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Development of Ornamental Fish Cultivation to Support Fisheries Tourism In The Sari Nadi Group, Marga District, Tabanan, Bali

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A B S T R A C T

Koi fish (Cyprinus carpio) is an ornamental fish that has a beautiful body shape and color, so it has high economic value. Indicators of beauty in ornamental fish can be seen in the brilliant color, physical shape and completeness, behavior, and health conditions or stamina. These koi fish are often used as aquarium decorations and are art for consumption enthusiasts. The community demands the beauty of Koi fish, so farmers need to maintain the color of ornamental fish by providing feed that contains color pigments. Carotenoids are the main natural components that make color pigments, positively affecting red and orange colors. Carotenoids can come from spirulina, which contains phycocyanin, chlorophyll-a, and carotene. Carotene is composed of xantophyll (37%), carotene (28%), and zeaxanthin (17%). Providing a source of color pigment in fish feed is one of the efforts to get a bright color evenly distributed in fish. Feeding containing 8% spirulina was effective in increasing color pigmentation in the red swordtail (Xiphophorus helleri). The addition of 1.2% spirulina flour to artificial feed significantly increased color intensity and was the highest result in increasing color intensity of Koi fish.

1. INTRODUCTION

1.1. Research Background

One of Indonesia's biodiversity that should be proud of is the diversity of freshwater ornamental fish species. There are estimated to be about 400 species of ornamental fish worldwide. One of the commodities introduced by freshwater ornamental fish, which is still a prima donna in the international market, is an expensive, fluctuating, and relatively stable ornamental fish. Koi fish is widely loved because of its beautiful color, so that it can be used as a decorator for the pond at home. Koi fish is also believed to be a suitable luck carrier. Koi fish have a wide variety of features and colors. Brighter colors, such as red, are preferred by Koi fish keepers because they make the Koi fish even more beautiful and expensive [1]. This triggers Koi lovers to make their Koi fish colors lighter. Genetic factors and lineage mainly influence the color of the fish. Nutritional factors also play a role in enhancing the beauty of the color of koi fish. The color of koi fish is influenced by the pigments produced by the chromatophore cells. Fish can produce color pigments by themselves, so farmers only need to provide quality feed without supplementing specific pigment content to increase fish color. Fish cannot produce carotenoids on their own and require external intake, so for fish feed supplementation to improve color, materials with high levels of carotenoids are generally used. The ornamental fish, or nishikigoi, is one of Indonesia's most popular ornamental fish because of its body shape and color. It is believed to bring good luck to koi lovers in Indonesia. The great potential of koi commodities in Indonesia as one of the leading ornamental fish commodities is quite rapid lately, especially in several areas such as Sukabumi, Cianjur, West Jakarta, Blitar, and Makassar. The Ministry of Marine and Fisheries (KKP) is interested in building several koi center areas to become the largest koi producing area in the country through the megapolitan concept. KKP develops the potential of national ornamental fish, which is expected to improve the quality of local koi that can compete with imported koi in both the domestic and international markets [2]. The koi ornamental fish commodity has become a mainstay commodity

in several areas such as Sukabumi, Cianjur, and Blitar because it has lifted the people's economy and made it an alternative source of income other than rice. The farmers and koi cultivators in the area are formed in farmer groups, so their production results are well-organized even though the method used so far is still traditional. Intensive cultivation must be developed in a controlled environment through improved cultivation technology to support koi production. Natural, semi-manufactured, and pure artificial fertilizers are expected to have a lifespan, and uniform size, and the quality of the eggs produced are also improved, resulting in enhanced larval synthesis compared to natural spawning, which is often constrained by the maintenance of larvae with low synapses [1, 2].

The koi ("Cyprinus carpio koi") is an ornamental fish with a beautiful body shape and color that is economically valuable. Indicators of beauty in ornamental fish can be seen in bright colors, physical shape and completeness, behavior, and health conditions or stamina [3]. In addition, this koi fish is often used as an aquarium decoration and is an art consumption for its interest [4]. Color is one of the reasons ornamental fish are in demand by the public, so cultivators need to maintain the color of ornamental fish by providing food containing color pigments. The color of fish is due to the presence of chromatophore cells present in the dermis skin. Carotenoids are the main natural components of color pigments that considerably influence red and orange coloration [5]. Some foods contain carotenoids, including carrots, sweet potatoes, corn, pumpkin, and other green vegetables [6]. Another source of carotenoids can also come from spirulina because spirulina contains phycocyanin, chlorophyll-a, and carotene [7, 8]. Carotene is composed of xanthophyll (37%), ß-carotene (28%), and zeaxanthin (17%) [9]. Providing a source of color pigment in fish feed is one of the efforts to get a bright color evenly distributed in fish. Many studies have shown the effect of giving spirulina to the color of ornamental fish and shrimp or lobster [10]. Feeding spirulina by 8% improves color pigmentation in red swordtail fish (Xiphophorus helleri) [11]. Adding 1.2% spirulina flour to artificial feed significantly increased color intensity and was the highest result in increasing goldfish color intensity [12]. The partner group involved is the Sari Nadi Ornamental Fish Group, which comprises 14 members. This group has been engaged in the fisheries business since 2012 and distributes it to Lake Batur.

1.2. Literature Review

The factors that determine the brightness of the Koi fish's body are:

1. Chromatophores

Chromatophores are color pigments that Koi fish have on Koi fish skin cells. The color pigment consists of red pigment (erythrin), black pigment (melanin), and yellow pigment (xanthin). If Koi does not have chromatophores, Koi will look white or albino. The increasingly dense chromatophores in Koi fish skin cells will cause brighter and more precise colors on the body's surface. This color pigment is not produced by its own body but is obtained from consuming color pigments from its food. Therefore, the more color pigments Koi fish consume, the brighter the body color. The chromatophores in the Koi fish's body remain throughout its life. That's why when the Koi fish gets bigger, the color will look faded. This is due to the fixed number of chromatophores with an increasing cross-section on Koi's fish body [13].

2. Feed

Koi fish color pigments are related to the pigments in the food they eat. Foods that contain lots of pigment are delicious. Foods that contain high color pigments are found in shrimp, algae, and snails. However, Koi fish breeders usually provide color enhancers to their feed for more practical purposes. Color enhancer helps increase pigment density in Koi fish. But if you give it too much, the white part of the Koi fish's body can turn pink. If that happens, the color enhancer must be stopped until the white color on the Koi's body returns to its original state. A good feed to brighten the color of Koi fish is a feed that contains a lot of carotene. Carotene is widely stored in carrots, algae, chlorella, spirulina, algae, cabbage, mustard greens, shrimp, krill, crabs, salmon, bloodworms, and water fleas. In addition to containing a lot of carotene color pigments, these foods also contain protein that is good for the body's metabolism of Koi fish. Ponds with a lot of green algae can also lighten the color pigments in Koi fish, although the pond water will be greenish because of the growth of this algae. Algae in Koi fish ponds can be replaced by consuming feed that contains lots of algae, algae, astaxanthin, or spirulina. Feeding pellets with a complete and balanced content is highly recommended using ingredients that contain natural spirulina, krill, and good astaxanthin to help produce color in Koi fish, especially red [2, 13].

3. Water Quality

Good water quality not only affects their health but will also affect their color pigments. Maintaining the quality of pond water for your Koi fish is very important. Poor water quality causes color pigments to fade but can also cause various diseases, such as white spots, skin worms, fleas, and viruses. Good water quality is clean and clear water with low ammonia, nitrite and nitrate levels. Minimum nitrite levels in the pool is less than 0.2%. Maintaining color pigments in Koi fish can be done by maintaining the pH and water hardness of the pond. In soft water and acidic water, it will tend to spread the red pigment. Hard water and alkaline water tend to spread black pigment. However, the ideal pH of the Koi fish pond is neutral, around 7.2 - 7.4 with an oxygen level of 3 - 5 ppm. Besides pH and water hardness, other things to note in water quality suitable for Koi fish are water temperature and sunlight. The ideal water temperature in Koi fish ponds is around 24 - 26 degrees celsius. Sufficient sunlight can increase brightness in Koi fish color pigments. But, too much sunlight being exposed to the pool will cause the pool's temperature to rise so it can fade the pigment color. To reduce exposure to sunlight on the pool, you can add shade by adding some trees next to the pool [1, 13].

1.3. Research Objective

The purpose of this PKM is to provide a solution for ornamental fish farming groups, as well as an initiation for the formation of a new group of ornamental fish farmers by providing an overview of aquaculture management and feeding that can improve the color quality of ornamental fish, so that it can provide added value to production. ornamental fish produced. Through this activity, it is hoped that economic empowerment in the Sari Nadi group can achieve its goals, provide optimal benefits, and increase public interest in developing ornamental fish cultivation.

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2. MATERIALS AND METHODS

2.1. PKM Location

The Sari Nadi fish cultivators group comprises 14 members chaired by I Wayan Suardana. This group has experience supplying tilapia seeds, especially seed providers in Lake Batur. This group wants to develop ornamental fish to support the Fisheries Tourism program plan in Baru Village. Due to limited knowledge about ornamental fish cultivation, fish cultivators find using ornamental fish hatchery technology complicated. This Community Service Activity is being carried out for fish cultivator groups engaged in ornamental fish cultivation in August 2022. The approach used for this activity is the lecture (counseling) method on effective and efficient ornamental fish farming techniques, techniques for keeping the color of Koi ornamental fish attractive, and hands-on practice of making simple chitosan and its application to feed to increase performance. Drag the color of the Koi fish and solve the problem at hand.

2.2. Materials dan Procedures

Make a feed to brighten the color of koi fish with crab carapace and shrimp shell

Materials:

1. The koi fish pellets are soaked in warm water for about 15 minutes.
2. Grind the shrimp shells and crab carapace until smooth.
3. Pellets that have been soft mixed with shrimp shells and crab shells.
4. The ratio of pellets, shrimp shells, and crab carapace is 8:1:1.
5. Shrimp shells and crab shells can also be made into a paste by mixing them finely with water and starch. This mixture of ingredients can be steamed and stored for feeding to koi fish.

This feeding can be done twice a day, morning and evening with a dose of 1/40 of the weight of koi. This corresponds to the dose from the fisheries service. For example, a fish with a length of 30 cm may be given 2 grains of pasta the size of a marble grain each time it is fed. Not only in the form of feed but also in the form of koi fish color pigment brightening nutrients can be done by adding medicines to fish feed. Common medications include: Cr-5, Cr-6, Astaxantine, and Spirulina powder. Dissolved in water and then mixed in koi fish pellets, according to the given dose. Spirulina Powder to brighten the color of koi fish.

2.3. Methods

Implementing the activities carried out is the application of science and technology using a participatory approach and potential-based problem-solving in the program location area. Activities carried out in two stages, including:

1. First Stage
   In the first stage, the activities to be carried out are socialization and initiation to provide information about ornamental fish cultivation for ornamental fish cultivators in the Sari Nadi group, Baru Village, Marga District, and Tabanan.
2. Second Stage
   The second stage is to conduct training on fish hatchery management, brood selection, and feed management using discussion and demonstration methods.
3. Third Stage

The third stage is evaluation and monitoring.

2.4. Analysis methods

The analytical method used is descriptive, which describes the color of the koi fish body during three months of maintenance. The number of chromatophores in koi fish tends to be constant throughout their life. The water quality parameters observed were temperature, dissolved oxygen, and pH. Good water quality can increase the brightness of the color of koi fish. Koi fish pond water is unhealthy if it contains too much dirt, ammonia, nitrite, or nitrate, which can cause the color of the koi to fade and cause koi fish disease.

3. RESULT AND DISCUSSION

3.1. Result

The Ornamental Fish Cultivator Group has been able to carry out the proper cultivation method to increase Koi fish production:

1. Selection of high-quality breeds
   Selected sires are crucial in starting a business or cultivating ornamental koi fish. Good fish breeders will undoubtedly produce good quality fish. By collaborating with koi fish lovers to breed koi fish from different locations so that the baby fish results are promising. Also, choose a healthy broodstock breed with an ideal body shape, calm and balanced swimming style, and bright colors.
2. Make a fish pond
   Any fish cultivation requires sufficient ponds for the fish to live in later. They can use soil ponds, tarpaulins, concrete, etc. Koi fish is an easy-to-treat type that can still be treated in aquariums. If using a pond for the fish's future residence, it is best to use a plaster pond with sufficient sunlight. The waterways in the pool must always be well maintained. Put a fine sieve in the pool near the watercourse so the koi fish won't get washed away.
3. Spawning Process The spawning process in the koi fish cultivation stage is a very important step because it will determine the success or failure of the koi livestock business or cultivation. To anticipate a male whose condition is not healthy, provide more than one male. Prepare 3-5 fish, then put the female fish into the spawning pond around 4 pm.
4. Keep Fish Pond Conditions Always Clean
   Keeping the pool clean during koi cultivation is also very important. Also, the temperature and the degree of water dryness should be considered. If the pool water is murky, it will affect the koi fish's health. The murky and dirty ponds are usually affected by fish droppings. So even if you're using a pool filter, it must be cleaned periodically. During the implementation of PKM activities, the water quality of the pond remained at the standard water quality standard for Koi fish life, namely pH water 7.2, dissolved oxygen 5 ppm and pond temperature 250C
5. Stocking density
   Koi fish need a large enough space for movement so their growth can occur quickly. So, if the number of fish

in the pond is excessive it will hamper their growth. For this reason, limit the number of koi fish in one pond.

There are several ways of cultivating koi fish to achieve optimal results. Starting from selecting quality broodstock, making ponds for koi, spawning processes, maintaining the cleanliness of the pond, and finally limiting the number of fish in one pond. In this way, it is hoped that the fish cultivation that is carried out can achieve optimal results.

6. Feeding

Feeding with added chitosan increases the density of color pigments in koi. Koi fish that are not given food to increase the density of color pigments become paler and less beautiful. Koi which initially had good quality, could decrease in quality if the feed did not add color pigment-strengthening elements. In nature, koi fish get color pigments from algae, shrimp, snails, and other foods. Meanwhile, in breeder ponds, the addition of color pigment to koi fish is given to food. Giving food that contains too much color enhancer makes the erythrin pigment too strong, so the white color of Kohaku turns pink. Precisely, this is not good according to koi kohaku standards. When koi fish have excess food containing color enhancers, the feeding can be stopped until the koi color returns to normal. The number of chromatophores in koi fish tends to be constant throughout their life, so when the koi gets bigger, the density of these color pigments in their bodies decreases due to the larger cross-sectional area of the koi fish's body. So koi fish that are old and large in color fade slightly. Chromatophores cells are branched cells. So that the color pigment can move and spread. This causes the color in the center of the cell to become faded and pale. Chromatophores are influenced by feed, water quality, background color, koi algae, and temperature. Koi fish feed that aims to brighten and brighten the color of koi fish contains a lot of carotene. Foods that contain carotene include carrots, algae, spirulina algae, chlorella, mangoes, mustard greens, cabbage, green chilies, crabs, crustaceans, krill, trout, salmon, water fleas, mosquito larvae, hair worms, blood worms, and others. Other. This feed can be added to koi fish feed in addition to increasing koi fish protein nutrition, it can also meet the nutritional needs for skin color pigments.

Fig 1. Sani Nadi Ornamental Fish Cultivator Group

Fig 2. Providing Chitosan Making Training

Fig 3. Mixing Kitosan on feed

Fig 4. Application to Koi fish in the pond

3.2. Discussion

3.2.1. ECONOMIC IMPACT

The community partnership program implemented in the Sari Nadi Group, Desa Baru, Marga District, Tabanan Regency, provided benefits to partner groups, especially partners who were able to make a feed from chitosan material to maintain the color of Koi fish so that the quality of Koi fish increased and selling prices also increased. The benefits of this PKM for partners were starting in July it has been seen the use of chitosan in feed and management of ornamental fish maintenance in ponds. So that the color of the Koi fish is more attractive

3.2.2. PARTNER CONTRIBUTION

The implementation of PKM is strongly supported by the Fish Sari Nadi group as well as village officials such as the Head of Village, Kelian Adat, Head of Environment, Fisheries Agency who want to combine this PKM program with the Baru village program to realize the mission vision of the Baru village of Taban Regency. The Sari Nadi group contributed in the form of counseling places, food-making practices, and fish ponds for chitosan applications. The group also prepared the consumption of counseling participants with the funds already budgeted for this PKM.

4. CONCLUSION

From our community partnership program, it can be concluded that the Sari Nadi group has been able to produce feed to maintain the color of Koi ornamental fish, can increase income from the use of natural feed from chitosan, and members of the partner

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group know about making feed with chitosan and proper management of ornamental fish maintenance. Sari Nadi's partner group needs to expand its knowledge of broodstock selection techniques to produce quality seeds and marketing techniques and increase business capital.

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