The technology of striped catfish broodstock (*Pangasius hypophthalmus*) in high-quality maintenance

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**Abstract.** Striped catfish (*P. hypophthalmus*) is a high economic value and is a determining factor at the hatchery stage. Quality catfish brooders that can produce superior seeds can be obtained through good handling. The purpose of this study is to gain knowledge in the maintenance techniques of catfish broodstock. The working methods used in the study is a descriptive method with primary and secondary data collection. Striped catfish broodstock uses a recirculation system which includes preparation of pond maintenance, broodstock maintenance, feed management, water quality management, broodstock selection, and spawning. The results of the average water quality parameters for 25 days are turbidity 17.85 cm, temperature 29.51°C, DO 4.23 mg/L, ammonium 0.005 mg/L, and pH 7.54. The average weight measurements in the first and second sampling are 3.11 kg and 3.13 kg, while the average length measurements in the first and second sampling are 55 cm and 56.05 cm. The growth rate in the maintenance of catfish broodstock for 21 days is 9.52 grams/day, and the specific growth rate is 0.028%. Catfish spawning uses a ratio of ten males and three females.

1. **Introduction**

Catfish broodstock is one of the fish from Indonesian waters that have been successfully cultivated and domesticated semi-intensive and intensive with high stocking densities and minimal use of water [1]. Catfish broodstock is cultivated in various countries in the world such as Thailand, Nepal, Pakistan, India, Bangladesh, Vietnam, Laos, Myanmar, and Cambodia. It is one of the most important freshwater fish groups in the aquaculture sector [2] and can tolerate low dissolved oxygen (DO) levels in water and can be cultivated in ponds or concrete tanks [3].

The cultivation of catfish broodstock can be done through three stages during the cultivation process, namely the stages of hatchery, nursery, and enlargement [4]. The maintenance of catfish broodstock includes pond preparation activities, broodstock preparation, care and measurement of broodstock growth, adequate feeding, water quality management, feed management, and eradication of pests and diseases. According to [5], water quality is a significant factor in the survival and productivity of aquaculture. Low water quality can have an impact on the broodstock's appetite decreases, and growth becomes slow so that the disease can quickly attack the broodstock catfish. A monitoring system and reasonable control of water quality will prevent adverse impacts on catfish broodstock.

The potential of catfish broodstock cultivation is huge in the development of freshwater fish...
farming in Indonesia, considering that catfish species are easy to be cultivated. One way to cultivate catfish broodstock is by handling catfish broodstock for quality. According to [6] guidelines, good quality of catfish which can produce superior seeds can be obtained through good handling. Therefore, it is important to learn the techniques for maintaining catfish broodstock. The purpose of this study is to gain knowledge in the techniques of raising catfish. The benefits of this study are to increase knowledge regarding the maintenance techniques of catfish broodstock.

2. Material and methods

2.1. Pond-maintenance preparation

Pond preparation begins by drying the bottom of the pool. The drying stage can be said to be complete if the subgrade is already dry and slightly cracked. Dike repair is done if there is a leak in the pool. Liming the soil is done after the subgrade has dried and has been reversed with the aim of ensuring the pond bottom pH is in good condition. Next is filling the pool water to a height of 100 cm by opening the inlet door and closing the outlet door.

Striped catfish brood ponds are square-shaped with pond walls made of concrete and pond bottom from the ground. The main maintenance pool consists of three units, consisting of 55, 56 and 57 ponds, each of which has a length and width of 5.5 m and a height of 1.5 m. Pool density 55 is three fish/m², pool 56 is one fish/m², and pool 57 is one fish/m².

Preparation of catfish brood pond begins by drying the bottom of the pond. If the subgrade is dry and slightly cracked, then reverse the subgrade by hoeing the pond ground. Land reversal aims to reduce the content of organic matter at the bottom of the pond and can increase dike and close dike leaks [8]. Liming the soil is done after the subgrade dried up and has been reversed [8]. Liming is done using dolomite lime at a dose of 500 grams/m². The aim is improving the acidity (pH) of the subgrade ponds and maintaining it in stable conditions, as well as functioning as a disinfectant and provider of nutrients needed by phytoplankton [9]. [10] explains that catfish pond areas have a soil acidity pH of more than 5.5. Pool water filling up to a height of 100 cm by opening the inlet door and closing the outlet door. According to [11], the inlet lane is used as the primary water source, while the outlet lane is part of the drainage for water drainage from ponds.

2.2. Maintenance of Striped catfish broodstock

Maintenance of Striped catfish is carried out in a concrete-based pond with a recirculating water system. Broodstock of male and female catfish are three years old with the weight of male 1.5-2.5 and female 2.5-4 kg fish. Striped catfish broodstock selection activities must be carried out before broodstock maintenance in order to be able to improve the genetic makeup of the broodstock to be used in spawning [12].

2.3. Feed management

Feed management is carried out twice a day, at 8:00 and at 15:00 GMT +7. The feed given is a product of Matahari Sakti with the brand MS Prima Feed LP 3 with a feed size of 3.2-4.0 mm. Determination of the amount of feed is done by calculating the average weight of fish multiplied by the total population of fish stocked multiplied by the percentage of feed level in units of kilograms or grams.

2.4. Growth of Striped catfish broodstock

Measurements of the growth of Striped catfish broodstock were taken randomly by ten individuals. Measurement of growth of absolute weight and length of the Striped catfish is calculated using the formula:

\[ W_m = \frac{W_t – W_0}{1} \]
\[ W_m = 3.13 \text{ kg} – 3.11 \text{ kg} \]
\[ W_m = 0.02 \text{ kg} \]
\[ W_m = 20 \text{ g} \]
Information:

\[ W_m : \text{Absolute weight growth (gram/fish)} \]
\[ W_t : \text{Final average weight of the fish (gram/fish)} \]
\[ W_0 : \text{Early average weight of fish (gram/fish)} \]

\[ L_m = L_t - L_0 \]
\[ L_m = 56.05 \text{ cm} - 55 \text{ cm} \]
\[ L_m = 1.05 \text{ cm} \]

Information:

\[ L_m : \text{Absolute length growth (cm)} \]
\[ L_t : \text{Final average length of fish (cm)} \]
\[ L_0 : \text{Early average length of fish (cm)} \]

According to [13] measurements of growth rate and specific growth rate can be calculated using the formula:

\[ GR = \frac{W_t - W_0}{t} \]

\[ GR = \frac{3130 \text{ g} - 3110 \text{ g}}{21} \]
\[ GR = 9.52 \text{ gram/day} \]

Information:

\[ GR : \text{Growth rate (gram/day)} \]
\[ W_t : \text{Final average weight (gram)} \]
\[ W_0 : \text{Early average weight (gram)} \]
\[ t : \text{time (day)} \]

\[ SGR = \frac{\ln W_t - \ln W_0}{t} \times 100\% \]

\[ SGR = \frac{8.048 - 8.042}{21} \times 100\% \]
\[ SGR = 0.028\% \]

Information:

\[ SGR : \text{Percentage of the weight of the average individual per day (% body weight/day)} \]
\[ W_t : \text{Final average weight (gram)} \]
\[ W_0 : \text{Early average weight (gram)} \]
\[ t : \text{time (day)} \]

2.5. Water quality management

Water quality management is carried out by sedimentation and filtration of water before putting it into a pond. Measurement of water quality parameters in the pond maintenance of Striped catfish is done every day at 08.00 and 15.00 GMT+7. Water quality parameters measured include turbidity, temperature, dissolved oxygen, pH, and ammonium content. Measurement of turbidity using a sechi dish and a ruler, measuring the temperature using a thermometer, measuring pH using a pH meter, measuring dissolved oxygen using a DO kit, and measuring ammonium using an ammonium kit.

2.6. Striped Catfish spawning

Striped catfish spawning includes broodstock selection, feeding, weighing, injection, stripping, fertilization, and hatching eggs. Gonadal ripe broodstock selection is made to get it ready for breeding, thus providing a chance for the broodstock's success in hatching quality eggs. Observation of Gonad Maturity Level is also part of the Striped catfish broodstock selection. The basis used to determine the level of gonad maturity of Striped catfish is based on visual consideration of the gonad morphology. Feeding is done by putting the broodstock in the reservoir for one night without giving food. The next step is weighing it in order to know its quality and determine the dose of ovaprim hormone that will be used in the spawning process.
The next step is an injection of the broodstock using ovaprim at a dose of 0.5 mL/kg broodstock as a stimulant of gonad maturity. The use of ovaprim is added NaCl which functions as a physiological solution or diluent in a ratio of 1:1. The injection is performed intra-muscularly on the back (inside of the muscle) with the needle forming an angle of 45°. The injection is only done on the female conjoined catfish and given twice. When injecting the female broodstock is done twice with the time interval from the injection of the second catfish until it can ovulate, i.e. between 10-12 hours. However, interval 6 hours after the second injection, a check is carried out on the female to find out whether the eggs have come out or not. Ordering is done by lifting the broodstock and then sort slowly and take care, so they are not stressed. Its eggs that have come out are accommodated using a basin until enough eggs are taken. Sperm retrieval begins by sequencing the abdomen of the male to the genital organs. Sperm coming out of the male catfish's genital organs are accommodated in a basin that already contains eggs from the sequencing of the female broodstock. The eggs and sperm of catfish that have been collected in the basin are then stirred using chicken feathers slowly until the eggs and sperm are mixed evenly. Stirring time at lasts for ± 30 seconds. Evenly mixed eggs and sperm are rinsed 2-3 times using clean water. The next step is to spread eggs in the aquarium. Control activities carried out every 3-4 hours. Each aquarium is given sufficient aeration to ensure dissolved oxygen content and temperature so that the egg incubation process runs optimally.

3. Result and discussion
3.1. Maintenance of Striped catfish
Maintenance of Striped catfish is carried out in a concrete-based pond with a recirculating water system. The observations of the morphology of the Striped catfish broodstock every week can be seen in Table 1.

Table 1. Morphological observation results of striped broodstock every week

| Week | Female Morphology | Male Morphology |
|------|-------------------|-----------------|
| 1st  | Stomach enlarges toward the anus | Tummy's skin is soft and thick |
|      | Stomach soft and smooth when it touched | Body size is smaller and slimmer than the female |
| 2nd  | Stomach enlarges toward the anus | Stomach enlarges toward the anus |
|      | The cloaca is swollen | The cloaca is swollen |
|      | Tummy's skin is soft and thick | Tummy's skin is soft and thick |
| 3rd  | Stomach enlarges toward the anus | The cloaca is swollen and coloured crimson red |
|      | The cloaca is swollen and coloured crimson red | The cloaca is swollen and coloured crimson red |
|      | If the stomach is pressed, it has not released an egg | If the stomach is pressed, it has not released sperm |
| 4th  | Swimming movements become slow down | Tummy's skin is soft and thick |
|      | Stomach enlarges toward the anus | The cloaca is swollen and coloured crimson red |
|      | The cloaca is swollen and coloured crimson red | If the stomach is striped, it has not released sperm |

Maintenance of Striped catfish uses a recirculation system. According to [14], a recirculation system in the maintenance of catfish culture can maintain the amount of production and reduce losses. The advantages of the recirculation system are: the use of water per unit time is relatively low, the flexibility of the location of cultivation, and the need for space or land is relatively small [15]. Broodstock of male and female catfish are kept at least three years old with the weight of male 1.5-2.5 kg fish and female 2.5-4 kg fish. [16] that the size and age of the broodstock plays an important role in the spawning process. Striped catfish broodstock selection activities must be carried out before broodstock maintenance in order to be able to improve the genetic makeup of them to be used in spawning [12]. The condition influences the quality of eggs produced by the broodstock catfish, so the selection of the broodstock must be made carefully and carefully, so they do not stress. According to [17], the characteristics of a good Striped catfish that is at the age of 3 years weighs at least 2 kg, starts laying eggs at the age of 3
years and does not lay young eggs in females and starts to contain sperm at the age of 2.5 months. Normal body or not deformed, fat or not thin, not injured and healthy, smooth skin, and respond to feeding.

### 3.2. Feed maintenance

The feed used in the maintenance of Striped catfish is an artificial feed of floating pellets. Feeding method is feeding 3% of the weight of biomass depending on the achievement of fish weight and the number of fish by spreading 1.5 kg of food twice a day at 07.00 and 15.00 GMT +7. The feed given is a product of Matahari Sakti with the brand MS Prima Feed LP 3 with the following nutritional content:

| No. | Nutritions   | Content       |
|-----|--------------|---------------|
| 1   | Protein      | Min 31-33%    |
| 2   | Fat          | Min 5%        |
| 3   | Fibre        | Max 4%        |
| 4   | Ash          | Max 12%       |
| 5   | Water content| Max 10%       |

Striped catfish broodstock requires nutrition in its growth, so it is necessary to provide food that has sufficient nutritional content. The Striped catfish broodstock was given an artificial feed of floating pellets. The shape floating pellet has an advantage in the resistance to float in water for up to 15 minutes or several hours [18]. The feed given is a product of Matahari Sakti with the brand MS Prima Feed LP 3 which has a minimum protein content of 31-33% which is given twice a day. According to [19], catfish feeding rates range between 2% -5% per day and require feed with a protein content of around 28-30%. So that the feeding of catfish broodstock conducted is in accordance with the literature because it applies to feed with a feeding rate of 3% of body weight. Feeding rate is the amount of feed given to catfish every day, so the smaller the FCR value, it shows a good indication of high-quality feed [20]. High-quality feed and water quality controller, which one from phytoplankton is important in striped catfish broodstock [21,22]. High-quality feeds are high in fat content to improve reproduction quality. Phytoplankton maintains water quality so that broodstock is not stressed. Phytoplankton can originate from aquaculture waters which are grown by increasing nutrient waters using fertilizers [23,24]. Phytoplankton is a type of plankton that has a high enough protein level that can stimulate the growth of fish or shrimp larvae, in addition to this phytoplankton can be mass-produced in a controlled tub or pond [25,26]. The content owned by phytoplankton according to [27,28] states that the nutrition content of phytoplankton is 37% protein, 7% fat and 21% carbohydrates, and the omega 3 HUFA content in phytoplankton is 15.5%. [29,30,31,32,33] further states that plankton have a water content ranging from 7.78-12.68%, ash content ranging from 55.47-61.14%, and crude fiber content ranging from 0.56-1.41%

According to [34], frequency feeding catfish is not known with certainty, but the timing of feeding influences the digestion process of fish. The frequency of feeding the catfish twice a day has shown sufficient value for the nutritional needs of the catfish. That is because of the smaller the size of the fish, the more frequent the frequency of feeding [35]. This relates to the capacity and rate of gastric emptying, which is the faster gastric emptying time, the higher the frequency of feeding needed [36]. The appetite of catfish broodstock will increase again if food is available after a reduction in stomach contents. That way, the frequency of feeding them twice a day can be said to be good enough. Catfish broodstock feeds are stored in a feed storage shed and placed on a wooden stand to maintain feed moisture and maintain feed quality [37].

### 3.3. The growth of Striped catfish

The Striped growth catfish was carried out twice, namely at the beginning of the first week and the end of the fourth week of the implementation of the Studies. The results of growth measurement of
Striped catfish broodstock can be seen in Table 3.

Table 3. Data on growth and weight of Striped catfish

| No. | Sampling I |          | Sampling II |          |
|-----|------------|----------|-------------|----------|
|     | Weight (kg) | Length (cm) | Weight (kg) | Length (cm) |
| 1   | 5.4        | 63.5     | 4.1         | 60.3     |
| 2   | 3.3        | 56       | 1.7         | 49       |
| 3   | 4.3        | 57.5     | 5.6         | 65       |
| 4   | 1.3        | 55       | 3.8         | 58       |
| 5   | 3.6        | 57.5     | 2.2         | 51.5     |
| 6   | 2.4        | 49.5     | 1.9         | 49       |
| 7   | 3.6        | 56       | 3.6         | 57.5     |
| 8   | 1.6        | 45       | 2.6         | 53.5     |
| 9   | 2.5        | 53       | 4.6         | 63.7     |
| 10  | 3.1        | 57       | 1.2         | 53       |
| Total | 31.1     | 550      | 31.3        | 56.05    |
| Average | 3.11   | 55       | 3.13        | 56.05    |

The measurement results of the weight and length of Striped catfish broodstock in the first measurement obtained an average weight of 3.11 kg with an average length of 55 cm and the second measurement obtained an average weight of 3.13 kg with an average length of 56.5 cm. So that the calculation of absolute weight growth in the maintenance of catfish for 21 days is 20 grams and absolute length growth is 1.05 cm. The measurement of the growth of Striped catfish was done to know the length and weight gain of catfish broodstock. Growth measurement for the broodstock cannot be done every day or in a short time because it can cause stress. Stress can disrupt the speed of the process of maturation of its gonad [38].

The density of the broodstock influences growth. A decrease will follow an increase in density in the rate of growth, and at a specific rate of growth, the growth will stop [39]. This occurs because the high-density stocking which can interfere with the physiological processes and behaviour of broodstock to the space of motion so that in the end, it can reduce the health and physiological its conditions. As a result of this process is a decrease in feed utilization, as well as decreased growth and survival. Selection is the activity of selecting or separating between a broodstock who has a mature gonad or ripe egg with a broodstock who has a mature gonad. The selection of Striped catfish aims to obtain good quality broodstock for breeding so that the catfish broodstock can produce good and superior quality seeds, and have high survival rates. Broodstock selection is very determining the success of hatchery, so it must be done carefully and accurately based on predetermined criteria [40]. According to [41], the success of Broodstock spawning is determined by carefulness when choosing a mature gonad broodstock. The gonad ripe selection is done to get a broodstock that is ready to be bred, thus providing an opportunity for the success in hatching quality eggs [42].

3.4. Water quality management

Water quality measurements are carried out twice a day at 08.00 and 15.00 GMT +7. The results of water quality measurements every week can be seen in Table 4. Fertilized eggs are then spread evenly at the bottom of the aquarium and endeavoured so that no eggs accumulate because they can cause the eggs to rot and decrease water quality in the aquarium so that it can cause hatching failure. Control activities carried out every 3-4 hours. Each aquarium is given sufficient aeration to ensure dissolved oxygen content and temperature so that the egg incubation process runs optimally. Catfish eggs will hatch at 29-30°C after incubation for 12-18 hours [40]. The hatching eggs can be seen at intervals of 12-18 hours after fertilization which is marked by the presence of catfish larvae that begin to look swimming on the surface of the water. Egg welding does not co-occur but takes place gradually.
The average value of turbidity in catfish brood pond for four weeks ranged from 16.99-19.74 cm. This value is already optimum enough for the maintenance of catfish brood ponds which have a height of 80 cm. According to [61], catfish can adapt well enough to the environment. The results of the average temperature measurements in the Striped catfish pond for four weeks showed differences that were not too fluctuating, so they remained in optimum conditions because they ranged from 28.76-30.08°C. The temperature value is in accordance with [62], which states that the optimal temperature for catfish maintenance ranges from 27-31°C.

The average content of dissolved oxygen (DO) every week in the pond maintenance of Striped catfish ranged from 3.63 to 4.79 mg/L. Concentration and availability of dissolved oxygen is needed for the life of fish that are cultivated [63]. Factors that influence the difference in dissolved oxygen are the influence of pond activity so that the diffusion of oxygen from the air to water and phytoplankton abundance is easy. Ammonia is a waste from fish metabolism products such as faeces and urine, as well as food waste. High levels of ammonia can be known from the smell of pool water conditions [63]. The average value of ammonia in pond maintenance of Striped catfish for four weeks tends to be optimum because it ranges from 0-0.01 mg/L. Ammonia levels in the pond maintenance of Striped catfish must always be maintained in order to remain optimum. The degree of acidity (pH) is a concentration of hydrogen ions which indicates that the waters are acidic or basic [64]. The average pH in the pond maintenance of Striped catfish for four weeks tends to be optimum because it ranges between 7.46-7.64. Changes in pH can be caused by changes in weather or physiological activity in fish. According [65] explains that catfish species can tolerate and live in acidic waters up to pH five and can survive in alkaline waters up to pH 9.

### 3.5. Striped broodstock selection

One hundred ten brooders selected 30 broodstock that is ready to be spawned. The characteristics of Striped catfish that have been selected during the study are listed in Table 5. The results of observations of the morphological characteristics of Striped catfish did not show a significant difference. The average of striped catfish in the broodstock rearing pond has morphological characteristics which are ready to be bred. According to [43], there are differences in the morphological characteristics of the female and male broodstock which are ready to be spawned, namely the body posture of the female conjoined catfish broodstock tends to be wide and short, but the male Striped catfish tend to be slim and long. Second, the stomach of the female conjoined catfish tends to be soft, smooth and enlarged, whereas in the male conjoined catfish tend to be slimmer. Third, the female genital characteristics are reddish and swollen, which if the stomach of the female broodstock is ordered to produce eggs, while the male releases sperm.

### Table 4. Data on average of water quality measurements in every week

| Parameters  | 1st Week | 2nd Week | 3rd Week | 4th Week | Average |
|-------------|----------|----------|----------|----------|---------|
| Turbidity (cm) | 16.99 | 17.49 | 19.74 | 17.17 | 17.85 |
| Temperature (°C) | 29.69 | 28.76 | 29.50 | 30.08 | 29.51 |
| DO (mg/L) | 4.79 | 4.57 | 3.93 | 3.63 | 4.23 |
| Ammonium (mg/L) | 0.01 | 0.01 | 0 | 0 | 0.005 |
| pH | 7.56 | 7.49 | 7.46 | 7.64 | 7.54 |

The morphology of the Striped catfish broodstock that has been selected

| No | Female Striped Broodstock | Male Striped Broodstock |
|----|---------------------------|-------------------------|
| 1  | At least three years old  | At least three years old|
| 2  | Has a minimum weight of 2 kg fish | Has a minimum weight of 1.5 kg fish |
| 3  | Stomach enlarges toward the anus | Has a thin and flabby stomach |
| 4  | Swollen and prominent genitals that are dark red | Swollen and prominent genitals that are dark red |
| 5  | If it sorted into the anus can not release eggs | If it sorted towards the anus will be released sperm |
The results of observing the characteristics of the selected Striped catfish, it can be said that the Striped catfish has good quality and is ready to be spawned. This is because the characteristics of catfish broodstock are by the literature, which is the Striped catfish broodstock ready for breeding when the gonads mature at least two years old with a range of bodyweight of each individual is 1.5-2 kg [44]. Observation of Gonad Maturity Level is also part of the Striped catfish broodstock selection. According to [45], the division of gonad maturity stages can be done in two ways, namely laboratory analysis and visual observation, but the most commonly used method is visual observation method based on gonad size and appearance, which is subjective. According to [46], a good catfish egg has a diameter between 0.9-1 mm (gonad maturity IV) with uniform size, ivory yellow, and when in contact with water, the egg will separate or not clot.

Gonadal maturity index is a quantitative method that aims to determine the level of maturity that occurs in the gonad [47]. Observation of gonad morphology in females can be in the form of observations of ovarian shape, size of ovaries, filling of ovaries in body cavities, the colour of ovaries, ovarian smoothness, egg size in ovaries in general, clarity of shape and colour of eggs with parts, size (lines middle) eggs, and the colour of eggs in a new state [48].

Spawning is an activity to unite mature male and female gonads to fertilize eggs, namely the meeting of sperm cells with eggs [49]. Striped catfish brooders that have been selected are then taken to the reservoir to carry out the robbery activities. According to [50], stamping means storing broodstocks from the broodstock maintenance pool in a sinking tub with the aim of removing sewage, because dirt can interfere with sorting eggs and can pollute eggs.

Striped catfish broodstock that has been scooped is then weighed to determine the quality of the broodstock and determine the dose of ovaprim that will be used in the spawning process. The advantage of using a smaller Broodstock fish is that it can reduce the volume of hormones, the Broodstock feed used, and easy handling of the broodstock during spawning [51]. The results of observations of the weight and level of Gonad Maturity in the Striped catfish broodstock are on the gonad maturity III levels, namely maturing/ripening which is characterized by an average egg diameter ranging from 0.6 to 0.8 mm.

Broodstock of the female Striped catfish that have been weighed is then injected using ovaprim at a dose of 0.5 mL/kg. This is by the opinion of [52] that the dose of ovaprim needed to stimulate spawning of female catfish is 0.5 mL/kg. According to [46], injection of conjoined catfish using ovaprim can increase the concentration of the gonadotropin hormone in the blood so that it can stimulate egg development and accelerate the process of ovulation. Injecting is one method to include hormones as stimulants of gonad maturity in the broodstock. According to [17], injection using ovaprim is done in back section intra-muscular (muscles) with the position of the needle, forming an angle of 45°. This position was chosen because on the back of the dorsal fin the catfish has quite thick muscles so that injection treatment can be done as well as the small risk of hormone fluid coming out through the injection hole.

3.6. Striped Catfish spawning
Striped catfish which have been selected are then taken to a temporary storage tank or storage tank to carry out the robbery activities. Thirty broodstock were selected, selected ten male and three female broodstock ready for breeding. 13 fishes of catfish that have been selected are then taken one by one for weighing. The results of observations of the weight and gonad maturity of Striped catfish can be seen in Table 6.

| No | Gender | Weight (kg) | Gonad maturity |
|----|--------|------------|----------------|
| 1  | Male   | 2.7        | 4              |
| 2  | Male   | 2.8        | 4              |
| 3  | Male   | 2.7        | 4              |
| 4  | Male   | 3.6        | 4              |
The female weighed was then injected with ovaprim at a dose of 0.5 mL/kg broodstock. Female who has been injected has increased into gonad maturity four after 6 hours from the second injection. The dose of ovaprim given to the female conjoined female catfish can be seen in table 7.

**Tabel 7. Dosage of ovaprim in female catfish**

| No | Gender | Weight (kg) | Dosage of ovaprim (0.5 mL/kg) | Gonad maturity |
|----|--------|-------------|------------------------------|---------------|
| 1  | Female | 4.6         | 2.3                          | 4             |
| 2  | Female | 4.4         | 2.2                          | 4             |
| 3  | Female | 4.1         | 2.05                         | 4             |

Injections are only performed on female Striped catfish and are given twice using ovaprim. According to [46], the process of sequencing the stomach of male catfish that can secrete white sperm can be said to be a gonad mature and ready to be spawned, so there is no need to be injected using ovaprim. The higher the dose of ovaprim given, the more gonadotropins released by the pituitary gland [53]. According to [49], when injecting female is done twice at 15.00 until 21.00 GMT +7, but there is also one time. If done twice, then the first injection is one third, the rest is put on the second injection, with an interval of about 6 hours. This is supported [54] that twice ovaprim injections produce a latent time of 6 hours 8 minutes with the number of eggs striping as many as 241 eggs/gram of the broodstock, and the percentage of egg maturity of 84.444%.

The use ovaprim is added NaCl which functions as a physiological solution or diluent in a ratio of 1:1. In the study of [55], the addition of physiological diluents/NaCl in a ratio of 1:1 produced the highest fertility and egg hatching rates. Ovaprim functions as a fish stimulant agent for spawning, suppressing the spawning season, regulating gonadal maturity during the normal spawning season, maximizing reproductive potential, and stimulating the process of egg removal [46]. The time interval from the injection of a second catfish broodstock until it can ovulate is between 10-12 hours. However, at the interval of 6 hours after the second injection, a check is carried out on the female to find out whether the eggs have come out or not, namely by sorting the broodstock's abdomen slowly.

The treatment of ovaprim injection can increase the level of gonad maturity in the broodstock of Striped catfish that will be spawned, namely from gonad maturity III to IV in the mature/ripe/gravid phase. The increase in gonad maturity is due to ovaprim content which helps accelerate the process of gonad maturation and egg quality in the broodstock of Striped catfish. Ovaprim contains salmon gonadotropin-releasing hormone analogue (GnRHα) with a concentration of 20 µg/mL and dopamine antagonist (domperidone) with a concentration of 10 mg/mL [56]. Hormones given to Striped catfish can increase the gonadotropin-releasing hormone (GnRH) content released by the hypothalamus. Also, the presence of antidopamine will inhibit dopamine activity, thereby increasing the performance of the hypothalamus gland in releasing GnRH [57]. According to [58], the GnRH hormone will affect the pituitary in increasing the release of gonadotropin hormone (GH). GH that has been released by the pituitary then works on the target organ so that it can stimulate egg development or final maturation.

The process after injection uses ovaprim, which is doing stripping or sequencing. Striped catfish check is done by sorting the urogenital part [46]. Catfish broodstock is considered ready to be sorted if
it meets the criteria such as swelling, looks slightly open, and ejects eggs when sorted on the female broodstock. Sorting is done after 10 hours of injection of the two broodstock. According to [59], the latency time or interval between the time injection and the time of egg discharge depends on the dose of ovaprim given. In that study, the latent catfish time was 9 hours over 22 minutes when given an ovaprim dose of 0.6 mL/kg.

Ordering is done by lifting the broodstock and then sort slowly and take care so that the fish are not stressed. Broodstock is ordered from the end abdomen near the dorsal fin to direction of the anus to release the egg. The egg must not come into direct contact with water because the microbial canal will close, and the spermatozoa will not be able to fertilize the egg [60]. Catfish eggs that have come out are accommodated using a basin until enough eggs are taken. Sperm retrieval begins by sequencing the abdomen of the male to the genital organs. Sperm coming out of the male catfish's genital organs are accommodated in a basin that already contains eggs from the sequencing of the female. The eggs and sperm of catfish that have been collected in the basin are then stirred using chicken feathers slowly until the eggs and sperm are mixed evenly. Ripe or good eggs have a diameter between 0.9-1 mm with uniform size, ivory yellow and when in contact with water, the egg will separate or not clump [46]. Stirring time lasts for ± 30 seconds. Evenly mixed eggs and sperm are rinsed 2-3 times using clean water. The first flushing aims to activate spermatozoa which are triggered by the addition of freshwater [60]. The next rinse aims to remove the remaining sperm and mucus. The next step is to spread the eggs in the aquarium that has been prepared.

4. Conclusion

1. Maintenance techniques for Striped catfish include preparation of maintenance ponds, broodstock maintenance, feed management, water quality management, broodstock selection, and spawning that can be done twice a year depending on feed management.

2. The average results of water quality parameters for 25 days are turbidity 17.85 cm, temperature 29.51°C, DO 4.23 mg/L, ammonium 0.005 mg/L, and pH 7.54. Feeding is carried out twice a day with a feeding method of 3% of the biomass weight. The growth in the maintenance of catfish for 21 days is 9.52 grams/day, and a specific growth rate of 0.028%. Catfish spawning uses a ratio of 10 males and three females.

3. The problem faced in the maintenance technique of Striped catfish brooders is the ineffective management of feed which has an impact on the level of gonad maturity in catfish broodstock.

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