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The Tiger Grouper Hatchery Techniques In The Lampung Marine Aquaculture Centre, Indonesia

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Abstract – The tiger grouper (Epinephelus fuscoguttatus) exhibits characteristics ideal for cultivation due to its rapid growth rate and ability to be mass produced to satisfy market demand. The aim of this study is to implement the Tiger Grouper Hatchery Technique and measure the Fecundity, Fertilization Rate (FR), Hatching Rate (HR), and Survival Rate (SR) at the Tiger Grouper (Epinephelus fuscoguttatus) Hatchery located at Balai Besar Lampung Mariculture Fisheries. The chosen survey method allows for the collection of relevant data for the aforementioned parameters. Data can be collected through primary and secondary sources, as well as observation, literature review, and documentation. Hatchery techniques for Epinephelus fuscoguttatus, include the selection of parent fish, brood rearing, spawning, egg handling, larval rearing, harvesting, maintenance and transportation of seeds. The quantity of eggs laid was 3,292,475, with an average fertilization rate of 88.76%, an average hatching rate of 22.57%, and 350,000 larvae stocked, leading to 21,000 individuals or 6% survival ratio, measuring 1-3 cm in size.

Keywords – Epinephelus Fuscoguttatus, Hatchery Technique, The Tiger Grouper.

I. INTRODUCTION

The Grouper, in particular, is among the high-value commodities in aquaculture (Retno, 2021) Indonesia, stretching from Sabang to Merauke, comprises 17,499 islands and covers a total area of approximately 7.81 million km, making it the largest archipelago globally. Of this expanse, 3.25 million km consists of the ocean and 2.55 million km the Exclusive Economic Zone, while just 2.01 million km2 is land. Given such vast seas, Indonesia boasts significant potential in marine and fisheries domains. According to Rahmaningsih and Ari (2013), the tiger grouper is a highly promising grouper variety for cultivation. As grouper fish is an export-oriented commodity, its selling price is reliant on the strength of the dollar exchange rate. Therefore, a higher exchange rate translates to a higher selling price. (Ryan et al., 2022).

The tiger grouper is a demersal fish variety that inhabits coral waters and prefers to live between the crevices of coral reefs. This fish, which is a less active carnivore, can be relatively easy to breed due to its high adaptability. The shift in consumer preferences from dead or frozen fish to live fish has led to the growth of the live grouper market, and as a result, people are taking steps to meet market demand for grouper through aquaculture (Syafitri et al., 2016).The Lampung Marine Aquaculture Centre or Balai Besar Perikanan Budidaya Laut (BBPBL) is among the various centre that cultivate tiger grouper comprehensively. BBPBL Lampung has effectively carried out brood-stock rearing, spawning, larval rearing, seed production, and consumption size production in floating net cages (KJA). The research aims to investigate the hatchery techniques employed at the Lampung Aquaculture Centre (BBPL) for Tiger Grouper.

II. LITERATURE SURVEY

The quality of feed is determined by the nutritional content in the feed and its storage process. Shrimp feed must contain essential nutrients which include protein, lipids, carbohydrates, minerals, and vitamins. Protein is the largest component in feed, generally 30% -55% of the total nutrition in feed. The nutritional content of shrimp feed will affect the growth of shrimp,

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especially protein, different nutrient content will have a different effect on growth. Farmers should be able to selectively choose the type of feed that can improve the performance of shrimp growth and provide a good level of feed efficiency. Feed efficiency is one way to reduce production costs so that the profit margins can be increased.The good growth of vanname shrimp is indicated by the performance conditions of weight gain, proportional shrimp size and in accordance with the development of shrimp rearing age[1,2].

In the maintenance of vanname shrimp in ponds, generally farmers use commercial feed products from companies that are their partners in developing the shrimp pond business. In addition to supplying feed, the company also provides technical services related to monitoring water quality, controlling pests and diseases and monitoring services for vanname shrimp growth. which is done regularly. However, shrimp pond cultivators should also have a reference in choosing and deciding the type of feed they will use. In addition to considerations of feed quality and quality, the price factor is also important to take into account because it has a direct effect on production costs and the profits they will get later. Expensive or cheap feed prices are not necessarily able to provide maximum profit, because it correlates with the growth rate and the efficiency level of feed use[3,6].

III. METHODOLOGY

Time and Place of Research

The study was conducted at the Lampung Center for Marine Aquaculture, at Jl. Yos Sudarso, Hanura, Teluk Pandan District, Pesawaran Regency, Lampung.

Method

The research employed the survey method, which involved direct observation of all hatchery activities and field discussions pertaining to tiger grouper.

Sources of Data

a. Primary Data

The primary data source was obtained directly from the main source (Pramiyati et al., 2017). Direct involvement in tiger grouper hatchery activities at the Lampung Aquaculture Center allows for the collection of primary data including fecundity data (total eggs), fertilization rate (FR), hatching rate (HR) and fish survival rate (SR) for tiger grouper (Epinephelus fuscoguttatus).

b. **Secondary data**

Secondary data provides support for primary data needs and is obtained from various literature on tiger grouper hatchery activities.

The Technique of Data Collection

1. Observation

Observation is a complex process involving various biological and psychological processes, including the processes of observation and memory (Pratiwi et al., 2017). Direct observations were made while participating in every tiger grouper hatchery activity during practice at the Lampung Center for Marine Aquaculture (BBPBL).

2. Literature Study

In the literature review, information is gathered from several relevant sources, including books and references, concerning tiger grouper hatchery techniques.

3. Documentation

According to Pratiwi et al. (2017), documents serve as records of past events. They can manifest in various forms, including writings, images, or monumental works. Writing documentation includes forms like diaries and biographies, while images documentation includes photos.

The Technique of Data Analysis

The data and information collected in this study undergo descriptive quantitative analysis. Descriptive analysis entails presenting data obtained from the field (Naburko and Achmadi, 2004) objectively, while quantitative descriptive analysis includes computing for parameters such as fecundity, Fertilization Rate (FR), Hatching Rate (HR), and Survival Rate (SR) using the following formula:

1. Fecundity

Fecundity refers to the quantity of eggs found in the ovaries of female fish that possess fully matured gonads and are therefore ready to be released during spawning. Rahmaningsih and Ari (2013) provide a formula for calculating fecundity, which is as follows:

$$\text{Fecundity} = \frac{The\ number\ of\ egg\ produced}{Brood\ weigh}$$

2. Fertilization Rate (FR)

Fertilization refers to the proportion of eggs that become fertilized out of the total number of eggs that are ovulated. The calculation for determining fertilization is as follows (Tondang et al., 2019):

$$\text{FR} = \frac{The\ number\ of\ fertilized\ eggs}{The\ total\ of\ egg} x\ 100\%$$

3. Hatching Rate (HR)

Egg hatchability refers to the percentage of fertilized eggs that yield hatchlings. To observe egg hatchability, samples are taken from fertilized eggs. An equation proposed by Tondang et al. (2019) can be used to calculate egg hatchability.

$$\text{HR} = \frac{number\ of\ eggs\ hatch}{the\ number\ of\ fertilized\ egg} x\ 100\%$$

4. Survival Rate (SR)

Survival rate refers to the percentage of fish that survive. The calculation formula for calculating SR is provided by Tondang et al. (2019):

$$\text{SR} = \frac{The\ number\ of\ population}{initial\ stocking\ amount} x\ 100\%$$

IV. Result And Discussion

Brood Rearing.

Tiger grouper brood-stock were reared in floating net cages (KJA) made of High Density Polyethylene (HDPE) measuring 4mx3mx3m with 2-inch mesh. The parent containers in KJA were prepared by washing, drying and installing the net.

Brood-stock were fed with fresh kuniran-type fish and pellets, with feeding done ad libitum or approximately 1-3% of body weight given in the morning at 08:30 WIB. Feed pellets provided to the tiger grouper brood-stock were blended with 64 vitamin E capsules, 5 g of biovit, 5 g of c-san, 10 ml of DHA, and 5 g of Progol. The mixture was evenly stirred with hot water and then added to 5 kg of feed pellets. The multivitamins and added enriching components are intended to complement the nutritional needs of the brood-stock, with the goal of stimulating gonad development and enhancing the quality of eggs produced.

To ensure the maintenance of water quality in the area where tiger grouper brood-stock is raised, we replace soiled nets with clean ones and eliminate any garbage found around the KJA. Net replacement frequency is determined by the extent of dirt buildup on the net once a month.

. The following is data on checking the water quality of brood-stock rearing in Floating Net Cages;

Tabel 1. Data Kualitas Air Pemeliharaan Induk Di KJA

Parameter	Unit	SNI	Score
Temperature	ºC	Alami*	29.6
pH	-	7-8,5*	8.47
Salinitas	g/l	30-34*	32
DO	Mg/l	>4	5.1
Nitrit	Mg/l	0.05**	0.056
Amoniak	Mg/l	0,3*	0.26

Source : * Minister of Environment Decree no. 51 of. 2004, Sea Water Quality Standards for Marine Biota

** Control of Marine Environmental Pollution PP 24 of 1991

Score: Result of field activities.

Tiger grouper fish that are susceptible to disease exhibit symptoms such as solitary swimming, weak movements, decreased appetite, and a change in their pigment concentration. A method to alleviate this involves soaking the parent fish in fresh water for 10-15 minutes and manually rubbing their bodies to remove any attached parasites. Notably, no tiger grouper brood-stock were observed to be affected during this practice.

Brood-stock

Prospective brood-stock selected for tiger grouper hatchery activities are the result of enlargement in KJA. The chosen brood-stock candidates possess favourable physical attributes, are free from deformities, in good health and disease-free. Furthermore, they respond well to the provided feed, exhibit normal swimming patterns and are sociable fish. In order to assess the level of gonadal maturity in parents-to-be, the stripping method must be applied for males while cannulation is preferred for females. The features of tiger grouper males that exhibit gonadal maturity during stripping will release white, milky sperm. In contrast, for female mothers, gonadal maturity is defined by the release of eggs during the cannulation process. Male tiger grouper brood-stock display a larger body size, brighter body colour, and milky white gonads, whereas female brood-stock have a darker body, rounded and shorter body shape, and an enlarged abdomen during spawning season. Additionally, upon inspection of the genital opening, female groupers have a cracked opening while male groupers have a slightly protruding one.

Spawning

Spawning of tiger grouper brood-stock occurs in floating net cages (KJA). To prepare the container, a happa with a mesh size of 500 microns is installed in the parent rearing container the day prior to spawning. This is done to prevent eggs from being lost in the sea current during spawning.

Tiger grouper spawning takes place at night during either the dark or light moon. The natural method employed for tiger grouper spawning in KJA yielded a total of 12 females and 9 males, weighing approximately 7.5 - 10 kg per head.

Egg Handling

a. Eggs Harvesting

Egg collection is carried out each morning at 08.30 WIB. The eggs are gently scraped using a scoop net and collected in a bucket before being taken to the hatchery. The eggs are then carefully placed in a 100-litre container filled with aerated water. Finally, the total number of eggs is determined through the use of a sampling method. Unfertilized eggs are removed using a siphon hose, ensuring that only high-quality or fertilized eggs are retained. It should be noted that good quality or fertilized tiger grouper eggs have a yellowish and transparent appearance and float at the water's surface, while unfertilized eggs are cloudy white and sink to the basin's bottom.

b. Egg Counting

Tiger grouper egg count was performed using the volumetric sampling technique. The eggs were extracted thrice using a 20 ml sample container, after turning the aerator on to ensure even distribution in the basin. The eggs were extracted thrice using a 20 ml sample container, after turning the aerator on to ensure even distribution in the basin. Subsequently, the eggs were placed on a 20 x 30 cm screen net and enumerated individually. The formula for determining the egg count is:

$$\text{The number of eggs} = \frac{(S1 + S2 + S3)}{3} \times 50 \times 100 \text{ L}$$

Desc : S1 = sample 1

S2 = sample 2

S3 = sample 3

50 = The multiplier result obtained from a 20 ml glass sample scaled up to a total of 1 litre.

100 = The volume of the container used after the number of eggs is is o obtained next is search for FR (*Fertilization Rate*).

c. Hatcing Egg

Tiger grouper eggs hatch within 16-24 hours of spawning. Egg hatching involves placing the egg collector in a fibre tub measuring 200 cm x 100 cm x 80 cm, filled with 80% water, and using the running water system method. Aeration is also provided in the system to prevent egg aggregation and ensure continuous water flow. The calculation of the heart rate is conducted every morning at 07:00 BST using the identical method as the prior calculation. From the presented egg data, it is evident that the average FR is 88.76% and HR is 22.57%.

Table 2. Tiger Grouper Egg Data.

No	Date	Egg Total	FR	FR (%)	HR	HR (%)
1.	6/3/2022	821.650	785.825	95.63%	247.298	31.46%
2.	7/3/2022	1.605.000	1.250.000	77.88%	414.516	33.16%
3.	8/3/2022	865.825	803.325	92.78%	24.339	3.1%

LARVAR REARING

The larvae of the tiger grouper were cultured in concrete tanks measuring 5 m x 2 m x 1.2, which were outfitted with 24 aeration stones, inlet and outlet channels, and algae inlet channels. Larval rearing containers should be prepared by brushing the walls and bottom of the tub, disinfecting with chlorine ≤100 ppm, installing aeration, and then filling with seawater. The seawater should be treated with Sanocare Pure, an effective disinfectant that kills pathogens such as bacteria, viruses, and fungi commonly found in aquaculture, at a dose of 1 ppm. The tub should be filled with seawater to approximately ¾ of its volume.

a. Larval Stocking

Larval stocking takes place in the morning where larvae are gently collected from the water surface using a basin and gradually transferred into the larval rearing tanks. The ideal larval stocking density ranges from 10-15 larvae per litre. The larval rearing tanks have a capacity of 350,000 larvae. Before stocking, the larval rearing media is treated with elbayu at a dose of 1 ppm to inhibit the growth of pathogenic bacteria and maintain optimal water quality in the tanks.

b. Larva Feeding

Tiger grouper larvae require external nutrition when their yolk sac food reserves are depleted. In normal temperature conditions, these reserves deplete by their third day (D3). On the second day (D2), the larval rearing medium is supplemented with phytoplankton, specifically Nannochloropsis sp. with a density of 300,000-500,000 cells/ml. The use of this

phytoplankton enhances water quality, diminishes sunlight intensity, and provides food for rotifers. Phytoplankton, in the form of Nannochloropsis sp, was administered in quantities of 150-300 litres from day 2 until day 35. On day 3, larvae were provided with natural food in the form of rotifers at a density of 3-5 ind/ml. The rotifer feeding frequency should be regulated as frequently as possible during the morning, afternoon, and evening by scrutinizing the density using a beaker glass to ensure that the larvae always have access to rotifers in the tanks (Agusta & Ihwan, 2020).

Upon reaching the age of D12, tiger grouper larvae are provided with natural food in the form of Artemia sp, specifically branded Supreme Plus. The frequency of which Artemia sp is given shall be done twice daily in the afternoon and evening. Every morning, the presence of Artemia in the larval tanks shall be verified. Should the supply of Artemia be depleted, further culturing shall be carried out. At D6, tiger grouper larvae were fed Love Larva size 1 or LL1 artificial feed in small amounts with the aim of acclimating them to pellets by D35 or harvest time. Feeding occurred 2-4 times daily at 07:30-11:00 and 13:30-15:30 WIB. The feeding schedule was tailored to the size of the larvae's mouth, ensuring that the size of the feed provided increased as the larvae grew.

Table 3. Type and Frequency of Larval Feeding

No	Day	Types of Feed	Dose	Time
1.	D2-D7	Rotifer	3-5 ind/ml	Morning (10.00 WIB)
				Afternoon (14.30 WIB)
2.	D8-D35	Rotifer	5-7 ind/ml	Morning (10.00 WIB)
				Afternoon (14.30 WIB)
3.	D13-D35	Artemia sp.	1-3 ind/ml	Morning (10.00 WIB)
				Afternoon (14.30 WIB)
4.	D6-D28	Artificial Feed LL1	Ad satiation	Morning (07.30-11.00)
				Afternoon (14.00-15.00)
5.	D15-D35	Artificial Feed LL2	Ad satiation	Morning (07.30-11.00)
				Afternoon (14.00-15.00)
6.	D25-D35	Artificial Feed LL3	Ad satiation	Morning (07.30-11.00)
				Afternoon (14.00-15.00)
7.	D33-D35	Artificial Feed LL4	Ad satiation	Morning (07.30-11.00)
				Afternoon (14.00-15.00)

a. Water Quality Management

Water quality management practices for rearing tiger grouper larvae may involve flushing and changing the water. Watering can be carried out once the larvae have reached D20 or by checking the condition of the bottom of the larval tank. If the bottom of the tank appears dirty, watering should be conducted. The following data presents the results of a water quality analysis conducted on March 13th, 2022, for larval rearing purposes :

Table 4. Larval rearing water quality data

Parameter	Unit	SNI	Score	Description
Temperature	ºC	Nature*	29	*In Situ*
Ph	-	7-8,5*	7.79	*In Situ*
Salinitas	g/l	30-34*	32	*In Situ*
DO	mg/l	>4	5.09	*In Situ*
Nitrit	mg/l	0.05**	0.37	*Ex Situ*
Amoniak	mg/l	0.3*	0.019	*Ex Situ*

Source : * Minister of Environment Decree no. 51 of. 2004, Sea Water Quality Standards for Marine Biota

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Score: Result of field activities

c. Pest Disease Prevention

Certain parasites such as Oodium sp., Uronema marinum, Trichodina sp., and gill and skin trematodes can attack larvae. In addition, larvae are also susceptible to bacterial infection from Vibrio sp. To prevent such infestations, it is recommended to apply 1 ppm of Elbayu to larvae tanks both before stocking and after flushing. Additionally, it is crucial to maintain cleanliness of tools and materials used during larval rearing..

d. Larval Growth Sampling

Growth was measured every five days by determining total length using millimetre block paper and taking 3 fish from a tub for the growth sampling. Growth sampling was continued until the larvae reached D35.

Table 5. Larval Growth Sampling

No	Day	Length (cm)
1.	D5	0.3
2.	D10	0.4
3.	D15	0.6
4.	D20	0.83
5.	D25	1.26
6.	D30	1.8
7.	D35	2.2

e. Larval Harvest

Tiger grouper larvae are harvested at D35 in order to level the stocking density, homogenize fry size, and avoid cannibalism and competition for food during the grading process. Technical terms are explained upon first use. Tiger grouper larvae are harvested at D35 in order to level the stocking density, homogenize fry size, and avoid cannibalism and competition for food during the grading process. The larvae are harvested with care using a trolley to prevent stress and squashing. Harvesting takes place at 9:00 AM WIB. The estimated survival rate (SR) from the harvest is 6%.

SEED REARING

Tiger grouper fry were cultured in fibre tanks measuring 2m x 1m x 1m. The tanks were outfitted with inlet and outlet channels alongside two aeration units. Prior to use, the containers underwent preparation which involved flushing the walls and bottom of the tank with a chlorinated water solution (20 ppm). Prior to use, the containers underwent preparation which involved flushing the walls and bottom of the tank with a chlorinated water solution (20 ppm). The walls and bottom of the tank were then cleaned with a brush and rinsed thoroughly with fresh water before being left to dry for between 1 to 2 hours. After drying, the tanks were filled with seawater to a level of 80%.

a. Seed Stocking

Around 21,000 fish measuring 1-3 cm/head were stocked as fish seeds. The seed stocking density used amounted to 10-20 tails/L. Following seed stocking, the seed tanks were treated with acriflavine at a concentration of 3-5 ppm, which acts as an antiseptic, inhibiting and eliminating the growth of microorganisms and bacteria that may adversely impact fish.

b. Seed Feeding

Breeding activities involve feeding fish at satiation, until they are as full as possible. The types of feed provided include Love Larva, Megami and KAIO, and they are given to the fish 6-8 times per day. Feeding times are in the morning (08.00-11.00 WIB) and in the afternoon (14.00-15.30 WIB). D30-D40 fry are fed LL3-LL5 with a feed diameter of 0.31-0.63mm, while D40-D60 fry are fed EP0-GR2 with a feed size of 1.3-2.2mm.

c. Seed Water Quality Management

Water quality management in seed rearing utilizes a running water system and penyiponan. Technical terms such as penyiponan shall be defined upon first use. The piping process occurs twice a day following feeding, in both the morning and the evening. Water is flushed and sorted until the water level is 15-20 cm from the bottom of the tub, achieved through opening a 2-inch diameter outlet. This process facilitates replacement of up to 80% of the previous water's total volume.

Table 6. Seed Water Quality Management

Parameter	Satuan	SNI	Nilai	Keterangan
Suhu	^{o}C	Alami*	30	*In Situ*
Ph	-	7-8,5*	7.95	*In Situ*
Salinitas	g/l	30-34*	31	*In Situ*
DO	Mg/l	>4	5.3	*In Situ*
Nitrit	Mg/l	0.05**	0.017	*Ex Situ*
Amoniak	Mg/l	0.3*	0.09	*Ex Situ*

Source : * Minister of Environment Decree no. 51 of. 2004, Sea Water Quality Standards for Marine Biota

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Score: Result of field activities

d. Pest Management and Prevention

Disease management in tiger grouper fry is approached using two methods; immersion in fresh water for 5-10 minutes or treatment with acriflavine antibiotic drugs at a dosage of 3-5 ppm within the fry tanks. Afflictions that affect tiger grouper fry are often caused by parasitic organisms, including Trichodina sp., gill and skin trematodes, oodium sp., and uronema marinum. Biosecurity measures, as well as maintaining proper sanitation of tools and materials during larval rearing, can help prevent potential issues.

e. Seed Growth Sampling and Grading

Sampling is done every 5 days. 3 fish are taken at random and the length and weight of the larvae are measured.

Tabel 7. Sampling Pertumbuhan Benih

No	Hari	Panjang (cm)	Berat (g)
1.	D35	2.2	0.36
2.	D40	3.2	0.6
3.	D45	3.7	1.3
4.	D50	4.46	2.7

In the case of tiger grouper juveniles, grading is carried out whenever there is a difference in the size of the juveniles, in order to avoid high cannibalism in tiger grouper juveniles, since tiger grouper is a fish with a cannibalistic nature.

d. Seed harvesting and transport. Seed harvesting can be done in the morning or during the day, depending on the delivery schedule to the customer. Harvesting techniques can be done in 2 ways, namely partial and total, according to the number of consumer requests. The seeds to be harvested must first be bent for 12-24 hours. The seeds are harvested with the help of a fine sieve, a rombong and a serving hood equipped with sterofoam. Once the seeds have been harvested, they are sorted to ensure that the fish sent to the consumer are healthy, undamaged and uniform.

There are 2 types of seed transport, open and closed. In open transport, the container used can be a toren, the size of which is adapted to the number of fish. The container is first cleaned and then filled with ½ - ¾ part sea water, the container is then aerated and the tube is weighted with a hose and aeration stone to ensure the availability of oxygen during transport. To maintain a temperature of 22-24oC, the container can be filled with ice cubes wrapped in plastic. In the case of closed transport, plastic packaging with a thickness of 0.8 mm and dimensions of 120 cm x 50 cm, rombong, sterofoam, insulation, rubber bands, basins and oxygen cylinders can be used and the materials required are oxygen, ice cubes and seawater. The ratio of water to oxygen used is 1:3.

V. CONCLUSION

Based on the results of the research on Tiger Grouper (Epinephelus fuscoguttatus) hatchery techniques, it can be concluded that

1. Tiger grouper (Epinephelus fuscoguttatus) hatchery techniques can include broodstock rearing, broodstock selection, spawning, egg handling, larval rearing, larval harvesting, seed rearing, seed harvesting and transport.
2. The number of eggs produced was 3,292,475 eggs with an average FR of 88.76%, an average HR of 22.57% and the larvae stocked was 350,000 fish resulting in an SR of 21,000 fish or 6% with a size of 1-3 cm..

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