red and brown algae.

During abalone seed rearing, weight and length growth sampling is carried out once a week to observe abalone growth. The results of the length growth of abalone seeds can be seen in Figure 2. Meanwhile, the weight growth of the abalone seeds can be seen in Figure 1. During the maintenance of the abalone seeds, the length and weight growth of the seeds increased every week. This can be influenced by feeding and a controlled environment during maintenance.

Based on the results of measurements that have been carried out, the growth of abalone seeds has increased during maintenance with the absolute weight growth of abalone seeds being 2.87 gr and the absolute length growth of abalone seeds being 0.59 cm. Meanwhile, SGR growth was 1.04 % per day with SR value was 95.7%. This growth is of course influenced by water quality, quality feed and good pest management. This is in line with the statement by Ririhena *et al*. (2021) which states that feed is one of supports that has an important role in increasing fish growth by paying attention to the quality and dose of feed provided. As well as water quality factors that need to be considered during maintenance. The high SR value is also influenced by the density of abalone in one basket, this can provide enough space for abalone to move or eat without having to compete. Apart from that, it is also influenced by water quality and a running water system that maintains water quality during maintenance even with low DO values. less than optimal, but the immune system of the seeds is strong so they are rarely attacked by disease during maintenance. This is supported by the statement of Farliani *et al*., (2020) that a factor that can influence the survival rate of abalone is abalone

density that is too high because it can cause competition both spatially and as well as food, water quality, cleaning of maintenance tanks or cleaning of leftover food, feces or parasites, a running water system that can maintain water quality.

The water quality management carried out when rearing abalone seeds is siphonization, which is one of the routine activities carried out, once every day, in the morning or afternoon during abalone seed rearing. Aeration that is on for 24 hours functions as an oxygen supplier. Water changes are carried out after carrying out syphoning, namely by adding water that is reduced during syphoning with a flow through system during rearing of abalone seeds and the water quality parameters measured include the average temperature of the water during seed rearing is 25.6 °C, which is optimal value. The salinity measurement resulted in the average salinity during the activity being 32.2 ppt, this value is optimal for abalone growth. The pH measurement with the average value obtained during rearing of abalone seeds is 8.2, which is normal. Pebriani *et al*. (2016) stated that the optimal water quality required by abalone is a temperature between 24 - 30 °C, salinity 30-35 ppt, pH between 7 - 8.5. Apart from that, ammonia measurements were also carried out with the average during the measurements obtained being 0.06 mg/l, which is also normal. According to Hamid *et al*., (2017) the optimal ammonia value for abalone is <1 mg/l. And the average dissolved oxygen (DO) measurement over the 5 weeks was 3.7 mg/l, this value is not normal. According to Hayati *et al*. (2018) the dissolved oxygen value that can be tolerated by abalone is >5 mg/l. This low DO value can be caused by increasing temperature. Islami *et al*. (2017) states that aeration can help supply oxygen in the cultivation media.

During the maintenance of abalone seeds, many pests are found that can interfere with the growth of the seeds. These pests come from the seaweed food provided, such as small crabs, wild snails and small crustaceans which can cause the abalone to be injured, and are competitors in getting food and shelter which can disrupt the growth process of the abalone seeds. Handling that can be done is to clean the feed that will be given and clean it from the basket. As for disease, during maintenance activities, no disease was found to attack abalone. This is in line with the statement of Abdi *et al*. (2021) that the risk of disease in abalone will decrease if the water quality is well maintained. In addition, Firdaus *et al*., (2013) stated that rust disease is a disease that can cause death in abalone and to date the cause of this disease is still being identified.

CONCLUSION

Based on this activity that have been carried out at BPBL Lombok, it can be concluded that management of abalone (*Haliotis squamata*) seed rearing includes pond preparation, seed stocking, feeding, sampling of growth in length and weight of the seed during rearing which is carried out once a week. As well as important factors that can influence the abalone growth process, namely water quality management, pest and disease control by paying attention to the cleanliness and availability of food like *Gracilaria* sp., *Sargassum* sp. and *Ulva* sp. This activity can provide practical experience and technical knowledge that will be useful in the abalone cultivation industry.

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