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# TECHNIQUE FOR BREDDING CATFISH (CLARIAS GARIEPINUS) AT THE FISHERIES TRAINING AND EXTENSION CENTER (BPPPP) BANYUWANGI

Teknik Pembenihan Ikan Lele (*Clarias dariepinus*) Di Balai Pelatihan Dan Penyuluhan Perikanan (BPPPP) Banyuwangi

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## ABSTRACT

Catfish *(Clarias gariepinus)* Hatchery is a crucial stage in aquaculture to ensure the availability of high-quality fry. The Banyuwangi Fisheries Training and Extension Center (BPPP) has developed effective hatchery techniques, including broodstock maintenance, broodstock selection, spawning, egg incubation, and larval rearing. Male and female broodstock are kept in separate ponds at a density of 2–3 fish per square meter and fed high-protein pellets (30–35%) to accelerate gonad maturation. Broodstock selection is based on physical and gonadal maturity, where females with large, soft abdomens and males with reddish genital papilla, showing healthy and active conditions, are selected. Spawning is carried out naturally using fiberglass tanks measuring 110 cm in length, 80 cm in width, and 50 cm in height, with *kakaban* substrate for egg attachment. After spawning, the broodstock are removed to prevent cannibalism. Egg incubation lasts for 24–36 hours at a temperature of 28–30°C. Larvae are reared in controlled tanks at a density of 500–700 fish/m³ and fed with natural food (*tubifex* worms) and high-protein formulated feed. Water quality management includes monitoring pH (6.5–8), dissolved oxygen (≥5 mg/L), and temperature (28–31°C). To prevent pests and diseases, probiotics in the form of salt water solution and papaya leaf solution are administered at a dosage of 2.5 liters. After 20 days, the catfish fry are harvested and transferred to nursery ponds.

**Keywords**: Catfish, Clarias gariepinus, BPPP Banyuwangi

## ABSTRAK

Pembenihan Ikan lele (*Clarias gariepinus*) merupakan tahap krusial dalam kegiatan budidaya untuk menjamin ketersediaan benih yang berkualitas. Balai Pelatihan dan Penyuluhan Perikanan (BPPP) Banyuwangi telah mengembangkan teknik pembenihan yang efektif meliputi pemeliharaan induk, seleksi induk, pemijahan, penetasan telur, dan pemeliharaan larva. Induk jantan dan betina dipelihara dalam kolam yang berbeda dengan kepadatan 2-3

ekor/$m^2$, diberi pakan pelet yang tinggi akan kandungan protein (30-35%) untuk melaju kematangan gonad. Seleksi induk dilakukan berdasarkan kriteria fisik kematangan gonad dengan memilih betina berperut besar dan lunak sedangkan jantan memiliki kelamin berwarna merah serta kondisi sehat dan aktif. Pemijahan dilakukan secara alami (*Natural spawning*) menggunakan media bak viber ber ukuran panjang 110 Cm, lebar 80 Cm, dan tinggi 50 Cm dengan substrat kakaban untuk menempelkan telur. Setelah proses pemijahan induk dipisahkan agar mencegah kanibalisme. Penetasan telur berlangsung selama 24–36 jam pada suhu 28–30°C. Larva dipelihara dalam bak terkontrol dengan kepadatan 500–700 ekor/$m^3$ dan pemberian pakan alami (Cacing sutra) serta pakan buatan berbasis protein tinggi. Manajemen kualitas air meliputi parameter pH (6,5–8), oksigen terlarut (≥5 mg/L), dan kualitas suhu (28$^o$ – 31$^o$ C). Untuk menanggulangi hama dan penyakit dilakukan pemberian probiotik berupa larutan air garam dan larutan air daun pepaya dengan dosis 2,5 liter. Setelah usia 20 hari benih ikan lele dilakukan pemanenan untuk dipindah kekolam pendederan.

**Kata Kunci**: Pembenihan, Ikan lele (*Clarias gariepinus*), BPPP Banyuwangi

## INTRODUCTION

Catfish (*Clarias gariepinus*) is one of the freshwater fishery commodities that has high economic value and plays an important role as a source of protein for the people of Indonesia. With supportive geographical conditions, such as the availability of fresh water, a suitable tropical climate, and high biodiversity, Indonesia has great potential in developing the freshwater fish farming sector, including catfish. Catfish production in Indonesia reached 1.12 million tons in 2022, reflecting a positive trend in the development of the aquaculture industry (KKP, 2024) and also showing a significant increase in the aquaculture industry (Asiah *et al*., 2020).

One of the key aspects in catfish farming that determines the success of production is the seeding stage. Seeding includes a series of processes such as parent maintenance, spawning, egg hatching, to seed enlargement to a certain size that is ready to be spread in the rearing pond. The quality of the seeds produced greatly determines growth, disease resistance, and feed efficiency in the next stage. In recent years, catfish seeding technology has undergone significant developments, from the use of hormones for artificial spawning to the use of more efficient pond media such as tarpaulin ponds and concrete ponds.

However, natural spawning techniques remain an important alternative, especially in the context of small and medium-scale cultivation, as well as for the purpose of conserving local broodstock genetics. Natural spawning techniques have the advantage of maintaining a reproductive process that is closer to the natural cycle of fish, minimizing the use of chemicals, and being relatively more cost-effective in terms of operational costs.

Good seeding techniques not only contribute to catfish productivity but also support ecosystem sustainability by reducing fishing from nature. Along with the increasing market demand for both domestic consumption and export, innovation in seeding is a key factor in increasing the competitiveness of the national aquaculture industry (Ramadhan and Sari, 2018).

This research was conducted at the Banyuwangi Fisheries Training and Extension Center (BPPP), an institution that plays an active role in developing human resource capacity and community-based fisheries technology. In this study, the natural spawning method was used to determine the effectiveness of the seeding process under controlled environmental conditions. This study aims to evaluate the success of natural spawning in catfish and the quality of the seeds produced, so that it can be used as a model for sustainable seeding practices that can be replicated by local farmers.

With the increasing demand for catfish products in the domestic and export markets, a seeding management strategy is needed that is not only oriented towards quantity but also

quality and sustainability. Therefore, the development of effective, efficient, sustainable, and responsible natural seeding techniques is essential to ensure optimal production without causing negative impacts on the environment.

## RESEARCH METHODS

### Place and Time

This research was conducted at the Banyuwangi Fisheries Training and Extension Center (BPPP), with a period of 2 months starting from November 12, 2024 – January 12, 2025.

### Tools and Materials

The tools used in the research activities include Thermometer, Litmus paper, DO meter, microscope, scales, aeration, vibration tank, net, and scoop.

The materials used during the research activities include catfish broodstock, coarse salt, papaya leaves, silk worms, PF 1000 pellets, and Vitamin E..

### Methods

This study was conducted using a survey method to obtain (Marhawati & Ma'ruf, 2018), relevant data related to the catfish seeding process at the Banyuwangi Fisheries Training and Extension Center (BPPP). Primary data collection was carried out through direct observation of all stages of seeding, interviews with related parties to obtain in-depth information, and active participation in every activity that took place. Meanwhile, secondary data was obtained through a literature review that included various sources of literature relevant to the research material, including previous research results, scientific publications, and official documents that supported the analysis carried out.

## RESULT

### Preparation of Broodstock Pond

The pond is one of the media used in the maintenance of catfish broodstock, at the Banyuwangi Fisheries Training and Extension Center (BPPP) Cultivation Unit/heatchery the pond used is a concrete pond which is divided into 4 types, namely ponds for maintaining male and female broodstock and ponds for maintaining fish that have mature male and female gonads, can be seen in table 1.

Table 1. Data on the size of the pond used for broodstock care.

| Type | Long | Tall | Wide | Amount |
|---|---|---|---|---|
| Male Pool (D2) | 4,9 m | 2,5 m | 1,2 m | 105 ekor |
| Female Pool (E2) | 4,9 m | 2,5 m | 1,2 m | 102 ekor |
| Male Gonad Maturity (B1) | 1,9 m | 1,9 m | 1,8 m | 6 |
| Female Gonad Maturity (B2) | 2,9 m | 1,9 m | 1,8 m | 4 |

### Feed Management

Feed management is one of the determining factors for fecundity and egg quality, during the research activities the frequency of feeding the catfish broodstock was 2 times, namely in the morning at 07.30 and in the afternoon at 15.30 with a percentage of 50% in the morning and 50% in the afternoon. good quality feed also affects the rate of maturity of catfish broodstock. According to (Cahyani and Hafiludin 2022), the dose of catfish feed is 3% of the biomass weight, so that the amount of daily feed intake that is given to catfish can be known. can be seen in table 2.

Table 2. Data on nutritional content in catfish broodstock feed.

| Contents | Amount |
|---|---|
| Protein | 31 % |
| Fat | 5 % |
| Fiber | 5 % |
| Ash Content | 13 % |
| Water Content | 12 % |

**Water Quality Management**

The process of controlling water quality management is a step in managing various parameters and water conditions to meet the standards required in maintaining catfish broodstock. During the research activities, there were 3 water parameters that were used as benchmarks to provide an efficient environment for the growth rate of catfish broodstock. Among them are temperature, pH, and dissolved oxygen levels or DO (Dissolved Oxygen). Water quality checks were carried out twice a day, which were carried out in the morning at 07.30 and in the afternoon at 15.30 with an average temperature measurement result as stated in table 3.

Table 3. Data on the results of checking the water quality parameters of the catfish broodstock pond.

| Parameter | K. Male | K. Female | K. MG Female | K. MG Male | Optimal |
|---|---|---|---|---|---|
| Temperature (º) | 28º - 35ºC | 28º - 35ºC | 28º - 32ºC | 28º - 32ºC | 20-30 (Augusta, 2016) |
| pH | 7 | 7 | 7 | 7 | 6-8 (Afdan *et al*., 2023) |
| DO (ppm) | 3,6 ppm | 3,7 ppm | 3,6 ppm | 3,4 ppm | 5,5 (Liliyanti *et al*., 2024) |

**Parent Selection**

After going through various stages of care, the catfish broodstock must first be selected to determine which broodstock are gonad mature and ready to spawn. One of the objectives of this selection is to obtain superior and healthy broodstock so that when spawning time comes, it produces superior seeds that are resistant to various environmental conditions according to the opinion of (Hutagalung 2021) broodstock selection is an important activity to determine the quality of good broodstock in order to improve the quality of the seeds produced, there are several special characteristics that must be possessed by broodstock that are ready to spawn as stated in table 4.

Table 4. Characteristics of catfish broodstock ready to spawn.

| Male | Female |
|---|---|
| Age reaches one year. | The stomach is large and soft when touched. |
| The genitals are clearly pointed. | The genital hole is red. |
| The body color is slightly reddish. | The genital hole is slightly enlarged. |
| The body is slender and the movements are agile. | If the stomach is massaged towards the anus, yellow eggs come out. |

**Rebellion**

One of the stages carried out before spawning is the fertilization. The fertilization activity was carried out at the Banyuwangi Fisheries Training and Extension Center (BPPP) Fish

Cultivation Unit/Hatchery for 24 hours. According to the opinion of (Hartanti *et al*., 2023), the purpose of fertilization is to reduce the fat content in the egg outlet channel so that when the eggs are released, it can run smoothly because the egg outlet channel is free from fat.

**Preparation of Spawning Place**

The place used for catfish spawning is a round viber tank with a diameter of D: 2 m and T: 0.8 m. Before spawning, preparation of the place has been done first, such as cleaning the viber tank by brushing it, so that pests and diseases in the pond can be removed. The pond is dried for 1 day. After the pond is dry, the pond is filled with water to a height of 30-40 cm. The spawning pond is first provided with a kakaban made of coconut fiber as a place for egg attachment, the size of the kakaban is adjusted to the size of the viber tank. One pair of parents requires 3 kakaban which are adjusted to the size of the pond because it is feared that there will be more eggs at the bottom of the pond so that the eggs rot and do not hatch. The kakaban is placed at the bottom of the pond and on top of it is given a weight in the form of a brick, the aim is so that all the kakaban remain in a sinking condition at the bottom of the pond.

**Spawning**

The spawning technique used is natural spawning, which is by combining male and female broodstock that have mature gonads then into one tub that has been provided with kakaban media. This spawning uses a ratio of 1: 1 (1 male and female broodstock). Spawning usually occurs at 24.00 WIB to 04.00 WIB. During the spawning process, water quality must always be maintained by measuring the water parameters that have been presented in table 5.

Table 5. Data on water quality measurements during spawning.

| Parameter | Spawning Pool | Optimal |
|---|---|---|
| Temperature (°) | 28° - 29°C | 20-30 (Augusta, 2016) |
| pH | 7 | 6-8 (Afdan *et al*., 2023) |
| DO (ppm) | 4,5 ppm | 5,5 (Liliyanti *et al*., 2024) |

**Egg Care and Hatching**

The male and female catfish broodstock after spawning are immediately lifted and put into the original broodstock pond because it is feared that the eggs will be damaged and eaten by the male and female catfish broodstock. After the broodstock is lifted, the kakaban is moved to the egg hatching tank until the eggs hatch, similar to the opinion of (Maryeni *et al*., 2022) if the broodstock has finished spawning, then the kakaban containing eggs is moved to the hatching tank. The tank used for hatching eggs is rectangular with dimensions of P: 1.2 m, W: 0.8 m, and T: 0.5 m. Fertilized eggs will hatch for 48 hours 2 days 2 nights from spawning, during the egg care and hatching process, water parameters are always controlled to ensure stability, which is presented in table 6.

Table 6. Data on water quality measurements during egg care and hatching.

| Parameter | Spawning Pool | Optimal |
|---|---|---|
| Temperature (°) | 28° - 30°C | 20-30 (Augusta, 2016) |
| pH | 7 | 6-8 (Afdan *et al*., 2023) |
| DO (ppm) | 4,3 ppm | 5,5 (Liliyanti *et al*., 2024) |

**Reproductive Parameters**

Fecundity

Fecundity is the total number of eggs that will be produced by fish during spawning. To find out fecundity, use the following formula:

$$F = (Wg/Ws) \text{ x } N$$

FR (*Fertilization Rate*)

*Fertilization Rate* (FR) is the number of eggs fertilized by sperm, according to (Nainggolan *et al.,* 2023) is the process of spermatozoa entering the egg cell through the micropyle and joining the egg cell nucleus. To find out the FR, use the following formula:

$$\text{FR (\%)} = \frac{\text{Number of fertilized eggs}}{\text{Total eggs counted}} \times 100\%$$

HR (*Hatching Rate*)

*Hatching Rate* (HR) is a calculation of the hatching rate of the number of eggs. To find out HR, use the following formula:

$$\text{HR (\%)} = \frac{\text{Number of eggs hatched}}{\text{Total eggs counted}} \times 100\%$$

**Seed Maintenance**

The seed maintenance process is a critical stage in the seeding cycle which includes several stages, namely starting from feed management, water quality management, monitoring seed growth, and controlling pests and diseases. Feed management is carried out after the seeds are D4, for ages D1-D3 the seeds still have food reserves in the form of egg sacs (yolk sacks). The natural feed used is in the form of silk worms and additional plankton from green water. After the age of D8 the seeds begin to be trained to use artificial feed, namely PF 1000 pellets which are moistened with the content listed in table 7. After the age of D12 the seeds can use PF 1000 pellet feed in its entirety. The dose required for catfish seeds is 10% of the biomass weight and the frequency of feeding is 3 times a day with a percentage of 30% at 07.30 am, 35% at 13.00 pm, and 15.30 pm.

Table 7. Data on nutritional content in catfish seed feed.

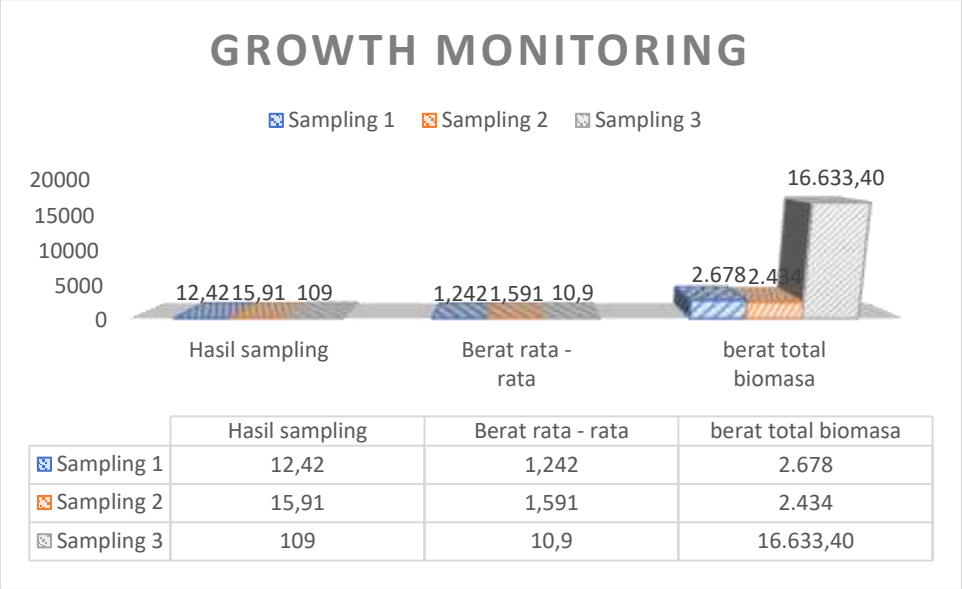
| Contents | Amount |
|---|---|
| Protein | 39 % |
| Fat | 6 % |
| Fiber | 3 % |
| Ash Content | 11 % |
| Water Content | 10 % |

Apart from feed management, the success of the seed maintenance cycle also depends on regular water quality control to maintain the stability of the water parameters presented in table 8.

Table 8. Data on water quality measurement results during seed maintenance.

| Parameter | Spawning Pool | Optimal |
|---|---|---|
| Temperatu re (°) | 27° - 31°C | 20-30 (Augusta, 2016) |
| pH | 7 | 6-8 (Afdan *et al*., 2023) |
| DO (ppm) | 3,6 ppm | 5,5 (Liliyanti *et al*., 2024) |

Controlling seed growth or sampling must also be done to determine seed growth in terms of weight and biomass length. Controlling or sampling activities during the study were carried out every 15 days, which can be seen in Figure 1. The sampling process was carried out by taking 20 catfish seeds to measure the weight and length of the fish seeds so that the average fish growth was known during the 15-day period.




| | Hasil sampling | Berat rata - rata | berat total biomasa |
|---|---|---|---|
| Sampling 1 | 12,42 | 1,242 | 2.678 |
| Sampling 2 | 15,91 | 1,591 | 2.434 |
| Sampling 3 | 109 | 10,9 | 16.633,40 |

Figure 1. Data from monitoring or sampling of catfish seeds

Obstacles that are often faced when maintaining seeds are being attacked by pests and diseases. During the implementation of the research, there were several findings of pests and diseases that attacked catfish seeds which can be seen in table 9.

Table 9. Data on nutritional content in catfish seed feed.

| Pests and Diseases | Reason | Countermeasures |
|---|---|---|
| Fungal Infection | Temperature Fluctuations | Giving noni fruit |
| Lizard | Lack of Protection | Cover the seed tray with a net |
| White Disease | Bacteria | Giving salt water solution |

## DISCUSSION

Catfish seeding has several processes and stages that must be considered. Before the spawning process, the catfish broodstock is first treated starting from pond preparation, feed management, water quality measurement, to pest and disease control.

The initial stage for broodstock care is preparing the pond starting from cleaning the pond with a brush and broom to remove moss that is still attached to the bottom of the pond. The size of the pond used in broodstock care is listed in table 1 both in terms of size and type of pond. After the cleaning process, the pond is dried first for 1 day so that germs and bacteria

that are still attached to the walls or bottom of the pond can be killed by the high temperature of sunlight and also so that the smell from the dry pond can accelerate the maturity of the catfish broodstock gonads. The next stage is filling the broodstock pond with water from the water tank that is already available at the Banyuwangi Fisheries Training and Extension Center (BPPP).

Feed management for catfish broodstock is carried out by providing good feed to accelerate the maturity of the broodstock. During the research activities, feeding of catfish broodstock was done using pellets mixed with vitamin E which aims to accelerate fertility in egg formation. The total feed consumed during one day was around 3 kg with 1.5 kg given in the morning and 1.5 kg in the afternoon with the nutritional content listed in table 2.

Measuring water parameters is a mandatory thing that must be done in seeding activities. There are 3 water parameters that are used as benchmarks during research activities, including temperature, pH, and DO. From the results of measuring water quality parameters listed in table 3, it shows that there is a significant increase in temperature in the afternoon which touches around 35o C because the catfish broodstock pond is directly exposed to direct sunlight without any barriers. Quoted from (Haliyani 2021) that the optimal temperature for catfish growth is at 25o C- 30o C. The pH levels obtained during the study were still at the optimal level, namely 7 because according to the opinion of (Pamungkas, et al. 2024) pH values less than 7 are acidic and pH values more than 8 are alkaline. Meanwhile, the levels of dissolved oxygen or DO during catfish broodstock maintenance activities are still in the range of 3.6 ppm, this figure is still not optimal because it refers to the optimal level in the table at 5.5 ppm, a decrease in DO usually occurs in the morning which is caused by the accumulation of carbon dioxide released by plankton and the absence of water circulation that occurs at night while during the day the DO quality increases due to plankton in the waters releasing oxygen and continuous water circulation.

Diseases and pests that attack during the broodstock maintenance process are infected catfish broodstock with White Spot Disease or white disease which is characterized by the appearance of white spots on the skin or fins of the fish and broodstock infected with white disease will experience itching and will rub their bodies on the walls of the pond. The control of this disease is carried out by treatment by separating them from other broodstock or isolating them from healthy broodstock and then giving them probiotics in the form of a solution of coarse salt and squeezed papaya leaf water with the initial step of reducing the water in the treatment tank by 50% from the initial volume height, soaking with salt solution and papaya leaves is done for 30 minutes, then the water is refilled according to the initial volume of the treatment tank.

After the broodstock maintenance process is carried out properly, the next stage in catfish seeding carried out at the Banyuwangi Fisheries Training and Extension Center (BPPP) Fish Cultivation Unit/Hatchery is the spawning process with several stages starting from preparing the pond, the parent selection stage by looking at the genital characteristics of mature gonad fish, the spawning stage with a ratio of 1 male to 1 female and the use of kakaban as a medium for attaching eggs, monitoring the egg hatching process until they become larvae to the larval maintenance stage starting from maintaining water quality stability to feed management and overcoming pests and diseases.

The pond or place used for spawning at the Banyuwangi Fisheries Training and Extension Center (BPPP) Fish Cultivation Unit/Hatchery is a round viber tank with dimensions of D: 2 m and T: 0.8. Cleaning the viber tank uses a brush to remove dirt that is still stuck to the sides and bottom of the tank so that the dirt can be clean and does not become a source of disease. After being cleaned, the vibration tank is dried to remove bacteria that have been cleaned and also to produce spawning stimulant odors. The process of filling water into the

vibration tank is carried out using a pipe connected to a water machine from a fresh water tank with a water height reaching 35 cm from the height of the vibration tank. The installation of an aerator is also needed to supply oxygen content to the spawning tank and create an atmosphere like the spawning season, the function of the aerator according to (Arifin, et al. 2022) is to meet the needs of dissolved oxygen levels in the water. After installing the aerator, the installation of the kakaban as a medium for releasing eggs for the female parent is continued. The kakaban used is made of coconut fiber combined with two pieces of bamboo and tied with rope at both ends of the bamboo. The kakaban used is 3 pieces, according to (Star and Junianto 2024) the kakaban functions as a medium for laying catfish eggs.

The broodstock used for spawning is first selected by looking at the genitals (papillae) to see the maturity of the gonads in the male broodstock and has red genitals, an enlarged stomach and when touched has a soft texture for the characteristics of female catfish broodstock. Before the merging process, the broodstock is first weighed for biomass and measured for length with a weight of 2 kg length 67 cm for the female broodstock and 1.7 kg length 65 cm for the male broodstock.

The spawning is carried out before spawning with the aim of knowing whether the catfish's body really contains eggs or fat. Female catfish containing eggs will not shrink after the spawning, but when the catfish's stomach shrinks, this is because of the accumulation of fat. The spawning is usually carried out for 24 hours, after the spawning process the catfish broodstock is then combined in a viber tank that has been prepared for spawning activities..

The spawning technique used during the study used a natural spawning technique, namely by selecting male and female broodstock that have mature gonads and then putting them together in one pond that has been provided with kakaban media. The catfish broodstock will spawn during the night between 24.00 and 04.00 in the morning. Spawning according to (Matriadi *et al*., 2023) the female broodstock releases eggs and the male broodstock releases sperm simultaneously. During the spawning process, water parameters are also controlled in terms of temperature, pH, and DO, so that the spawning process runs smoothly, from the measurement results listed in table 5 showing that during the spawning process the water quality is very good and without significant fluctuations in water parameters.

After the spawning process is complete, the catfish broodstock are immediately moved to prevent cannibalism from the catfish broodstock towards the eggs. Fertilized eggs are brownish yellow in color while unfertilized eggs are cloudy white. The egg hatching process is carried out in a different tub from the spawning with a rectangular shape with a length of 1.2 m, a width of 0.8 m, and a height of 0.5 m. This stage is considered the most critical in the seeding cycle because it determines the survival of fish seeds. The transfer is carried out from the spawning tub to the hatching tub and the eggs are cared for until they become seeds, according to (Prihatini, 2018) the transfer and collection of kakaban is carried out after the eggs hatch into larvae. The egg hatching process lasts for 24 to 48 hours. The development of the eggs is seen using a microscope provided in the laboratory of the Banyuwangi Fisheries Training and Extension Center (BPPP) to facilitate monitoring the development of the eggs. Water quality measurements were also carried out at the egg hatching stage as listed in table 6.

To check the reproductive parameters, several strands of ijuk on the kakaban containing catfish eggs were cut to be placed in the aquarium with a total of 386 eggs. The weight of the catfish before spawning was 2 kg while after spawning it became 1.8 kg. the weight of the eggs in the female parent was 200 grams, in 1 gram there were 386 eggs, then the fecundity value or the total number of eggs was 77,200 eggs, because referring to the opinion of (Iswanto, et al. 2016) the fecundity of the pearl catfish is relatively high. Dumbo catfish which ranges from 50,000-100,000 eggs per kg of weight while the Sangkuriang catfish parent has a fecundity of around 40,000-60,000 eggs per kg of parent weight. For the FR (Fertilization Rat) value itself,

namely the eggs are in the aquarium as a sample calculation totaling 386 eggs, but only 329 are fertilized, so the FR result is 80%. While for the HR (Hatching Rate) value of 329 fertilized eggs after a period of 48 hours, only 243 larvae, therefore the HR result from the spawning process is 74%, this figure is still relatively unstable when referring to the opinion (Baharudin *et al*., 2016) the sangkuriang type reaches 90%, while the dumbo catfish is 80%.

During the 3-day period after hatching, catfish fry still have food reserves called yolk sacks. Feed management is given when the egg yolk is finished by giving natural feed in the form of silk worms and additional plankton from green water until the age of D7 fry, when entering the age of D8 the fry begin to be trained using artificial feed in the form of PF 1000 pellets which are moistened using water with the pellet feed content listed in table 7. After entering the age of D12 the fry can use PF 1000 feed without being moistened. The dose required for catfish fry is 10% of the biomass weight, the provision of feed for fry that have used pellet feed in its entirety is determined through sampling by taking a sample of 20 fry. From the results of the first sampling it is known that the daily feed requirement for catfish fry is 267.8 grams with the frequency of feeding divided into 3 times, namely in the morning as much as 30% the amount of feed is 80.3 grams while for the afternoon and evening the percentage of feed given is the same as 35% with a total of 93.7 grams. After entering the age of D20, catfish seeds were sampled again to determine their growth and daily feed requirements. In the second sampling, the feed dose required by the seeds remained the same, which was 10% of the biomass weight, but there was a decrease in the amount of feed given from the initial 267.8 grams to 243.4 grams due to the reduction in the seed population due to high levels of cannibalism and the presence of dead seeds. The usefulness of the sampling process in addition to determining the daily feed dose is also to determine the growth of the seeds, from the data already listed in Figure 1, the increase in the growth of catfish seeds was quite rapid, it is known that in the first sampling with the number of fish sampled as many as 20 seeds had an average weight of 1.24 grams, but at the time of the second sampling the average weight of the fish increased to 1.59 grams, while in the third sampling the weight of catfish seeds experienced very significant growth with an average weight of 10.9 grams. From the sampling data, it can be concluded that the seeding activities at the Banyuwangi Fisheries Training and Extension Center (BPPP) Fish Cultivation Unit/Hatchery are classified as optimal. In addition to growth monitoring, water parameter checks are also carried out regularly during the seed maintenance process with the results listed in table 8. The quality of water parameters obtained during seed maintenance is considered optimal and in accordance with the levels referred to in previous studies.

Pests and diseases are one of the obstacles in seeding activities, during the study, diseases were found that attacked both catfish broodstock and catfish seeds. The disease that attacks the broodstock is White Spot Disease or white disease which is characterized by the appearance of white spots on the fins and fish infected with this disease will rub their bodies on the bottom of the pond or the walls of the pond caused by the itching caused by this disease. At the Banyuwangi Fisheries Training and Extension Center (BPPP) Fish Cultivation Unit/Hatchery, the control of catfish broodstock infected with the disease is seen from the behavior of the fish. If the fish are known to behave abnormally such as being attacked by disease, then treatment measures need to be taken by reducing the water by 50% from the initial volume of the pond, then adding coarse salt dissolved in water. Soaking in salt water solution is carried out for 30 minutes then the water is refilled according to the initial volume. The dose of salt water solution given is 5 grams of coarse salt for 10 liters of water. According to (Ash'ari *et al*., 2023) the use of coarse salt for fisheries aims to normalize the pH level of the water, overcome parasitic attacks on fish and inhibit the growth of moss. Fungal and bacterial infections also attack catfish seeds caused by erratic rainfall and temperature fluctuations during seed care which cause quite

a lot of mass deaths of catfish seeds, which initially numbered around 50 thousand to 2567 and accompanied by high cannibalism. This is done by separating the ogolan catfish seeds in order to reduce the level of cannibalism in the seeds and providing probiotics in the form of a solution of coarse salt water mixed with papaya leaves and providing noni fruit to prevent the seeds from bacterial and viral infections and increasing the body's resistance by providing noni fruit..

## CONCLUSION

From the results of the study above, it can be concluded that catfish seeding activities at the Banyuwangi Fisheries Training and Extension Center (BPPP) are carried out through systematic and measurable stages starting from parent care, spawning process, egg hatching, to seed maintenance. The parent care process includes pond cleaning, feed management, water quality measurement, and disease prevention. Spawning is carried out naturally using kakaban media, with water parameter monitoring to support fertilization and egg hatchability. Seed management is carried out by providing gradual feed according to age and sampling to monitor growth. Disease control uses natural ingredients such as coarse salt, papaya leaves, and noni fruit. From the results of monitoring fecundity, FR, HR, and seed growth rate, seeding activities are classified as successful even though they are faced with challenges such as temperature fluctuations and cannibalism. Overall, the seeding process at BPPP Banyuwangi shows optimal and applicable results for the development of catfish cultivation in Indonesia.

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