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ARTIFICIAL HATCHERY TECHNIQUES FOR SIAMESE CATFISH (*Pangasianodon hypopthalamus*) AT THE FRESHWATER AQUACULTURE FISHERIES CENTER, GELAM RIVER, JAMBI

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ABSTRACT

Siamese catfish (Pangasianodon hypopthalamus) is a type of fish that is included in the catfish group, this fish has a fairly large market so the demand for catfish is increasing from year to year. The main obstacle to the production of catfish seeds is the spawning cycle of Siamese catfish which still depends on the season, so optimization is needed in the supply of seeds through artificial spawning with the help of hormonal stimulation. This study aims to examine techniques for artificially hatching Siamese catfish using the hormone ovaprime and evaluate the performance of Siamese catfish hatcheries. The time for carrying out this research was 3 months using the observation method, participating directly in Siamese catfish hatchery techniques and through interviewing sources in the field of catfish hatchery. Siamese catfish hatchery techniques start from preparing the container, rearing the brood stock, selecting the brood stock, spawning, injecting, stripping, fertilizing, hatching, and raising the larvae until they become seeds and are ready for distribution. Based on the results of research on artificial seeding techniques for Siamese Catfish (Pangasianodon hypopthalamus) at the Gelam Jambi River Freshwater Aquaculture Fisheries Center (BPBAT), it produces an average fecundity of 170,394.75 eggs/kg. Meanwhile, the fertilization rate for four cycles averaged 69.54%, and the hatching rate was 68.95%. The problem with hatching Siamese catfish at BPBAT Sungai Gelam is that the availability of natural food is not sufficient for the needs and quantity required for larvae at the start of rearing, causing a decrease in larval survival rates.

Keywords: *Hatchery techniques, Siamese catfish, Pangasius hypophthalmus, artificially, seeds*

INTRODUCTION

Siamese Catfish (*Pangasianodon hypopthalamus*) is a native freshwater fish that lives along the Mekong River which crosses various countries including China, Myanmar, Laos, Thailand, Vietnam and Cambodia. This fish has been introduced to various Southeast Asian countries including Indonesia and is thought to have been introduced to Indonesia from Thailand around 1972 as a commodity for consumption and ornamental fish cultivation (Ansari *et al.,* 2013). The catfish that are generally cultivated in Indonesia are local catfish that live in the river waters of Sumatra and Kalimantan and Siamese catfish that are introduced from Thailand (Amri & Khairuman, 2008).

The Siamese catfish (*Pangasianodon hypopthalamus*) Pustina strain is a new variety developed at the Sungai Gelam Freshwater Aquaculture Fisheries Center (BPBAT), Jambi. This fish has fast growth compared to other types of catfish in general. This has been proven through trials of 3 generations, which have advantages such as resistance to disease. And this type of catfish can cut growth time up to two times. So that it can increase the economic productivity of catfish farmers (Oktopura, 2022).

The hatchery stage is one aspect that can influence the level of success of fisheries production, because at this stage the fish seeds will grow quickly along with optimal feeding. The critical stage or level of vulnerability of farmed fish is at the larval to fry stage, because the fish's body is still susceptible to disease attacks or the surrounding environment (temperature, pH and dissolved oxygen) and requires good quality and quantity of food consumed. Therefore, to reduce negative impacts that can affect fish growth, an environment that can be engineered is needed (Idawati *et al.,* 2018).

Increasing fish seed production is determined by the quality of the brood stock, environmental quality, availability of natural food, and the hatchery techniques applied. A good parent will produce good seeds. Fish seeds will have higher growth if the water used for rearing and the feed provided are of good quality (Perangin Angin, 2023).

So that the increase in the number of catfish production in Indonesia can always be met, of course it must be balanced with the availability of sufficient and good quality Siamese catfish parent stock which will ultimately produce seeds that have qualities like their parents so that sustainable Siamese catfish production can be achieved. In cultivation activities, seeds are a link in the chain whose quality will determine business success because quality seeds can be maintained and developed in subsequent segments until they reach consumption size (Irwan *et al.,* 2019).

A problem that often occurs in the management of Siamese catfish brood stock is the low egg hatch rate due to inappropriate water quality used in cultivation. Apart from that, the low hatch rate is thought to be caused by catfish eggs being adhesive or sticking so that the flow of oxygen to the eggs that are stuck together is reduced and can cause fungus to grow on the catfish eggs (Fani *et al.,* 2018).

Catfish management needs to be improved because of the large market demand and relatively high selling prices (Tariningsih *et al.,* 2015). Domestic market demand for catfish consumption per capita tends to increase every year, reaching 21.9% starting from 2014 to 2017 with a preference for products consumed as fresh fish as much as 76%, foreign preserved fish 15% (KKP, 2018). National catfish production is greatly influenced by the availability of sufficient catfish seeds for fish farmers. The success of a catfish hatchery business is largely determined by quality input and a good production process. The quality of fish seeds greatly determines the output of catfish that will be produced. If the catfish seeds are of good quality then it is likely that the catfish fish for consumption will also be of good quality (Yulfiperius *et al.,* 2003).

Currently, in Indonesia there are several catfish production centers, such as in Jambi, Palembang, Riau, Lampung, West Java, South Kalimantan and Central Kalimantan. This is inseparable from government support through catfish cultivation development programs initiated by the Ministry of Maritime Affairs and Fisheries to encourage and achieve the target of increasing national catfish production. The Sumatra region as one of the catfish production centers can contribute around 68.07% of national catfish production and one of the largest catfish production centers in Sumatra is Jambi Province. Jambi occupies the fourth position in catfish production in Indonesia, namely it can produce around 60 tons of catfish/day (KKP, 2019) so that it can be encouraged to become a national fish barn, especially as a catfish commodity.

The aim of this research is to be able to carry out hatching activities for Siamese catfish (*Pangasianodon hypopthalamus*) at the Jambi Freshwater Aquaculture Fisheries Center (BPBAT), to be able to calculate fecundity, (Fertilization Rate) FR, (Hatching Rate) HR, (Survival Rate) and SR (Survival Rate), as well as being able to determine the growth rate in the Siamese catfish (*Pangasianodon hypopthalamus*) hatchery technique at the Sungai Gelam Freshwater Fisheries Cultivation Center (BPBAT), Jambi, can analyze the problem of hatching Siamese catfish (*Pangasianodon hypopthalamus*) at the Freshwater Aquaculture Center BPBAT) Gelam River, Jambi.

MATERIALS AND METHODS

This research activity was carried out for 3 months starting from January 12 2024 to March 30 2024 at the Gelam River, Jambi Freshwater Aquaculture Fisheries Center (BPBAT). The method used in this research is the survey method. The survey method aims to see the situation that is the object of research as it is, by looking at the data and information in the sample, without paying special attention (Indrawan & Yuniawati, 2014). Meanwhile, the method used to acquire and improve skills is the participatory method.

Participation is spontaneous involvement accompanied by awareness and responsibility for the interests of the group to achieve common goals (Andreeyan, 2014).

The data sources in this research are primary data and secondary data. Primary data is data collected by an individual/an organization directly from the object under study and for the purposes of the study in question, which can be in the form of interviews and observations. Collecting data by direct observation or direct observation is a way of collecting data using the eyes without the help of standard tools for this purpose. Meanwhile, secondary data is data obtained/collected and combined by previous studies or published by various other agencies. Usually, indirect sources are official documents and archives (Situmorang, 2010).

Before carrying out data analysis, it is necessary to process the data first. The data processing stage in this research includes editing and tabulation. Editing is checking or re-examining data that has been collected to find out and assess the suitability and relevance of the data collected for further processing. Tabulation is a further step after inspection and coding. In this stage the data is arranged in tabular form to make it easier to analyze the data in accordance with the research objectives (Tika, 2005). The calculation formula used is as follows:

Fecundity (F)

The fecundity value is calculated using the formula according to Effendie (1979), as follows:

$$Fecundity = \frac{Number\ of\ egg\ (items)}{Wt} \text{ ..... (1)}$$

Information, Wt: Average weight of fish at time t (g)

Fertilization Rate (FR)

The degree of egg fertilization is calculated using the formula referring to Effendie (2002), as follows:

$$FR\ (\%) = \frac{Number\ of\ fertilized\ eggs\ (items)}{Number\ of\ sample\ eggs\ (items)} \times 100 \text{ .. (2)}$$

Hatching Rate (HR)

The degree of egg hatching is calculated using the formula referring to Effendie (2002), as follows:

$$HR\ (\%) = \frac{Number\ of\ hatched\ eggs\ (heads)}{Number\ of\ fertilized\ eggs\ (heads)} \times 100 \text{ ..... (3)}$$

Survival Rate (SR)

Survival rate is the percentage of the number of live fish at the end of the observation divided by the number of live fish at the start of the observation. The calculation formula used is as follows:

$$SR(\%) = \frac{Number\ of\ viable\ seeds\ at\ the\ end\ of\ observation\ (tails)}{Number\ of\ seeds\ at\ the\ begining\ of\ observation\ (tails)} \times 100 \text{ ..... (4)}$$

Embryogenesis

Embryo development is observed microscopically, namely observing egg development starting from the spreading process until the eggs hatch at intervals of every two hours. Data on egg development were observed descriptively.

RESULT AND DISCUSSION

Preparation of hatching containers

The container used for hatching catfish eggs is a hatching funnel with a volume of 15 liters. The funnel is connected to a larval reservoir where the larvae have been installed with "*hapa*" to accommodate newly hatched larvae. The funnel is equipped with a paralon pipe as a water recirculation channel, where the water flow will stir the eggs so they don't stick together. Egg stocking density is around 500 ml/funnel. The flow and volume of water in the funnel are regulated using the water tap located in each hatching funnel so that the eggs are completely stirred perfectly.

Figure 1. Larval hatching funnel

The next stage is the preparation of a larval rearing container using a rectangular aquarium measuring 2 m x 1 m x 0.8 m with a maximum stocking capacity of 25,000 larvae per aquarium and a seed rearing container in the form of a cement tank lined with HDPE with a size of 11 m x 5 m x 1 m, with a stocking density of 250,333 fish/tank. Preparation activities for larval rearing containers include washing the container and outlet pipe, rinsing, installing a heater in the aquarium, and filling with water. Preparation of larval rearing tanks can be seen in the following **Figure 2**.

Figure 2. preparation of larval rearing tanks (a) HDPE tank cleaning, (b) Aquarium cleaning

Parent Maintenance

The main rearing container used is a concrete pond with a rectangular ground base with an area of 150m^2 and a depth of 1.5m. The number of catfish brood stock ponds is 14 ponds with a stocking of 150 broodstock per pond.

Table 1. Composition of parent feed pellets

No	Tipe	Pellet
1	Protein	Min 39-41%
2	Fat	Min 5%
3	Crude Fiber	Max 6%

Feeding of the brood stock is done once a day, namely at 14.00 WIB, the percentage of feeding the brood stock is 1% of the total biomass of the brood stock being reared. The main feed given is Hi-Provite floating pellets and sinking pellets produced by BPBAT Gelam River which have a protein content of 35-40%. This is in accordance with the opinion of Stageari *et al.* (2018), providing parent feed with a protein content of 36-38 percent is given in an amount of 0.8-1 percent of the biomass weight per day, or if the feed given has a protein content of 28-30 percent, then the amount of feed given is two percent of the fish biomass weight per day. The feeding method is done manually or hand feeding at a three-point feeding site. Feeding is adjusted to weather conditions, if it rains then feeding is not carried out. Following the maintenance of brood stock by providing food can be seen in the following **Figure 3**.

Figure 3. (a) Maintenance pond, (b) Feeding, (c) Sinking feed

Parent Selection

Parent selection is the initial stage in spawning, where parent selection is carried out in the morning by netting the parent pool. check the maturity of the gonads visually and cannulate using a catheter. The catheter is inserted into the urogenital opening slowly, the

eggs are sucked out using the catheter. The eggs obtained are placed in a cup or in the hand to be observed. Ripe or good eggs have a uniform size, are ivory yellow in color, male parents whose gonads have matured will release white fluid when they are massaged from the abdomen towards their urogenital organs, while in female parents it can be seen from the size of the stomach which looks bulging and if you touch the parts stomach skin feels soft and thin. The characteristics of a parent with mature gonads can be seen in the following **Table 2**.

Table 2. Characteristics of mature gonads

No	Female Parent	Male Parent
1	The stomach is enlarged and the skin surface is thin	The stomach is large and elongated
2	The urogenital area is swollen and dark red	Genitals are dark red
3	The egg cells are uniform in size and white in color	Spermatozoa cells are milky white

Examination of the maturity of the gonads in male catfish parents is carried out by massaging the papillae slowly. If the sequencing is carried out in the urogenital direction, thick sperm fluid will be released which is white and does not contain blood. Meanwhile, in the female parent that will be spawned, the abdomen looks enlarged when touched and feels soft, and the urogenital opening looks red (Iskandar *et al.,* 2022). Next, the brood stock that have gone through the selection process will be put into a sack and weighed to determine how many doses of ovaprime will be injected, then the catfish brood stock will be placed in the *"hapa"* according to the brood number to make the injection process easier for the fish.

Figure 4. (a) Observation of eggs, (b) Pond screening, (c) Catfish egg

Siamese Patin Fish Spawning Technique

Injection

The selected parent catfish that have undergone a period of deformation will then undergo an injection process. This injection is carried out at night around 21.00 WIB, this aims to ensure that the fish experience ovulation. Injecting brood stock using the ova prime hormone, ova prime is a hormone that functions to stimulate and stimulate gonadotropin hormones in the fish's body, thereby speeding up the ovulation and spawning process (Astiyani *et al.,* 2021). The injection is carried out on the right and left back of the dorsal fin or the dorsal part (intramuscular) in the thickest part of the flesh so as not to touch the parent's spine at a 45º angle. After the hormone is injected into the parent's body, the syringe is slowly pulled out while the injection mark on the fish's back is sequenced in one direction towards the front towards the parent's head so that the hormone solution can enter more optimally. This is in accordance with the opinion of Fani *et al.* (2018), after the injection the fish will be stripped for 12 hours for stripping the next day.

Figure 5. Parent injection using the ova prime hormone

Stripping

Ovulation in catfish parents occurs after 12 hours of injection. Checking ovulation can be done by slowly massaging the female's stomach towards the genital opening if the egg is released. The female is ready to carry out the stripping process. Next, the parent will be anesthetized using a stabilizer, so that during the stripping process the parent will not put up a fight.

Table 3. Latent time in Siamese catfish broodstock, 1

	Parent	Parent Weight (Kg)	Egg Weight (g)	Ovulation time	ESI(%)	*Latency period*	Ovulation rate (%)
Cycle1	1	4	568	09.00	14,2%	12 hours	100%
	2	5	1.190	09.05	23,8%	12 hours past 5 minutes	
	3	5	756	09.07	15,12%	12 hours past 7 minutes	
	4	4	700	09.10	17,5%	12 hours past 10 minutes	
	5	5	680	09.12	13,6%	12 hours past 12 minutes	
	Total	23	3.894		1.738,6%		
	Average	4,6	778,8		347,72%		

Based on the **Table 3**, an ovulation rate of 100% was obtained in the first spawning cycle from the five brood stock that successfully ovulated, while in the second cycle there were two brood stock that did not ovulate, resulting in an ovulation rate of 81.8%, for the third brood stock the ovulation rate was 100. % and in the fourth cycle the ovulation rate is also 100%. The success of ovulating female catfish can be influenced by hormonal and environmental factors. In accordance with Leonita *et al.* (2021), which states that the success rate of the mother is due to the condition of the mother who will be injected and after the injection, apart from that ovulation can also occur due to environmental signals received by the central nervous system which are then transmitted to the hypothalamus. Based on the data above, the latent time for both cycles is 12 hours. The latent time lasts quite a long time so it is necessary to check regularly, if it is too long it can cause the egg to accumulate with other eggs (overlap). The long latency time is because the egg has not developed optimally so that the egg follicle has not ruptured (Leonita *et al.,* 2018). Other factors that can influence latent time include the quality of the parent (age, size and whether or not they spawn frequently), egg quality, quality of the male parent and type of hormone (Putra *et al.,* 2019).

The parent that will be stripped will first be subjected to anesthesia so that the fish do not resist during the stripping process. Before stripping, the surface of the mother's skin and fins is first dried using a dry towel and tissue. This is in accordance with the statement of Ihwan *et al.* (2021), the stripping process is carried out using the dry method (dry stripping) by drying the fish's stomach area so that the egg cells are not exposed to water which can cause the egg to harden and the micro phyll hole is closed so that sperm cannot enter to fertilize the egg. The male and female parents who have been stripped, then collect their sperm in a bowl or glass and give 0.9% NaCl as a diluent, while the eggs obtained from the female parent are collected in a dry basin. The stripping process on the main can be seen in the following **Figure 6**.

Figure 6. (a) Anesthesia, (b) stripping, (c) Weighing the egg

Fecundity

Fecundity calculations were carried out by taking egg samples three times, then the egg samples were weighed and the eggs were counted manually to get the average number of eggs produced by the catfish mother.

Table 4. Percycle fecundity

No	Cycle	Fecundity
1	Cycle 1	240.719,73
2	Cycle 2	132.558
3	Cycle 3	152.933,8
4	Cycle 4	155.279,4
	Average	170,394,75

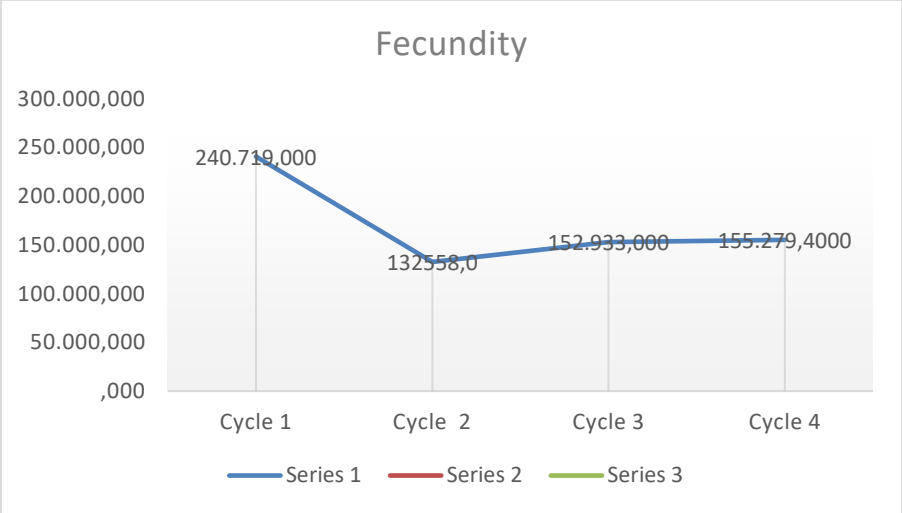

Diagram 1. Fecundity

Based on the graph above, in the first cycle the quality of the eggs produced was relatively high due to the increase in feeding with protein which was relatively high than usual. In the second cycle, the fecundity of the eggs decreased. This decrease in fecundity occurred because during parent selection that week the weather changed to the rainy season, this affects the resulting egg power. For cycles 3 and 4, the resulting fecundity is fairly normal. Based on these data, the fecundity produced by the parent both in the first cycle to the fourth cycle is classified as high with an average of 170,394.75 eggs/kg, this is in accordance with the National Standards Agency (2016), which states that the fecundity value for Siamese catfish is around between 120.000-200.000 items/ kg. The high level of fecundity is thought to be due to the excellent quality of the brood stock (gonad maturity), apart from that, the dosage and type of hormones also influence catfish fecundity. This is in accordance with the statement by Leonita *et al.* (2021), that the ova prime hormone contains GnRH which stimulates the pituitary to produce Follicle Stimulating Hormone which functions for egg maturation and Luteinizing Hormone which functions for the ovulation process, so that the function of these two hormones can accelerate the maturation and release of eggs.

Fertilization Rate

Based on the **Table 5**, the number of fertilized eggs gives a percentage of the degree of fertilization. The results of calculating the degree of egg hatching in cycles 1,2,3 and 4 are as follows, the degree of fertilization in the first cycle with an average of 84.8%, the degree of fertilization in the second cycle with an average of 81.77%, in the third cycle it is 77, 07% and the fourth cycle was 48.93%. Based on this data, the degree of fertilization from the four cycles obtained a high total average result of 69.54%. In accordance with research by Fani *et al.* (2018), stated that the percentage of fertilized eggs above 50% is considered high, while the percentage of fertilized eggs of 30-50% is considered medium and below 30% is considered low. The high rate of egg fertilization is thought to be because the egg cells are successfully fertilized evenly by the sperm produced by the male parent.

Table 5. Fertilization rate Persiklus

No	Cycle	Fertilization Rate
1	Cycle 1	84,8%
2	Cycle 2	81,77%,
3	Cycle 3	77,07%
4	Cycle 4	48,93%
	Average	69,54%.

Based on the results of observations of egg hatching in cycles 1, 2, 3 and 4, the results obtained from these four cycles were 68.95%. The results obtained from this internship activity are quite high when compared to research by Ihwan *et al.* (2021), with an egg hatching rate of 8.6%. The low hatching rate of eggs can be caused by the large number of eggs not being fertilized due to sperm not entering the micro phyll hole of the egg and the high density of eggs causing them to build up until they become rotten. Apart from that, other factors that can influence the success of egg hatching include egg quality, water quality and handling during hatching

Table 6. Hetching Rate

No	Cycle	Hetching Rate
1	Cycle 1	84,8%
2	Cycle 2	81,77%
3	Cycle 3	77,07%
4	Cycle 4	48,93%
Average		68,95%

Conception

The egg fertilization process is carried out by mixing the sperm into the egg holding basin. Next, stir gently until all the eggs are evenly mixed with sperm. According to Ihwan *et al.* (2021), stirring is carried out for ± 1.5 minutes to increase fertilization and thin sperm. The egg has been mixed with sperm, then mineral water is added until the entire egg appears to be submerged in water while stirring, then left for approximately three minutes so that the sperm can fertilize the egg. This is in accordance with Tahapari *et al.* (2019), that after the eggs and sperm are evenly mixed, the sperm is activated by adding sterile water rich in oxygen. The fertilized eggs are then rinsed using water to remove any remaining sperm. Image of fertilization in the following **Figure 7**

Figure 7. Fertilization a) Mixing of male sperm, b) fertilized egg, c) Giving mineral water with normal pH to activate sperm

The fertilization process takes place quickly because sperm moves actively when exposed to water. Next, the eggs are rinsed with clean water to remove the mucus found in the eggs when mixed with sperm. The rinse water is discarded and continued with the addition of soil solution which has been separated and filtered from dirt. The process of adding red soil solution can be seen in the following **Figure 8**.

Figure 8. a) Giving red soil, b) Red soil that has been cleaned

The purpose of adding the soil solution is to eliminate the adhesive force on the eggs. According to Fani *et al.* (2018), washing eggs using red soil solution affects egg quality because catfish eggs are adhesive which has the potential to cause mold on the eggs. The red soil solution has a very small particle size and its texture can cover the mucus on the eggs so that the eggs will separate and not stick. In the next stage, the eggs are filtered and rinsed again with clean water to remove the soil solution before being placed into the hatching funnel. Like the following **Figure 9**.

Figure 9. a) Red soil flushing, b) Packing larvae

Egg Hatching

Egg hatching is carried out in a hatching funnel or funnel system. Where the eggs that have been washed clean will be put into plastic packing, then the eggs will be taken to the hatching place where the catfish eggs will be hatched in funnels where each funnel has a stocking density of 500 ml per funnel. The flow and volume of water in the funnel are regulated using a water tap located in each hatching funnel so that the incoming water flow can stir the eggs perfectly so that the eggs do not clump. The following image of larvae hatching in the funnel is shown in the following **Figure 10**

Figure10. Egg hatching

During the process of hatching eggs until they become larvae, the water flow is continuously turned on and regulated slowly so that the incoming water is continuously replaced to carry oxygen. According to Anjar *et al.* (2022), in the egg hatching process using a funnel system there is a flow of water which causes the eggs to continue to move constantly so that the eggs hatch more quickly and the degree of hatching is higher in the funnel system compared to the tray system. Water quality measurements such as pH and temperature are carried out before and after the eggs are placed into the hatching funnel. The results of measuring the pH of the water in the hatching funnel were 6.5-6.8 and the water temperature was around 28 - 30oC. According to SNI 01-6483.4-2000, the appropriate temperature for egg hatching media is around 27 - 30oC and the appropriate water pH is 6.5 - 8.5.

Calculation of the degree of fertilization or Fertilization rate (FR) is carried out 6-8 hours after fertilization. Egg samples were taken from the hatching funnel and fertilized eggs were observed. Fertilized eggs are counted by placing egg samples in a petri dish, where eggs fertilized by sperm appear clear in color, while unfertilized eggs are milky white. Observation of egg development (embryogenesis) using a Nikon SMZ-10A microscope. Observation of eggs was carried out by taking a sample of fertilized eggs using a pipette of 5 -10 eggs, then placing them in a

"*petri dish*" and observing them under a microscope.

Harvest Larvae from Hatching Eggs

Larvae harvesting is carried out at 02.00 WIB and is carried out in stages because the eggs do not hatch simultaneously. Harvesting is done in the morning when the temperature is not hot, thereby reducing the level of stress on the larvae. The eggs hatch into larvae, then the larvae will swim to the surface of the funnel and exit through a pipe connected to the *"hapa-hapa"* in the larvae reservoir. Next, the larvae that are inside the "hapa" are removed using a seser or scoopnet and placed in an aerated fiber tub with a volume of 200 liters. The handling of transferring the hatched larvae from the happa to the fiber tub is carried out quickly because the "hapa" which is full of larvae becomes heavy and the larvae will easily come out of the "hapa". Next, the larvae were counted as shown in the **Figure 11**.

Figure 11. a) Sampling Larvae, b) fiber tub, c) Harvesting larvae

After harvesting, the total larvae will be peeled and transferred to seeding tanks where the stocking density for one tank is around 250 thousand/tub. Based on the **Table 7**, the performance of the four seeding cycles averaged 371,336 individuals.

Table 7. Total yield of larvae in cycles 1, 2, 3 and 4

Cycle	Volume (ML)	Sampling Mean Larvae	Density (tails/L)	Container Volume	Number of larvae(tails)
1	100	283,3	2.833	200	56,666
2	100	579	5.791	200	710,666
3	100	345,6	3.456	200	691.333
4	100	134	1340	200	26.800
	Average				371,366

Feed management

Larvae Feed

The main factor that supports successful seed management is the availability of adequate and sustainable natural food. Natural food is needed in hatchery activities, especially at the larval stage.

1. Natural Feed

a.Artemia feed

Artemia natural feed is one of the natural feeds used in fish farming activities, especially at the larval rearing stage. The size of the artemia is small so that it fits the mouth opening of the catfish larva. Artemia also has a high nutritional content so it can be used on catfish larvae to meet the nutritional needs of catfish and support faster growth of catfish. According to Hafezieh *et al.* (2009), Artemia is given to larvae from two days old to five days old larvae. The advantage of Artemia as natural food is that it contains pigment (canthaxanthin), protein, vitamin C, and several fatty acids that are important for the growth and survival of larvae.

The stages in carrying out artemia culture are by preparing a culture container using a conical tank with a volume of 35 liters. There are 6 units of conical tanks used for artemia culture which are adjusted to the time of feeding the larvae. The process for culturing artemia is to add 20-35 liters of water, then add 250g of sea salt per 10 liters of water and baking soda. Next, enter artemia at a dose of 50-150 ml and give strong aeration. According to Stageari *et al.* (2013), strong aeration is introduced into the bottom of the hatching container to increase dissolved oxygen and for the stirring process so that Artemia cysts do not settle at the bottom of the container. cultured. Harvesting of artemia is carried out

after 24 hours of culture by removing the outlet pipe attached to the aeration hose, then leaving the artemia for approximately 3-5 minutes to settle the artemia shell. After settling, artemia can be removed by opening the tap at the bottom of the conical tank and filtered using a plankton net. Artemia is rinsed using fresh water so as not to affect the salinity of the larval rearing medium.

Figure 12. Artemia Culture

Feeding artemia is done when the larvae are two days old after hatching because when they are two days old the egg yolk in the larvae starts to run out so the larvae start looking for food. Artemia begins to be given to larvae on the second day at 19.00 WIB and the next feed is given at intervals of 4 hours. The frequency of giving artemia in a day is six times at 03.00 WIB, 07.00 WIB, 11.00 WIB, 15.00 WIB, 19.00 WIB, and 23.00 WIB. The administration of Artemia continues for five days during the larval rearing period.

b. Tubifex sp feed.

Tubifex or silk worm feed begins to be given when entering the sixth day of the larval rearing period. The silk worms that are given are first finely chopped to suit the size of the larva's mouth opening. Next, the chopped silk worms or tubifex are rinsed with clean water to remove dirt, mud and blood that is still mixed with the silk worms. The natural tubifex feed can be seen in the following **Figure 13**.

Figure 13. Silk Worm (*Tubifex* sp)

The amount of tubifex administered is 600 ml – 800 ml which is regulated and adjusted to the availability of tubifex. The frequency of giving tubifex is six times a day and is carried out until the larvae enter the 14th day of rearing period. Silk worms that have been finely chopped and rinsed of dirt are then added to clean water until they reach the amount given to the aquarium. Giving tubifex to each aquarium is 500 ml–600 ml which is spread evenly in each part of the aquarium.

2. Artificial Feed

When the larvae enter two weeks of age, natural feeding begins to stop and the larvae begin to be taught to recognize artificial food. Entering the age of two weeks, the larvae's body organs are complete and look like the shape of an adult catfish. This is followed by an increase in the size of the larvae so that the larvae are moved from the aquarium to the nursery tank I. Catfish larvae that have developed into fry are then given artificial feed in the form of powder which is adjusted to the larva's mouth opening, namely PF 100 then continued with PF 500. Nutritional content of the feed larvae can be seen in the following **Table 8**.

Table 8. Nutrient content of larval and fry feed

Type of Feed	DOC	Feed Size (mm)	Nutrient Content				Source	Feed Dosage
			Protein	Fat	Ash	Fiber		
Artemia sp.	2-5	-	60%	20%	*Artemia* sp.	-	Wibowo *et al. (*2013)	*500 ml*
Tubifex	5-14	-	57%	13,3%	*Tubifex*	2,04%	Hidayat *et al.* (2016)	*600-700 ml*
PF 100	14-28	0,4-0,7	40-42%	6%	PF 100	3%	Feed packaging	-
PF 500	>28	0,5-0,7	40%	6%	PF 500	3%	Feed packaging	-

The seeds that have been transferred to nursery tank I are starting to be given artificial food. The method of feeding the fry is by ad satiation or until the fish are full and do not appear to be chasing food. Catish are a type of bottom feeder fish or search for food at the bottom of the water, so the way to feed the seeds so they come to the surface and respond to the food given is by spreading the food little by little on the edge of the tank to lure the seeds to come to the surface. Next, if the seeds are seen clustered on the surface, continue to encourage the seeds with food to swim towards the corner of the tub, this is to teach the seeds to gather to find food at one feeding point. After that, the food continues to be distributed evenly so that all the fish get to eat. If you see the seeds starting to bulge, stop feeding. The frequency of feeding is four times a day, namely at 07.00 WIB, 11.00 WIB, 15.00 WIB and 19.00 WIB.

Water quality

Water quality is one of the factors that can influence the spawning process or hatching process of Siamese catfish eggs. Based on the **Table 9**, the water quality values in brood stock rearing ponds and hatching funnels are classified as stable and in accordance with the range required by fish and eggs.

The temperature value in the main pond is 29.3^{o}C, the dissolved oxygen level is 6.7 mg L-1, and the pH value is 7.76. In the hatching funnel, the temperature value was 28.4^{o}C, the dissolved oxygen level was 6 mg L-1, and the pH value was 7.89. The water quality value is still classified as optimal according to what fish and eggs need because it is still within the range of water quality standards in accordance with the National Standardization Agency, for temperature values ranging from 25-30oC, dissolved oxygen levels of >4 mg L-1 and pH values of 5.5-8.5 (National Standards Agency, 2016).

Table 9. Water quality measurements

No.	Parameter	Pool		SNI:01.6483.3-2016
		Parent	Hatchery	
1	Temperature (^{o}C)	29,3	28,4	25-30
2	Dissolved Oxygen (mg L^{-1})	6,7	6	>4
3	pH	7,76	7,89	5,5-8,5

Rearing of larvae and fry

1. Monitoring Larval Growth Rate

Sampling was carried out by taking 10 samples and then measuring the length of the seeds from the tip of the mouth to the tip of the tail using a ruler. Seed length measurements were carried out every seven days. The absolute length measurement is used to calculate the increase in fish length during rearing, using the formula according to Jaya (2013). A picture of measuring larval length can be seen in the **Figure 14**.

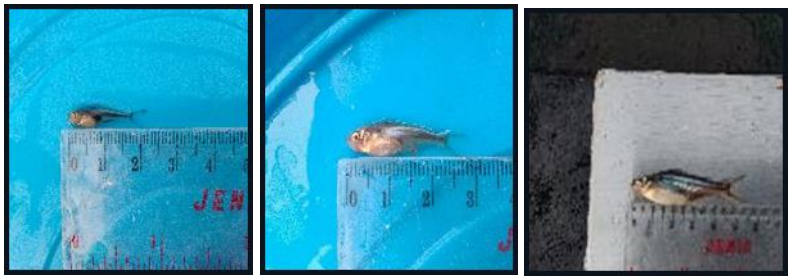

Figure 14. Seed growth sampling

Seed length sampling was carried out during the final practice using 10 seeds which were taken at random and the body length of the seed was measured from the tip of the mouth to the tip of the tail of the seed so that the development of the average length of the seed each week during the rearing period could be seen. The growth graph can be seen in the **Diagram 2**.

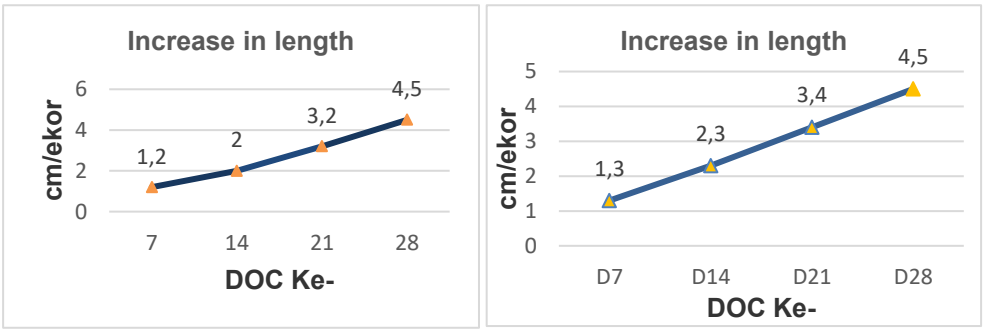

Diagram 2. Measuring seed length; (a) seeds in a concrete tank, (b) seeds in an aquarium

Based on the graph above, it can be seen that during the rearing process, catfish fry have a significant increase in body length, but there is a difference in the body length of the fry stocked in concrete tanks measuring 55m^2 and aquarium containers measuring 2m^2. The difference in body length between fry reared in an aquarium and a concrete tank is thought to be due to the provision of natural food at the start of rearing which is insufficient for the number of larvae being reared. Providing natural food to fry kept in an aquarium container is easier to control because the volume of the container is smaller, making it easier for the fry to find food. Apart from that, better maintained aquarium water quality helps increase the fry's appetite. The survival rate results in nursery 1 with a stocking density of 25,000/aquarium1 produced 18,125 fry/aquarium1 with a seed survival percentage of 72.48%.

Seeds sown in concrete tub maintenance containers gave slightly lower growth in length in the first and second weeks. This is thought to be because the fry reared in concrete tanks are still in the adjustment phase to their environment so that the fish fry are slow to respond to food and competition occurs in obtaining this food (Wangni *et al.,* 2019). This is in line with the opinion of Fujaya (2008) in Wangni *et al.* (2019), if the number of individuals in the water is too large, it is not proportional to the condition of the food, competition for the food can occur and the seeds will not respond to the food provided as a result of their lack of adaptation to the environment. The growth table can be seen on the attached page.

Pests and Diseases

During the production process of Siamese catfish seeds, no diseases or viruses were found that attack catfish larvae. However, when the larvae began to enter the nursery phase, parasites were found that attacked the seeds, namely Dactylogyrus and Oodinium. According to Mahatma (2012) in Munawwaroh & Rahayu (2017), Dactylogyrus sp. is a parasite that lives in the gills, where the mature parasite will attach to the gills and lay eggs there. Fish infected with Dactylogyrus sp. shows several symptoms, including: increased mucus production, changes in the color of the gills to pale and whitish and increased breathing in the fish. This worm parasite can damage the gill filaments and is relatively difficult to control so it is quite dangerous for fish. Meanwhile, the parasite Oodinium sp. including a type of protozoa that attaches to fish using a flagellum which then forms sucking rods (legs) and can enter the skin and mucous membranes of the fish's gills. Once

adult size, Oodinium sp. will break away from its host and swim freely in the water, then divide into dozens of new cells ready to look for a new host. Treatment carried out during the research was routine water circulation by changing new water to reduce infections caused by parasites.

Harvest and Post-Harvest

Harvesting is done when the seeds are 28-35 days or 4 weeks old by grading to separate the seeds according to their size. The seeds to be harvested are fasted from the morning with the aim of emptying the fish's stomach so that they do not release too much waste during the harvesting process. According to Ismi *et al.* (2016), fermentation of larvae before distribution is carried out with sufficient time so that during the transportation process the seeds are in an empty stomach so that the water quality in the plastic packaging remains clean. Harvesting is done by netting the fish, then the netted fish are taken and graded. The seeds that have been separated according to their size are weighed and the number is counted to determine the fish biomass. In nursery 2, the stocking density in rearing tanks was 14,000 birds/tank1, the results of rearing during nursery 2 were 11,250 birds/bin1. Patin seeds are usually sold to cultivators in the Sumatra and Lampung regions. There are two seed distribution systems, namely closed and open systems. The determination of the two distribution systems is carried out based on the delivery distance, where if the delivery distance is far enough an open delivery system will be used using fibers that have been filled with water and given oxygen. Meanwhile, if the delivery distance is close, a closed system is used, namely using plastic packing which has been filled with 3-5 liters of water at a temperature of 28-30°C and given oxygen until the plastic is ¾ filled, then the plastic is tied using rub.

CONCLUSIONS AND SUGGESTION

.Catfish hatchery activities start from preparing the container, rearing the brood stock, selecting the brood stock, spawning, injecting, stripping, fertilizing, hatching, and raising the larvae until they become fry and are ready to be distributed. Based on research results on artificial seeding techniques for Siamese catfish (*Pangasianodon hypopthalamus*) at the Gelam River, Jambi Freshwater Aquaculture Fisheries Center (BPBAT), it produces an average fecundity of 170,394.75 kg-1. Meanwhile, the degree of fertilization (Fertilization Rate) for four cycles averaged 69.54%, and the degree of hatching (Hatching Rate) was 68.95% and SR was 72.48%. The problem with hatching Siamese catfish at BPBAT Gelam River is that the availability of natural food is not sufficient for the needs and quantity required for larvae at the start of rearing, causing a decrease in larval survival rates.

It is necessary to plan and manage larval food well before starting spawning to ensure the availability of sufficient larval food during larval rearing activities and proper air treatment needs to be carried out to prevent and reduce disease infections due to parasites that develop in the waters which can threaten the survival of catfish seeds. as well as stocking air quality equipment in each division, to minimize the spread of disease from one place to another, considering that the process of raising seeds is very susceptible to disease and viruses.

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