LITERATURE STUDY: FRESH WATER FISH CULTIVATION

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Abstract

Indonesia is the second country known for its biodiversity. One such diversity is in the fisheries section. Fish farming is a way of nurturing fish so that they grow and reproduce. Fish cultivation that is usually carried out by the community is a type of freshwater fish cultivation. The purpose of this research is to find out and review how to cultivate freshwater fish from various reliable articles. This study uses the literature study method, namely solving problems by tracing written sources that have been made before. In cultivating freshwater fish there are several processes, namely pond preparation, brood selection, parent release, spawning, hatching eggs, caring for larvae, nursery, and harvesting.

Keywords: Aquaculture, Freshwater Fish, Literature Study.

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Introduction

Indonesia is the second country known for its biodiversity. One such diversity is in the fisheries section. As many as 2000 species of fish are found in Indonesian waters with various types of fresh water, marine, and brackish water fish. Many of these types of fish are commodities that are of interest to the public in the country and abroad. Freshwater fish is one of the aquaculture commodities that have economic value. This is because the nutritional content of fish can meet daily protein needs, so it is not surprising that aquaculture is a profitable industry. Therefore, cultivation is an important sector in improving the community's economy. One of the cultivation that has long been developed in the community is fish farming. Aquaculture is known as aquaculture, namely a fishery activity that produces aquatic biota (organisms) in a controlled environment with the aim of making a profit. Fish cultivation that is usually carried out by the community is a type of freshwater fish cultivation. Freshwater aquaculture aims to produce fish using several cultivation systems such as containers and depending on existing water sources (Sutiani et al, 2020).

Freshwater fish are vertebrates that have habitats in freshwater. Fish are cold-blooded animals with the characteristics of having a backbone, gills, and fins and a unique and varied body shape. Freshwater fish live in different habitats such as rivers, lakes, swamps, and ponds. In general, freshwater fish can live in the optimal temperature range between 28oC-32oC. Habitats that are mostly inhabited by freshwater fish are rivers, lakes, and swamps. Human activities also greatly affect population decline and environmental quality, such as PETI and land clearing. Forest destruction is the biggest threat to freshwater fish species because forest destruction can reduce food sources for fish, besides that the water temperature also rises with the decrease in tree shade and there will be an increase in water turbidity which will kill fish slowly (Siska et al, 2020).

Aquaculture is an effort to cultivate fish that used to live in the wild to become aquarium fish. All efforts to keep and obtain fish are caused by human presence, regardless of whether the fish are still wild in nature or have their own location. Aquaculture is a method of human action to increase water productivity. The position of humans in producing and increasing aquatic productivity is aimed at seeking profits, especially freshwater fish (Ferouk and Bartholomeus, 2021). The profitability of aquaculture production is highly dependent on the healthy accumulation of bio-bass at the end of the production season, and operating costs, maintenance costs (Thalji, 2019). According to Aswathy and Manoharan (2021), fish farming has a large space in the rural development process.

In aquaculture, any characteristic of water that affects the survival, reproduction, growth, or management of fish or other aquatic creatures in any way is considered a water quality variable. Poor water quality is reportedly affecting global aquaculture production. The pH of the water has a significant positive effect on the weight and size of the fish. Fish farming is required to manage water quality in order to provide a relatively stress-free environment (Tumwesigye et al, 2020).

Therefore, the purpose of writing this article is to find out and review how to cultivate freshwater fish from various articles.

Research methods

This study uses the literature study method, namely solving problems by tracing written sources that have been made before. This method aims to reveal various theories that are relevant to the problems of freshwater fish farming.

Results and Discussion

A study by Darwis et al (2019), explained the parameters tested during the maintenance of carp (Cyprinus carpio) with an aquaponic system for 4 weeks, namely growth, survival (SR), and water quality. The research design used was RAL with 4 treatments and 3 replications. The research was started by preparing a maintenance container in the form of an aquarium and labeled with treatment and repetition in each aquarium. The placement of the aquarium is done randomly. The fish seeds that are stocked must be weighed and each aquarium has the same average weight of fish seeds. During the rearing period, the fish were fed in the form of commercial pellets at a dose of 5% of the fish weight per day, by feeding them 2x a day in the morning and evening. Growth observations were carried out once a week during the maintenance period. The water parameters tested were temperature, DO, pH, ammonia, nitrite, and nitrate. The results of observing the daily growth of goldfish with different densities obtained the highest value in treatment A at 3.02%, then treatment B at 2.7%, treatment C at 2.66%, and treatment D at 2.42% per day. An increase in the daily growth value indicates that a low density has the ability to make good use of space compared to a fairly high density, because it is dense, there is competition between individuals in fighting for space and obtaining food. Lack of feed will slow down the growth rate of fish and space for movement. then treatment B was 2.7%, treatment C was 2.66%, and treatment D was 2.42% per day. An increase in the daily growth value indicates that a low density has the ability to make good use of space compared to a fairly high density, because it is dense, there is competition between individuals in fighting for space and obtaining food. Lack of feed will slow down the growth rate of fish and space for movement. then treatment B was 2.7%, treatment C was 2.66%, and treatment D was 2.42% per day. An increase in the daily growth value indicates that a low density

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Based on the results of the analysis of variance, the survival of goldfish showed that different densities had no significant effect on the survival of goldfish. While the water quality test found that the pH obtained for all treatments ranged from 6.3 to 7.9. The pH value in this range is good for goldfish farming. Temperatures during the study ranged from 27-30 °C, where temperature fluctuations in cultivation were relatively small due to pump activity which circulated water from the rearing vessel to the filtration media and back to the rearing vessel. The optimum temperature range for fish life is between 25-32°C. Dissolved oxygen levels obtained were between 3.1-5.9 mg/L. Dissolved oxygen levels are considered normal for goldfish farming. Meanwhile, the ammonia content increased significantly for all treatments, namely 0.133-0.376 mg/L. The growth of goldfish begins to be disrupted if the water in the living media contains 1.2 mg/L of ammonia. Nitrite content in goldfish rearing media increased for all treatments.

According to Zuriat et al (2021), the main goal for farmers to cultivate freshwater fisheries is not solely to get production, but how to make this business increase farmers' income and be economically viable. Thus, the business provides maximum profit for fish farmers. Fixed costs are incurred for the purchase of business facilities and infrastructure. The investment cost component consists of land, equipment and pool construction, and cottage buildings. From this investment capital, fixed costs will be obtained. In this study, the authors explained that the total cost of fish farming with a pond system was IDR 606,099 consisting of IDR 258,000 bamboo, IDR 169,833 wood, IDR 13,000 wire, IDR 26,067 pathos, IDR 9,233 nails, and IDR 129,966 equipment. These values are obtained from the average fixed costs for each sample of fish farmers in one harvest. The implementation of a business will not provide optimal production without being supported by the use of the right production facilities. The biggest costs incurred in this pond system fish farming business are feed 28.16 percent, and seeds 19.43 percent, and the remainder is for harvesting, transportation, and other costs. Labor costs are included in variable costs because the analysis of this farm uses economic analysis. and others. Labor costs are included in variable costs because the analysis of this farm uses economic analysis. and others. Labor costs are included in variable costs because the analysis of this farm uses economic analysis.

Whether or not a business is feasible can be determined by a feasibility analysis. The analysis used in this study is a calculation to find out whether a business provides benefits for business actors. So the results of the study show that the freshwater fishery cultivation business run by farmers in Nagan Raya Regency is feasible to be cultivated and developed. This is shown from the results of the RCR calculations carried out, the RCR for each business is 1.09 for pond fish farming in Beutong and Seunagan Districts, Nagan Raya Regency, and 1.11 for pond businesses in Nagan Raya Regency.

Sangirova et al (2020) in their research entitled "Benefits of developing cage fish farming", explained that the development of fish farming is an acute problem throughout the country because the natural reserves of waters, rivers, seas, and

oceans are decreasing and it is necessary to switch to artificial water reserves. The Republic of Uzbekistan has natural water resources in the form of ponds, reservoirs, lakes, rivers, irrigation canals, and others. The country's current problem is the production of fish fry and the irrational use of natural reservoirs and artificial ponds. In fish farming projects, the financial and economic aspects of industrial management have received little attention, especially in terms of financing. Fish farming is actively developing in several districts with the participation of scientific institutions, where industrial development plans are being formed and integrated reservoir development lines are being formed. In 2019, 200 thousand tons of fish were produced on the territory of the Republic of Uzbekistan. For 2020 it is planned to increase the volume of fish production to a minimum of 350 thousand tons. Intensive fish farming is probably the main driver of the increased production of widely used fish. In his research, he also explained that cage fish farming is a new biotechnology in the world of aquaculture, the development of integrated water utilization. Fish ponds are created in large ponds, reservoirs, and small rivers with a favorable hydrochemical regime. In these places, cages consisting of 2 or more cages are organized for the production of marketable fish. Fish farming in the Republic of Uzbekistan is not particularly developed, because the price of fish is higher than the price of fish grown in the traditional way. Theree fore many people avoid cultivating fish in this way.

Research by Mulokozi et al (2020) explains that feed accounts for more than 50% of production costs in semi-intensive fish farming. Commonly used feed ingredients, namely fish meal, soybean, and rice bran, are increasingly scarce due to decreased production and increased competition from other consumers. He also explained that fish growth was not affected by the inclusion of AW in fish feed. The main focus is to reveal whether fish farming makes a positive or negative contribution to household income by using spinach as feed. From this article, it is explained that excess amaranth waste in the dry season in Dar es salaam can be used as feed material for tilapia without including fish growth. In addition, fish farming can replace chemical fertilizers with nutrient-rich pond water without affecting the growth and yield of spinach.

Liu et al (2018), explained in their research that rising feed prices, overexploitation of wild fish, and the environment have hindered the development of sustainable aquaculture in the future and attracted interest in biofloc technology (BFT) worldwide. The fish growth performance parameters of the two groups showed that the final biomass was 26.04 ± 2.04 kg/m3 and 24.32 ± 1.02 kg/m3 respectively in the GLU tank and NCA tank ($P > 0.05$). Although the survival rate, body weight gain, net yield, and feed conversion rate (FCR) in the tilapia in the GLU tank were slightly better than in the NCA tank, this showed no significant difference between the two groups.

Sahoo et al (2020), in their research, explained induction breeding techniques, breeding behavior, and the early life history of koi fish (embryonic and larval stages) including nursery maintenance. The male and female koi goldfish with sizes between 0.5 – 1.5 kg are stocked separately and fed 2% of their body weight. Feeding in bags is carried out in the morning by placing the bags in the corner of the pond location. The results show that the body of koi fish can vary from elongated to oval. Some koi fish is white with red and black stools, some are red, some are orange, and some are black. During the experiment, it was observed that fertilized koi fish eggs were adhesive,

demersal, and spherical. Spawning in koi fish occurs at a water temperature of around 18°C. After 30 days of fish seed rearing, large fry was obtained. The growth of koi fish in the rearing pond is quite encouraging due to better pond management and the quality of the feed given to the seeds that are maintained.

Meliko et al (2021), in their research, stated that 40.6% of fish cultivators applied a semi-intensive production system with the most common production practice being tilapia, namely 56.2%. This could have implications for seed availability which was reported as a major problem by respondents. To encourage catfish production, it is necessary to hold hatcheries in both the government and the private sector. In this article, the author also explains that catfish are slow growers and their predatory nature significantly suppresses stocking density, while tilapia is a very productive breeder which can increase stocking density in fish ponds. Therefore, to adjust the stocking density, the farmer calibrates (separates the larger fish from the smaller fish) the fish pond or inserts maggots into the pond to mimic the smaller fish. In addition, cleaning the pond treats disease and controls water quality, by changing the water from the pond or using cleaning agents to prevent the accumulation of disease and turbidity. All management variables except the number of ponds owned by farmers have a significant relationship with farming.

Research by Orinda et al (2021), explained that fishing is one of the main economic activities in the Lake Victoria region and is a source of employment. The challenge in fish marketing is illegal fishing. Fish farms also face stiff competition from cheaper fish imports from China and Uganda. This causes fish cultivators to be unable to compete profitably in the market.

Ramadhan and Luthfiana (2018) in their research on natural carp hatchery techniques, can include several processes, namely pond preparation, brood selection, brood release, spawning, hatching eggs, larval care, nursery, harvesting, packing, water quality management, pest, and disease control. In his research, the pool used was a concrete pool with a size of 15x5x1 m. The pond must be cleaned in advance and filled with water by opening the inlet channel and closing the outlet channel that has been installed with a filter to prevent dirt from entering and leaving fish larvae. The selection process is carried out in two stages, namely, selection based on gender by stripping method on the abdomen and based on the weight comparison of the mother fish. The weight ratio of the brood used is 2 kg male to 1 kg female (2:1), with the aim that the eggs of the female mother can be fertilized optimally by the male sperm. In the process of releasing broodstock by going through an open transportation process from the mother pond to the spawning pond because the distance between the parent spawning pond and the spawning pond is approximately 10 m. A good brood release time is in the morning and evening because at that time the water temperature tends to be low. Furthermore, spawning is carried out by placing male and female broods in one pond without being given special treatment and using only kakaban and waring as substrates as a place for eggs to cling. The spawning process is characterized by the sound of splashing water produced as a result of the process of chasing the female brood by the male.

The female mother will lay eggs near midnight on the kakaban and the warning is followed by the male mother who secretes white sperm fluid. After spawning, the mother fish is separated, the purpose of which is so that the newly attached eggs are not eaten by the mother carp. In the process of hatching carp eggs,

waring, and kakaban are removed and cleaned. Eggs that have hatched will become larvae, while eggs that fail to hatch will be white, indicating that the eggs have died. The cause of egg death is fertilization that is not as good as possible and the condition of the eggs that stick together or overlap each other at the time of spread in the waring so that oxygen circulation is disturbed and causes death. Fish larvae are the most critical phase in fish farming because fish larvae have poor resilience and are vulnerable to changes in arch conditions. 48 hours after hatching the food reserves in the larvae will be exhausted, so additional nutritional intake is needed, the feed given is in the form of cooked boiled egg yolks than egg yolks in sift above the water using a sieve until evenly distributed. Egg yolk feeding is given 2x a day in the morning and in the afternoon for 3 days. Carp larvae nursery is carried out in spawning ponds due to the limitations of ponds, ponds that have been fed with manure will have a greenish watercolor because there is natural feed in the form of phytoplankton.

Growth in length and weight of fish larvae were measured once a week. The results of the goldfish seed sampling obtained length gain values of 0.186 cm and 0.02452 grams per week. Harvesting carp seeds starts with reducing water by installing a filter and opening an outlet. It takes + 4 hours to lower the water to a height of 5 cm. Harvesting is done slowly because there is a lot of moss in the pond, the moss can clog the filter at the outlet which makes it difficult for the seeds to come out and can cause stress for the fish due to lack of oxygen. Harvested carp seeds were counted manually and 22 seeds were obtained. 828 individuals and a Survival Rate (SR) value of 30.44% with a seed size of 1-4 cm. Seeds that have been harvested can be moved to further nursery ponds or put into curing ponds.

The water used as a medium for rearing the broodstock, larvae, and carp seeds use water from the ambulance spring which flows directly into the pond through the aqueduct. Pest and disease control is an effort to prevent goldfish larvae or seeds from being attacked by pests and diseases. In larva-rearing ponds, the pests that usually attack are frogs and tadpoles (frog kids). During the larval rearing period, pests often appear because the location of the larval rearing pond is in an open space.

Conclusion

Freshwater fish are vertebrates that have habitats in freshwater. Fish farming is a form of aquaculture that specifically cultivates fish in tanks. In cultivating freshwater fish there are several processes, namely pond preparation, brood selection, parent release, spawning, hatching eggs, caring for larvae, nursery, and harvesting. The main goal for farmers is to cultivate freshwater fisheries, namely in order to increase farmers' income and be economically viable. Thus, the business provides maximum profit for fish farmers.

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