Journal of Fish Health
Volume 5, Issue 2, May 2025
https://doi.org/10.29303/jfh.v5i2.6411

Spawning Technique of Abalone (*Haliotis squamata*) Broodstock at Balai Perikanan Budidaya Laut (BPBL) Lombok

Kuratul Aini[1], Septiana Dwiyanti[1*]

[1]Aquaculture Study Program, Department of Fisheries and Marine Sciences, Faculty of Agriculture, University of Mataram
Pendidikan Street No. 37 Mataram, West Nusa Tenggara, Indonesia

Correspondence:
antiseptiana@unram.ac.id

Received:
February 26th, 2025
Accepted:
May 6th, 2025

Keywords:
Abalone, Eggs, *Gracilaria* sp., *Haliotis squamata,* Spawning

ABSTRACT

Abalone is one of the species of the Gastropoda class. There are 7 types of abalone that are spread throughout Indonesian waters, including *Haliotis asinina, H. varia, H. squamata, H. ovina, H. glabra, H. planate* and *H. crebrisculpta*. Abalone *Haliotis squamata* is one of the abalone species that is cultivated at Balai Perikanan Budidaya Laut (BPBL) Lombok. The abalone breeding technique at BPBL Lombok is carried out massively with a ratio of male and female abalone breeders of 1:3. The success rate of abalone breeding is determined by the level of gonad maturity, water quality, irradiation period as well as the length and weight of the abalone body. Abalone breeding begins with container preparation by adding 300 chlorinated limes (kaporit). Abalone breeders are maintained by placing them in a 300 x 80 x 80 cm fiber tank containing four baskets, three baskets containing female abalones and one basket containing male abalones. The feed given to abalone breeders is *Gracilaria* sp. and *Ulva* sp., while the feed for larvae is *Nitzchia* sp. feed. Abalone breeding begins with breeder selection. Breeders used are those that have mature gonads or gonads that have entered TKG 3 which are marked by gonad size larger than the shell. Abalone breeders must be over 4 cm in size and free from disease and. Abalone breeding is marked by the presence of a fishy smell and cloudy water in the container. The number of eggs produced from mass breeding is 1,041,600 grains.

INTRODUCTION

Abalone is a species of the Gastropoda class which has high economic value. Abalone usually lives in rocky waters in coral reef areas. According to Rochmawati (2015) abalone can be found in almost all sea waters in the world. There are approximately 100 species of abalone spread across tropical, subtropical, and arctic regions throughout the world. There are 7 types of abalone spread throughout Indonesian waters among all the species that exist, including: *Haliotis asinina, H. variety, H. squamata, H. ovina, H. glabra, H. planate* and *H. crebrisculpta* (Hamza et al., 2012). Countries producing abalone from cultivation activities are: China, Japan,

Taiwan, South Africa, Australia, the United States, Mexico, Ireland, Iceland, and New Zealand (Giri *et al*., 2015).

In Indonesia, data on abalone production, whether from wild catches or aquaculture, has not yet been officially recorded in production data. This aligns with the opinion of Ihsan *et al*. (2020), who stated that abalone production is still not recorded in Marine and Fisheries Production Data. However, it is known that two types of abalone are the most commonly cultivated in Indonesia: *Haliotis asinina* and *Haliotis squamata*.

Sudarmawan *et al*. (2013) stated that there are differences in spawning behavior between *Haliotis squamata* and *Haliotis asinina* abalone. The spawning behavior of *Haliotis asinina* broodstock involves rising to the surface and releasing its eggs, which can result in a lower number of eggs due to egg loss. In contrast, *Haliotis squamata* broodstock releases its eggs within the water, leading to a higher number of eggs produced. Additionally, *Haliotis squamata* has a high adaptability to its environment, contributing to a higher survival rate compared to *Haliotis asinina*. Therefore, the development of appropriate spawning techniques is necessary to improve larval survival rates and enhance the production of *Haliotis squamata* abalone.

Haliotis squamata abalone is one of the species cultivated at the Balai Perikanan Budidaya Laut (BPBL). Efforts to increase *Haliotis squamata* production continue through the implementation of proper spawning techniques. The selection of the broodstock ratio plays a crucial role in determining the success of abalone spawning. Thus, it is essential to enhance knowledge, insights, and hands-on experience for students in cultivating *Haliotis squamata*, particularly in spawning techniques, through research. This study aims to expand students' knowledge and experience in abalone breeding techniques, helping to anticipate potential failures in the breeding process and produce high-quality abalone seeds.

METHODS

This research was conducted in November 2023 at Balai Perikanan Budidaya Laut Lombok (BPBL). The method used is the method of data collection through mass abalone spawning. Data collection can be done by collecting primary and secondary data. According to Sari & Zefri (2019), primary data is information data obtained directly from the source obtained by directly participating in all activities at the cultivation location, direct observation or observation and interviews with BPBL agency staff. Secondary data is obtained through heritage studies from various books, journals, articles.

RESULTS

The results of the abalone spawning technique activities include broodstock container preparation, broodstock stocking, broodstock feeding, preparation of spawning ponds and egg distribution containers, spawning, egg counting, and water quality management. Based on the spawning technique results, the number of *Haliotis squamata* abalone eggs can be seen in Table 1.

Table 1. Number of Eggs Using Various Spawning Techniques

Spawning Techniques	Number of Eggs
Mass natural spawning	1,041,600
Natural spawning 1:3	128,000

Spawning Techniques	Number of Eggs
Artificial spawning	1,620,200

The results of water quality measurements during the study can be seen in Table 2.

Table 2. Water Quality Measurements

Parameter	Unit	Average Result	Quality Standar	Reference
pH	-	7.5	7.5-8.5	Alexander *et al*. (2022)
Temperature	^{0}C	27.5	27-29	
DO	mg/l	6.2	>4	
Salinity	ppt	32	31-35	

DISCUSSION

Container Preparation

The preparation of containers for abalone broodstock maintenance begins with the application of 300 grams of chlorine. The chlorine is then dissolved in 10 liters of water. The rearing and spawning tanks are then gradually rinsed with the dissolved chlorine solution, starting from the tank walls and bottom, and left to sit for one day. The following day, the tanks are drained, and the walls and bottom are scrubbed using brushes, nets, and sponges. The tanks are then rinsed with running water, refilled with water, and aeration is turned on. Which mentions that container preparation begins with sterilization using 200 ppm chlorine and strong aeration for 24 hours to remove scale and dirt from the tanks. Strong aeration helps lift ammonia and adhered scale. Chlorine can kill pathogens and microorganisms that may disrupt the growth and health of abalone. Chlorine must be rinsed because it can cause residue.

Broodstock Distribution

Broodstock maintenance is carried out by placing abalone broodstock in crate baskets, each containing 50 abalone and two shelters, which are placed in a 300 x 80 x 80 cm fiber tank. Each rearing tank consists of four crate baskets containing abalone broodstock. Of the four baskets, three contain female abalone, and one contains male abalone, maintaining a 1:3 ratio. The broodstock used is obtained from maintenance in Floating Net Cages (KJA) and hatchery-bred broodstock. This is in agreement with Iskandar *et al*. (2022) mass abalone spawning technique is carried out with a ratio of 1:3.

Feeding

The feed given to the abalone broodstock is *Gracilaria* sp. and *Ulva* sp. while the food for the larvae is natural food *Nitzchia* sp. *Gracilaria* sp. which will be used as feed is taken using a stick then placed in a basket and rinsed using running sea water until clean. Feeding is done every two days. Feed in the form of *Gracilaria* sp. is given as much as 2 handfuls as needed. The feeding method used is the method Adlibitum (feed is always available). According to Tjaonda (2014), abalone is fed using Gracilaria sp. can affect the increase in abalone length. Feeding using *Ulva* sp. is only done in certain seasons because*Ulva*sp. is not always available at all times. Marzuqi *et al*. (2012) The feed given to adult abalone is *Gracilaria* sp., *Ulva* sp. or *Laminaria* sp. but abalone prefers *Ulva* sp. due to its soft texture.

Feeding using *Ulva* sp. will give a green color pattern to the abalone shell (Kawakibi 2016). The difference between the two types of feed used will result in a difference in the color of the abalone shell. Abalone fed using *Gracilaria* sp. the shell will be reddish purple

while the abalone that is fed using *Ulva* sp. will be greenish. Both types of feed given have their own advantages and disadvantages. *Gracilaria* sp. is easier to obtain but many pests stick to the feed so it must be thoroughly cleaned before being given to the abalone. *Ulva* sp. has advantages including a softer texture, easy to digest and can facilitate gonad maturation but only depends on the season. Feeding broodstock abalone with a combination of *Gracilaria sp.* and *Ulva sp.* can enhance growth rates and gonad maturity (Marzuqi *et al*., 2012).

Preparation of Spawning Container and Spreading of Eggs

Preparation of containers for spawning activities is generally the same as the preparation of parent maintenance containers. The container used for spawning is a 300x80x80 cm fiber tub, while the concrete tub is used as a container for spreading eggs or maintaining larvae. Before the eggs or abalone veligers are spread in the concrete tub, they are first prepared feeding plate. as a place for natural food and abalone larvae to attach. Feeding plateare pieces of roof super viny lmodified wavy as a place for abalone to attach to the larval stage which is arranged using aluminum rods (Iskandar *et al*., 2022). Preparation of the egg spreading container must be done at least 2 weeks before the abalone spawns. Preparation of the container begins with cleaning the container and feeding plate before fertilization. The dose of fertilizer used for a 5-ton tub is 400 gr potassium nitrate, 50 gr disodium and 150 silicates. The use of this fertilizer is a special fertilizer for natural diatom feed (attached) which protects the natural feed cells. Furthermore, the natural feed is spread (*Nitzchia* sp.), the amount of natural feed spread is 150 L and will be added if the natural feed in the tank is seen to be decreasing. Use *Nitzchia* sp. as natural feed due to its small size, good nutritional content for abalone and easy to obtain. *Nitzchia* sp. is suitable for use as abalone larvae feed because it is a type of diatom that suits the living habits of abalone.

Spawning

Spawning activities begin with the selection of male and female abalone broodstock that have mature gonads. Abalone broodstock that have mature gonads are marked by the size of the gonads being larger than the shell or have entered TKG III. Gonad checking is done by opening the abalone's legs using a plastic spatula. The difference between male and female abalone is also marked by the color of the gonads, if the gonads are cream colored then the abalone is male but if the color of the abalone gonad is greenish it indicates that the abalone is female.

The spawning technique used in this activity includes both natural mass spawning in fiber tanks and artificial spawning with the aid of hormones. Abalone spawning typically occurs during dark and bright moon phases. According to Bidaryati *et al*. (2009), the light cycle signal is received by a light receptor located in the brain ganglion. This signal then activates neurosecretory cells in the brain ganglion to release hormones that stimulate the development of reproductive organs. Natural mass spawning is conducted using a male-to-female broodstock ratio of 1:3, with 50 male and 150 female abalones placed in the same fiber tank but in separate crate baskets. A drawback of the natural spawning technique is that abalones do not always spawn during dark and bright moon phases, even when their gonads are mature. This is supported by Iskandar *et al*. (2022), who stated that abalone spawning can be conducted naturally (in mass) with a male-to-female ratio of 1:3.

Artificial spawning activities have not yet been optimally implemented. The Lombok Marine Aquaculture Center (BPBL) has begun experimenting with artificial spawning using hormones, but it is still in the trial phase. The advantage of hormone-assisted spawning is that abalones can spawn outside the bright and dark moon phases. Additionally, the number of

eggs produced is higher than in natural spawning. However, excessive spawning due to hormone stimulation may lead to mortality.

Egg Counting

Spawning in abalone is marked by a fishy smell and the water in the tank becomes cloudy. According to Iskandar *et al*. (2022) abalone spawning is marked by the release of eggs and sperm which causes the water to become cloudy. Egg harvesting is carried out about 30 minutes to 1 hour after the parent spawns. Harvesting is done by placing a collector on the outlet to collect eggs. The collectors used are of two sizes, namely 80 mm and 200 mm. The 80 mm collector is placed above to filter dirt, then the 200 mm collector is placed to filter dirt and eggs. Eggs are harvested by transferring the eggs into a jar containing 9 L of water, then the collector is rinsed with 1 L of water and aerated. 10 samples of the harvested eggs are taken, then calculated using the formula of the average sample multiplied by 10,000. After knowing the number of eggs, embryogenesis observations are then carried out. Observations are made every 30 minutes.

Water Quality Management

Water quality measurements are carried out once a week. Based on the measurement results, an average pH value of 7.5, temperature 27.5 °C, DO 6.2 mg/L and salinity 32 ppt were obtained. This value shows that the water quality obtained is in the good category, this is in accordance with Iskandar *et al*. (2022) in abalone cultivation activities, the water quality values that are suitable for abalone maintenance are 27°C-29°C; salinity 31-35 ppt; dissolved oxygen 4> mg/L; pH 7.5-8.5. Water quality management in the maintenance tank begins by entering seawater through the inlet for 24 hours. This allows for 100% water changes.

The water that enters the maintenance tank through the inlet is first sterilized by sedimentation and then filtration. The filtration process begins with water entering the reservoir through the inlet then passing through four types of filtrations starting from Sand - Waring - Ijuk - Activated charcoal and will exit through the outlet whose water is channeled to the maintenance and spawning tanks. In addition, siphoning is carried out every day to clean up the remaining dirt and leftover feed that falls to the bottom of the tank. According to (Marzukqi *et al*., 2012) To maintain environmental conditions and abalone health, siphoning activities need to be carried out every day.

CONCLUSION

Abalone breeding begins with breeder selection. Breeders used are those that have mature gonads or gonads that have entered TKG 3. The natural spawning technique for Haliotis squamata abalone uses a ratio of 1:3 where 50 males and 150 females produce 1,041,600 eggs.

ACKNOWLEDGEMENT

Thank you to the Balai Perikanan Budidaya Laut (BPBL) Lombok for providing facilities and to the staff for their guidance. Special thanks to Mrs. Septiana Dwiyanti for her continuous mentorship, as well as to my family and BDP friends for their unwavering support.

REFERENCES

Astikasari, D. (2011). Teknik Pemeliharaan Induk Abalone Tokobushi (*Haliotis diversicolor supertexta)* di Balai Besar Pengembangan Budidaya Air Payau Jepara Jawa Tengah (Doctoral dissertation, Universitas Airlangga).

Aulia, L. (2014). Pengaruh Lama Waktu Pemaparan Laserpunktur Pada Titik Reproduksi Kerang Abalone (*Haliotis squamata*) Betina Terhadap Kematangan Gonad (Disertasi Doktor, Universitas Brawijaya).

Bidaryati, A., Chandra, M. J., & Azhar, F. (2009). Pembenihan Abalon *Haliotis asinina* di Balai Budidaya Laut Lombok, Nusa Tenggara Barat.

Giri, N. A., Marzuqi, M., Astuti, N. W. W., Andriyanto, W., Rusdi, I., & Andamari, R. (2015). Evaluasi bahan baku pakan dan pengembangan pakan buatan untuk budidaya pembesaran abalon (*Haliotis squamata*). Jurnal Riset Akuakultur, 10(3), 379-388.

Ihsan, Y, N., Koswara, B., Dhahiyat, Y., Junianto., Supriadi, D., Grandiosa, R., Prihadi, D, J., Rizal, A., Martasuganda, M, K., Pranowo, W, S., Syadiah, N., Widjanarko, E., Novriadi, R., Purba, N, P., Andhikawati, A., Khan, A, M, A. (2020). *Peluang dan Tantangan Pengembangan Abalon Untuk Menunjang Perikanan Budidaya yang Berkelanjutan di Indonesia*. Sumedang: Unpad Press

Hamzah, M. S., Dwiono, S. A. P., & Hafid, S. (2012). Growth and survival of tropical abalone *Haliotis asinina* seed in concrete tanks at differents stocking density. *Jurnal Ilmu dan Teknologi Kelautan Tropis, 4*(2).

Iskandar, A., Jannar, A. B., Sujangka, A., & Muslim, M. (2016). Teknologi Pembenihan Abalon *Haliotis squamata* Untuk Meningkatkan Produksi Budidaya Secara Berkelanjutan. Samakia: *Jurnal Ilmu Perikanan, 13*(1), 17-31.

Kawakibi, K. (2016). Teknik Pembesaran Abalon (*Haliotis asinina*) di Balai Perikanan Budidaya Laut Lombok, Nusa Tenggara Barat. Universitas Airlangga. Surabaya.

Khotimah, F. H., Permana, G. N., Rusdi, I., & Susanto, B. (2018). Pemeliharaan Larva Abalon *Haliotis squamata* dengan Pemberian Jenis Pakan Berbeda Dalam Bentuk Tepung. *Jurnal Riset Akuakultur*, *13*(1), 39-46.

Marzuqi, M., Rusdi, I., & Susanto, B. (2012). Aplikasi pakan buatan pada pemeliharaan benih abalon (Haliotis squamata). Jurnal Riset Akuakultur, 7(2), 237-245.

Maulidya, K. D. (2016). Teknik Pembesaran Abalon (*Haliotis squamata*) dengan Metode Keramba Jaring Apung di Balai Perikanan Budidaya Laut Lombok, Nusa Tenggara Barat. Universitas Airlangga. Surabaya.

Ridwanudin, A., Anggorowati, D. A., Sujangka, A., Badi, B. F., Tarmin, N., & Wahab, A. (2022). Pengaruh Penggunaan Pakan Buatan Berbahan Baku Tepung Makroalga Hijau *Ulva* sp. terhadap Pertumbuhan Yuwana Abalon *Haliotis Squamata. Jurnal Oseanologi dan Limnologi Indonesia), 7*(2), 53-64.

Rochmawati, A. M. (2015). Teknik Pemeliharaan Induk Unggul Abalon (*Haliotis Squamata*) di Balai Produksi Induk Udang Unggul dan Kekerangan (BPIU2K) Kabupaten Karangasem, Provinsi Bali (Doctoral dissertation, Universitas Airlangga).

Rusdi, I., Rahmawati, R., Susanto, B., & Adiasmara, I. N. (2016). Pematangan Gonad Induk Abalon *Haliotis squamata* Melalui Pengelolaan Pakan. *Jurnal Riset Akuakultur, 5*(3), 383-391.

Sari, S. F., Said, A., Anwar, L. O., Rosmawati, R., & Nurdin, I. N.(2020). Aktivitas Antioksidan dan Komponen Senyawa Bioaktif Ekstrak Metanol Abalon Tropis, *Haliotis asinina. Saintek Perikanan: Indonesian Journal of Fisheries Science and Technology, 16*(2), 104-

108.

Sari, M., S., Zefri, M. (2019). Pengaruh Akuntabilitas, Pengetahuan, dan Pengalaman Pegawai Negeri Sipil Beserta Kelompok Masyarakat (Pokmas) Terhadap Kualitas Pengelola Dana Kelurahan Di Lingkungan Kecamatan Langkapura. Jurnal Ekonomi.21 (3)

Sudarmawan, R. A., Hilyana, S., & Cokrowati, N. (2013). Pengaruh Seks Rasio Terhadap Tingkat Keberhasilan Pemijahan Pada Kawin Silang *Haliotis asinina* dengan *Haliotis squamata. Jurnal Kelautan: Indonesian Journal of Marine Science and Technology, 6(*1), 57-66.

Susanto, B., Rusdi, I., Ismi, S., & Rahmawati, R. (2016). Pemeliharaan Yuwana Abalon (*Haliotis squamata*) Turunan F-1 Secara Terkontrol dengan Jenis Pakan Berbeda. *Jurnal Riset Akuakultur, 5*(2), 199-209.

Syahrin, E. S., Patadjai, A. B., Sarita, A. H., & Effendy, I. J. (2018). Pengaruh Frekuensi Pemberian Pakan Formulasi terhadap Pertumbuhan dan Sintasan Juvenil Abalon *Haliotis asinina* yang dipelihara Pada Sistem IMTA (Integrated Multi-Tropic Aquaculture). *Jurnal Media Akuatika, 3*(3).

Tjaonda, M. (2014). Pertumbuhan Induvidu Abalon *Haliotis Squamata* Pada Kedalaman Yang Berbeda di Perairan Amahusu Ambon. Prosiding SNPRPT, 1(1), 290-296.