IRDH International Journal of Technology, Agriculture & Natural Sciences
https://irdhjournals.com/ijtans
Vol 1, No 3 (2024) : November. E-ISSN : 3032-2286

Hatchery Techniques For Black Tilapia (*Oreochromis Niloticus*) in Technical Implementation Unit–Freshwater Aquaculture Fisheries (UPT-PBAT Sukorejo), Malang Regency, East Java

Lilin Kurniawati[1], Lisa Elida[2], Siti Nur Kholissotin [3]
* *Correspondence Author: kurnialilin17@gmail.com*
[1,2,3] Faculty of Fisheries and Marine Sciences, University of Airlangga, Surabaya, Indonesia

I N D E X I N G
Keywords:
Keyword 1; Hatchery
Keyword 2; Techniques
Keyword 3; Black Tilapia
Keyword 4; Aquaculture
Keyword 5; Freshwater

A B S T R A C T
Tilapia (*Oreochromis niloticus*) is an introduced fish popular in Indonesia because it has high nutritional and economic value. The Regional Government of Malang Regency through the Regency Fisheries Office Malang carried out tilapia hatchery activities which is one of the fish commodities. This research was conducted at the Technical Implementation Unit–Freshwater Aquaculture Fisheries (UPT-PBAT Sukorejo), Malang, East Java, Indonesia. This research was carried out from July 11, 2022 to August 31, 2022. The method used in this research was participatory. Method Participatory is a method that is carried out by involving the workforce as well as participants in all activities carried out to achieve a purpose The data collection method in the research included collecting primary data and secondary data. The hatchery technique of black tilapia consists of several stages Among them are egg-hatching techniques, larval maintenance, and seed maintenance black tilapia. In addition, the pond used in tilapia hatchery black water quality management, pest and disease checks, and business feasibility of the cultivation. Black tilapia (*Oreochromis niloticus*) hatchery carried out in UPT – Freshwater Aquaculture Fisheries (PBAT) Sukorejo, Malang. It was concluded that seeding was carried out naturally using the spawning with a ratio of 1 : 3. The number of male fish is 50 and the number of fish 150 females per pond. Obstacles and problems in fish hatchery black indigo (Oreochromis niloticus) in UPT – PBAT Sukorejo include the lack of Empty pond setup for spawning and seed keeping.

Article History
Received 20 October 2024; Revised 01 November 2024; Accepted 17 November 2024

INTRODUCTION

Tilapia (*Oreochromis niloticus*) is an introduced fish popular in Indonesia because it has high nutritional and economic value. This fish has Some advantages including easy to plant, fast growth, ability to digest foods high in carbohydrates, tolerance to changes in environment, being fed natural or artificial feed, and good durability against disease attacks (Prabu *et al*., 2021). Fish Tilapia is designated as one of the leading commodity freshwater fish species Because the cultivation technology is relatively easy and the price is affordable for the community (Aliah, 2017). Therefore, tilapia attracts the attention of the fish farmers and the ease of breeding so that it can attract the attention of fish farmers, as well as described by Cai *et al* (2017).

Seeding is an activity or starting point in doing business aquaculture development. Seed availability is a factor that affects the sustainability of tilapia farming. Tilapia hatchery generally through natural spawning. This fish can spawn as long as a year, especially in the rainy season. Good seed quality will guarantee yield good production as well. Adequate availability of seeds in terms of quantity, quality, and sustainability must be guaranteed so that development efforts and cultivation can run well (Afriani, 2016). Tilapia hatchery is generally carried out en masse using a large pond or tub that is filled with many tilapia broodstock. The ratio of male to female Tilapia used in seeding in general is 1 : 3 (Sulistiyarto *et al*., 2021 ; Kibenge, 2022).

Seeing the potential for tilapia cultivation that is quite large and potential. The Regional Government of Malang Regency through the Regency Fisheries Office Malang carried out tilapia hatchery activities which is one of the fish commodities at UPT - PBAT Sukorejo, Malang Regency. Activities Seeding is one of the stages of cultivation activities. Cultivation activities It has several stages, namely seeding and enlargement. The seeding stage is an important stage because at this stage cultivators strive to produce offspring - superior offspring that will have a strong influence on the next stages of cultivation, as well as described by Muhaimin and Hamdani (2021).

LITERATURE REVIEW

The Biology of Tilapia (*Oreochromis niloticus*)

The life cycle of tilapia begins with the male digging a nest at the bottom pond, and then mating with several female fish. Usually male fish make nests in shallow waters. After a quick mating process, the fish female lays eggs in a nest that has been made by the male fish. The female fish will lay 2-4 eggs/gram of the female brood. The eggs will be fertilized by the male mother and will be nursed by the female mother in her mouth (buccal cavity) until it hatches. The fry will remain in the mouth of the female broodstock through the absorption of the yellow sac eggs and is often sheltered in his mouth for several days, as well as described by Dailami *et al*. (2021).

Tilapia classification according to Wober *et al* (2021) is as follows:

- Kingdom : Animalia
- Phylum : Chordata
- Class : Osteichthyes
- Order : Percomorphii
- Family : Cichlidae
- Genus : Oreochromis
- Species : *Oreochromis niloticus*

The Hatchery of Tilapia

The parent selection is carried out on a scoop net which can be seen starting from body shape, gender, body color, and checking the health of the fish. It is done so that the selected broodstock is good before the spawning process is carried out so that the quality of eggs or larvae can be increased. Physically it can be seen by the presence of a hole. Urogenital and characteristics of the secondary genitals. Female broodstock has weight It ranges from 300–400 grams/head, while in males ranges from 400–500 grams/head. Fish spawning uses a 1:3 ratio pair and is carried out Massively. Fish spawning naturally starts from the male mother making spawning nests with a diameter of 30-50 cm. After that, the

female mother will inhabit the nest that has been made until the female mother is approached by male fish and the spawning process occurs. At this stage the female brood Releases eggs and the male mother Releases sperm. The spawning process of Tilapia goes very fast. It takes 50 to 60 seconds for the fish and the female produces 20-40 eggs. The next process is for the female brood to incubate the egg in the mouth. This female mother is a mouth breeder which means that the egg is incubated in the mouth. The mouth of the female mother can be seen to grow when incubating the eggs (Sumarni, 2018 ; Path, 2024 ; Sucipto, 2024).

RESEARCH METHOD

Time and Location of the Research

This research was conducted at the Technical Implementation Unit–Freshwater Aquaculture Fisheries (UPT-PBAT Sukorejo), Malang, East Java, Indonesia. This research was carried out from July 11, 2022 to August 31, 2022.

Working Method

The method used in this research was participatory. Participatory method is a method that is carried out by involving the workforce as well as participants in all activities carried out to achieve a purpose (Kezar and Maxey, 2016). The implementation of work methods during street vendors is to observe and participate in all activities related to engineering black tilapia hatchery (*Oreochromis niloticus*) at UPT-PBAT Sukorejo. Black tilapia hatchery activities include preparing ponds for broodstock selection, spawning, egg hatching, and egg count calculation to determine the Fertilization Rate (FR) and Hatching Rate (HR), larval rearing, and seeds to determine the Survival Rate (SR).

Data Collection Method

The data collection method in the research included collecting primary data and secondary data. Primary data is data obtained directly from the source original. Primary data can be in the form of individual opinions of the subject (person) or group, the results of observation of an object (physical), event, or activity, and test results (Sangadji and Sopiah, 2010). Primary data that has been taken includes dense stocking, larval maintenance, water quality from broodstock to seeds, feed management in brood to seed, total broodstock spawning, FR (Fertilization Rate), HR (Hatching Rate) of eggs, SR (Survival Rate) of seeds, and growth of larvae.

According to Djaelani (2013), there are 3 techniques in primary data collection, namely observation, active participation, and interviews. Observation is the recording of the behavior patterns of subjects, objects, or events systematically without any questions or communication with individuals (Sangadji and Sopiah, 2010 ; Visser *et al*, 2021). The observations carried out in this study were carried out on various matters related to Tilapia (*Oreochromis niloticus*) hatchery techniques. Interview The research was conducted by way of question and answer with the staff of the center, field supervisor, or person concerned about history, structure organization, infrastructure, spawning techniques, and tilapia hatchery techniques (*Oreochromis niloticus*). Active participation carried out in Field Work Practice is by following direct activities related to hatchery techniques such as broodstock selection, The process of spawning, hatching eggs, and maintaining larvae to nursery seeds in tilapia hatchery techniques (*Oreochromis niloticus*).

Secondary data is data or information collected for a specific purpose or as scientific knowledge. Data can be obtained from literature and reports from previous research. Secondary data is Primary data that is further processed in the form of graphs, tables, diagrams, drawings, and so on so that it is more informative for other parties to use or researchers for further processing.

RESULT AND DISCUSSION

The Profile of the Technical Implementation Unit–Freshwater Aquaculture Fisheries (UPT-PBAT Sukorejo)

Based on Malang Regent Regulation Number 36 of 2016, the Fisheries of Malang Regency have the task of carrying out Regional government in the field of fisheries based on the principle of autonomy from duties assistance. UPT-Freshwater Aquaculture (PBAT) Sukorejo is one of the elements of operational technical implementation at the Marine and Fisheries Service Malang Regency. UPT – PBAT Sukorejo has the main task of carrying out fish hatchery management and assisting with direct guidance to UPR (People's Hatchery Unit) to increase production and clean quality.

The building of UPT - PBAT Sukorejo began construction in the Fiscal Year 2006. Previously (1952 to 2005) UPT - PBAT was located on Kebonsari Street No. 84 Sukun District, Malang City which was formerly known as the name BBI Kebonsari. Along with the relocation of the Office office in Kepanjen, The PBAT building was also moved to Sukorejo Village to become UPT – Fisheries Sukorejo Freshwater Cultivation until the present. UPT - PBAT Sukorejo is located in Sukorejo Village, Sub-district Gondanglegi, Malang Regency. UPT - PBAT has a total area of ±15,219 m^2 with 12 main ponds covering an area of ± 4,000 m^2 in the Western part and 19 pools (quarantine and nursery) ± 3,800 m^2 other areas used as office buildings, feed warehouses, laboratories, hatchery wards, seed packaging and an area of 3,480 m^2 at UPT - PBAT station Jatiguwi with 1,590 m^2 Pools, others for office buildings and courtyards.

Figure 1. Office of the UPT-PBAT Sukorejo, Malang
(Source : Author's Documentation, 2022)

In carrying out its duties, UPT - PBAT Sukorejo has a function next:

a) Carry out the operational authority of the agency in the field of fish hatchery.
b) Seed producers for fish cultivation and the spread of fish seeds in Public waters.
c) Preparation of superior parent candidates in supporting the People's Hatchery Unit
d) Facilities where the adoption and adaptation of hatchery techniques are carried out
e) Preparation of a plan for the development of facilities and infrastructure within the UPT-PBAT
f) Supervision and quality control of broodstock and fish fry to Implement certification in the region.

g) Distribution of seeds from seeding technology that has been tested in the field to the People's Seeding Unit
h) Organizers of partnership pattern cooperation in the field of hatchery business fish in the context of the development of freshwater aquaculture
i) Organizer of UPT office administration - Aquaculture Fisheries Insipid
j) Implementation of planning and evaluation of task activities for directing to the target.

Hatchery Techniques of Black Tilapia

The hatchery technique of black tilapia consists of several stages Among them are egg-hatching techniques, larval maintenance, and seed maintenance black tilapia. In addition, the pond used in tilapia hatchery black water quality management, pest and disease checks, and business feasibility of the cultivation. There are stages in the egg hatching technique starting from the preparation ponds, broodstock preparation, broodstock selection, and spawning, to hatching eggs from fish black indigo. Each black tilapia broodstock can produce as many as 2000 grains of egg.

a. Pool Preparation

Pool preparation consists of several stages, including drying soil, soil reversal, liming, fertilizing, and pond water filling. The pond used at UPT - PBAT Sukorejo, Malang is made of concrete with mud or soil that is still at the bottom of the pond. After the pond soil is turned over using a hoe, the pond at UPT-PBAT Sukorejo is carried out a liming process. This activity uses dolomite lime as much as 15 kg for one pond. Dolomite lime is a lime material that is commonly used in the agricultural industry to reduce soil acidity and add elements of calcium and magnesium. Calcium and magnesium are essential minerals necessary for the formation of fish bones and skeletons (Umari *et al*., 2017). Liming is carried out by sowing evenly on the pond soil that has been turned over. The Sukorejo UPT-PBAT pond that has been limered, will then be fertilized. Fertilization at this location uses artificial goat manure fertilizer A total of 25 kg for one pond is used to fertilize the soil. In addition, the purpose of providing fertilizer is to grow natural feed in the pond after the pond is filled with water (Salsabila and Suprapto, 2018).

b. Broodstock selection

The parent to be used is a parent that has matured the gonad. Mother mature gonadal females have an enlarged abdomen with Sluggish movements with the genitals slightly reddened and protruding. When massaged from the abdomen to the anus, it will release a white liquid yellowish while the male mother secretes a milky white liquid (Nainggolan, 2019). Black tilapia broodstock found in UPT-PBAT Sukorejo, Malang is maintained for 9 months until it is ready to be raised. According to Saline and Subasinghe (2022), and also Fregene *et al* (2024), tilapia can spawn with a weight of 250 grams at the age of 4-6 months. The parent that is maintained is Healthy broodstock is not deformed and has complete morphology. Broodstock maintenance males and females are carried out separately in the rearing pond for giving a gonad concoction to speed up the ripening process of gonads before stocking in spawning ponds.

Parent selection is an activity by selecting or separating mature brood gonads, complete body organs, and healthy fish conditions. The mothers who have been caught will be visually selected by looking at the body shape, gender, and body color, and checking

the health of the fish judging from the presence or absence of disease in the parent. The parent selection aims to select a good broodstock to use the spawning process so that it can produce a good quality and quantity of eggs (Sumarni, 2018). The differences between male and female tilapia include Male tilapia mothers having a large and rounded body shape, the body color being brighter, the genital organs are in the form of small and tapered protrusions, and the mouth is wider. Meanwhile, the female mother has a smaller and elongated body shape, Faded body color, concave genital organs, and a smaller mouth , has been described by Iskandar *et al*. (2021).

c. Spawning

Spawning is a mating process that occurs between tilapia mothers males and females so that egg fertilization occurs. Spawning of Black Tilapia in UPT-PBAT Sukorejo, Malang is carried out naturally. Spawning of male broodstock and females using a ratio of 1 : 3 (Iskandar *et al*., 2021). Fish used in UPT - PBAT Sukorejo is black tilapia with a weight of 500 -900 grams/head as many as 50 males and 150 females per pond with Size a 12 x 18 m^2, the depth of the pool is 1 meter, and the water level is 50 cm. Broodstock stocking at UPT - PBAT Sukorejo, Malang was carried out in the morning to avoid too high a temperature that can result in stress on the parent. Spawning is carried out in a concrete pond at the bottom of which is still present mud and soil. Spawning at this location is carried out naturally, namely by the placement of male and female mothers in one spawning pond unit. The mother in the spawning phase is fed twice a day, namely in the morning and afternoon. Feeding activities to broodstock during the spawning process is feed HI-PRO-VITE 781.

d. Egg Hatching

After the male and female brood occur, fertilization occurs in the spawning pond UPT-PBAT Sukorejo, Malang, the female mother will incubate her eggs in the mouth. According to Langi and Pintha (2016), tilapia is included in the group of fish Cichildae family which can maintain and incubate eggs in in the mouth. The characteristics of the mother who is incubating the eggs in the mouth are, the size of the The head and mouth of the brood are enlarged and closed. The spawning process is up to egg-hatching at UPT-PBAT Sukorejo, Malang naturally lasted for 16 days. The egg-hatching process can be done using a tool, namely an incubator or called funnel system. The use of incubators owns the advantage is that the risk of fungal growth can be reduced and make it easier for larvae to come out of the egg hatching medium. Eggs that have been incubated by the female mother will be expelled from the mouth and then put in an incubator. Incubators have a function to help Accelerate the egg hatching process with the help of water recirculation under the funnel. Preparation of the incubator begins with cleaning the incubator, concrete ponds, and preparing water pipes. Incubators and concrete ponds. Then it is drained, then the pond is filled with water. The water required is sourced from rice field irrigation water. The discharge of water coming out of the incubator is 0.1 liters/second. Egg retrieval is carried out on the 14th day and then put into the incubator so that it continues to move and does not stick to prevent the appearance of mold.

Egg harvesting is done by taking the female mother who is incubating the eggs in the mouth. The female brood that incubates the eggs is lifted and placed in the tub. Process Taking eggs from the mouth of the fish is done carefully, namely by opening the mother's

mouth and the egg is expelled slowly until the egg is not present again in the mother's mouth. Egg storage in the tub is carried out after the eggs come out from the mouth of the female mother. The egg shelter is carried out to simplify egg counting before being put into the incubator.

Figure 2. Egg Hatching Process Using an Incubator
(Source : Author's Documentation, 2022)

Fertilization Rate (FR) or the degree of fertilization of eggs is obtained by How to remove eggs from the mouth of a female tilapia, and then counting the total number of eggs with the number of eggs that have been fertilized. According to Fani *et al* (2018), fertilization rate is the percentage of eggs fertilized from the number of eggs that are released in the spawning process. The calculation of the formula that used as follows :

$$\text{Fertilization Rate} = \frac{\text{number of fertilized eggs}}{\text{total number of eggs}} \times 100\%$$

$$\text{Fertilization Rate on this Research} = \frac{1900}{2000} \times 100\%$$
$$= 95\%$$

Based on the data above, the fertilization rate is obtained as a percentage of 95%. According to Fariedah *et al* (2018), there are several values in fertilization rate, namely high, medium, and low groups. Fertilized fish eggs are classified as high with a score above 50%, medium group with a value of 30 - 50%, and low group with a value below 30%. The fertility rate value obtained is classified as high due to the influence of good water quality, egg quality, and sperm fish.

The degree of hatching of eggs or hatching rate (HR) is obtained by counting the number of eggs released from the female's mother's mouth, then dividing by the number of eggs that hatch into larvae. Egg hatching process It takes 2 - 5 days depending on the water temperature. According to Aziz and Verdian (2020), the degree of hatching rate is the percentage of the number of eggs that hatch from the number of fertilized eggs. Fertilized tilapia eggs and harvested from the mouth of the female mother, and then put into a funnel Hatching. The calculation of the formula used is as follows :

$$\text{Hatching Rate (\%)} = \frac{\text{eggs that hatch}}{\text{Fertilized eggs}} \times 100\%$$

$$\text{Hatching Rate on this Research (\%)} = \frac{1875}{1900} \times 100\% = 98{,}6\%$$

The hatching rate data obtained, shows that the number height is 98.6%. According to Wicaksono *et al* (2016) and Kurniawati *et al* (2024), the degree of egg hatching or the hatching rate of tilapia can reach 77.5 - 83%. Therefore, the data shows that the hatching rate at UPT - PBAT Sukorejo, Malang is classified as good and optimal in producing larvae.

CONCLUSION

Black tilapia (*Oreochromis niloticus*) hatchery carried out in UPT – Freshwater Aquaculture Fisheries (PBAT) Sukorejo, Malang. It was concluded that seeding was carried out naturally using the spawning with a ratio of 1 : 3. The number of male fish is 50 and the number of fish 150 females per pond. Obstacles and problems in fish hatchery black indigo (Oreochromis niloticus) in UPT – PBAT Sukorejo include the lack of Empty pond setup for spawning and seed keeping.

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