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Ornamental Fish Production Management at Mahkota Betta Fish, Lingsar, West Lombok

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ABSTRACT

Ornamental fish are one of the fishery commodities that have high economic value and are also one of the export commodities in Indonesia. This provides an opportunity for farmers to increase ornamental fish production in Indonesia. Ornamental fish are quite well-known by the public as aquarium decorations. Ornamental fish are a type of fish that live in fresh water or sea water that have attractive and beautiful body shapes or colors. This research aims to evaluate the cultivation techniques of ornamental fish at the Mahkota Betta Fish, Langko Village, Lingsar District, West Lombok Regency, West Nusa Tenggara. The research method involved observation, interviews, and ornamental fish cultivation activities. Data collection was carried out through observation and interviews, as well as engaging in ornamental fish rearing activities. The research results showed that can be drawn from this study is to be able to know, understand, and practice ornamental fish cultivation techniques carried out in Mahkota Betta Fish which are carried out in several stages to create quality results or seeds, namely pond preparation, broodstock preparation, media preparation for eggs, hatchery, nursery, enlargement, water quality management, and harvesting.

INTRODUCTION

Ornamental fish are one of the fishery commodities that have high economic value and are also one of the export commodities in Indonesia. This provides an opportunity for farmers to increase ornamental fish production in Indonesia. Ornamental fish are quite well-known by the public as aquarium decorations. Ornamental fish are a type of fish that live in fresh water or sea water that have attractive and beautiful body shapes or colors. One type of ornamental fish with its own uniqueness compared to other ornamental fish is the betta fish (*Betta* sp.). The uniqueness in question is its fondness for fighting with its own kind, but it does not rule out the possibility of other types but still in the same tribe. Its aggressiveness is very high so it is highly discouraged to place or keep this fish in one container (Nuraini & Gumilang, 2016).

Comet fish (*Carassius auratus*) is one of the ornamental fish that is widely cultivated in East Java. This is because comet fish have a fairly high and relatively stable market and demand. Due to the large number of fans and the holding of contests for ornamental fish

hobbyists. Comet fish have beautiful bright colors and flat body shapes, this makes comet fish have high selling value and demand and are relatively stable in the market. Seeing this, comet fish have high prospects for cultivation. Comet fish are fish that are widely kept in aquariums and ponds, but comet fish are fish that are difficult to handle during spawning because comet fish broodstock are fish that do not guard their eggs (Hartono et al., 2012). The availability of good quality seeds in sufficient quantities in fish cultivation greatly determines the success of cultivation (Khasanah et al., 2016).

The demand for koi fish seeds has not been met optimally until now, this is due to relatively limited production and various obstacles, both technological and natural, which make it difficult to find superior and quality seeds so that production potential has not been achieved optimally. Mastery of easy, cheap and fast seeding techniques will encourage the production of quality seeds and ensure the continuity of seed supply according to demand (Sudarti et al., 2014).

In order to support the production of quality ornamental fish seeds, production management is needed to develop cultivation carried out in a controlled environment. Field work practices regarding cultivation production management were carried out at Mahkota Betta Fish Lingsar Lombok Bara. Seeding is carried out naturally with the hope that the seeds produced will have a uniform age, size and the quality of the eggs produced will also be better so that the survival of the larvae increases (Kusrini, 2015).

The above problems are greatly influenced by aspects of ornamental fish cultivation carried out by fish farmers, both on a household scale and government-owned seed centers, especially ornamental fish to produce high-quality fish, so that basic knowledge, insight and skills are needed to do so. Therefore, the author took the title "Ornamental Fish Production Management at Mahkota Betta Fish Lingsar, West Lombok Regency".

METHODS

This research was conducted for 30 days in 2023 which took place at the Mahkota Betta Fish, Langko Village, Lingsar District, West Lombok Regency, West Nusa Tenggara. Data collection was carried out through observation and interviews, as well as engaging in ornamental fish rearing activities. The methodology followed the approach outlined by Annisa & Affandi (2024); Irawati & Affandi (2024); Mas'ud & Affandi (2024); Ningsih & Affandi (2023); Pebrianti & Affandi (2024), employing a descriptive method that involved observing all production activities at the research site. The methodology comprised several stages, including pond preparation, broodstock preparation, media preparation for eggs, hatchery, nursery, enlargement, water quality management, and harvesting.

RESULTS

Pond Preparation

The preparation of this pond must be done properly and follow existing procedures. Because the preparation of the cultivation land is something that greatly influences the cultivation process and the success of the cultivation. This land preparation activity includes emptying the pond water, cleaning the pond, refilling the water.

The pond for maintaining larvae and seeds for goldfish, betta fish, molly fish, guppy fish, and comet fish, uses a concrete pond measuring 2.5 m x 1 m as many as 1 pond. Before the larvae are transferred to the larval maintenance pond, the pond is first cleaned. After being

cleaned, the pond is dried. Drying the pond takes about 1-2 days. How fast or slow the pond dries depends on the heat of the sun. Drying the bottom of the pond aims to kill bacteria that can cause fish to get sick and toxins left over from previous cultivation activities. The drying activity is assisted by sunlight.

Broodstock Preparation

Before carrying out this ornamental fish cultivation activity, the broodstock selection is first carried out. The broodstock used in the breeding process must be healthy and without defects. The broodstock used is a male that is 6 months old and has met the requirements to be ready to spawn, namely having the characteristics of fish that produce foam on the surface of the water and a female broodstock fish that is 6 months old and has met the requirements to spawn, namely with the characteristics of a large stomach.

The breeding of betta fish (*Betta* sp.) begins with the selection of broodstock in betta fish. The broodstock used in the breeding process must be healthy and without defects. The betta fish broodstock used are 4-5 months old with a length of 4 cm for the female broodstock and 5 cm for the male broodstock.

In breeding activities, broodstock selection has an important role, therefore To select good broodstock can be seen from the male and female broodstock. For male broodstock, it can be seen from their characteristics, namely having a slender body with long fins, attractive appearance, agile and nimble movements, and having a genitalia called gonopodium. While for females, among others, fat body, bloated stomach, genitals in the form of urogenital, not only that, the number of broodstock available for spawning is 5 males and 5 females and can produce one spawning, not only that in selecting broodstock for breeding, of course, must pay attention to the level of gonad maturity which indicates a level of sexual maturity of the fish or a certain stage of gonad development before and after the fish spawn. Determination of the level of gonad maturity, among others, by observing the development of the gonads in the fish's body.

Breeding in guppy fish (*Poecilia reticulata*) begins with the selection of broodstock in guppy fish based on their morphology, male guppy fish have a slimmer body shape with a brighter body and fin color pattern than female guppy fish. Several other differences between male and female guppy fish can be seen from their morphological characteristics. Male guppy fish have a smaller body size compared to female fish, male guppy fish have wider tails and brighter tail colors than females.

Broodstock preparation and broodstock selection are carried out with the aim of determining the level of maturity of the broodstock fish to be spawned, so that later it can produce high quality seeds. Broodstock selection is the initial stage in fish farming activities that greatly determines the success of production. By carrying out the correct broodstock selection, broodstock will be obtained according to needs so that the productivity of fish farming efforts is optimal.

Media Preparation for Eggs

Preparation of media used to store eggs is different for each fish. Preparation of this egg media aims to allow the eggs to stick to the media that has been provided until the eggs hatch. The media used for comet fish is using net media, for goldfish using hydrilla media and for betta fish using plastic media.

Hatchery

Goldfish broodstock undergo natural spawning for about 1-2 days, after spawning small eggs can be obtained. The eggs from the spawning process that have been fertilized will stick to the kakaban, then the broodstock are removed from the spawning container. The spawning

process is carried out by inserting male and female broodstock with a ratio of 2 to 1, 2 females and 1 male in a spawning pool equipped with a kakaban as a place to spawn. Goldfish spawn at night until dawn.

Betta fish breeding carried out during the study was carried out naturally for about 1-2 days, after spawning small eggs can be obtained. The eggs from the spawning process that have been fertilized will stick to the nest or on the edge of the spawning container, then both broodstock are removed from the spawning container. After 2-3 days the betta fish eggs hatch, the betta fish fry after 3 days are moved into a 2.5 m x 1 m seed maintenance pond. This is done in order to find out the number of fish fry produced. Spawning is done in the afternoon towards evening. The spawning process occurs if the male broodstock has released bubbles on the plastic if there are bubbles it means the male broodstock has been stimulated and is ready to spawn. Betta fish seeding uses a plastic bucket and a transparent glass bottle before being used, the tools used for betta fish seeding are cleaned first, after being cleaned the water is filled to a height of 7 cm. Betta fish spawning is done by first inserting the male broodstock in the spawning container, then the female broodstock is placed in a transparent glass bottle into the spawning container. The female broodstock is placed in a transparent glass bottle first because this stage is the introduction stage between the male and female. The purpose of this is so that the male broodstock will crawl and release foam into the transparent plastic that has been provided for the betta fish to lay eggs. This stage is carried out for 12 hours after which the male broodstock is released into the spawning container.

Seeding or spawning is a mating process that occurs between male and female broodstock that release sperm and egg cells and occurs outside the fish's body. The broodstock are put into the spawning place as many as 10 fish. There are 5 male broodstock and 5 female broodstock. The spawning process is marked by the chasing carried out by the male broodstock against the female broodstock while grazing her body. This lasts 4-7 days after a week, the seeds appear to gather among the aquatic plants or swim on the edge of the tub or pond. After that, they can be separated from their broodstock and transferred to the nursery pond. The ability of molly fish to produce offspring is quite high when compared to other types of freshwater ornamental fish 10-300 fish.

Guppy fish broodstock spawn naturally for about 1-2 days, after spawning, small larvae can be obtained that swim in the water. Guppy larvae are transferred to a 2.5 x 1 m seed maintenance pond. Guppy fish breeding uses 10 broodstock with a ratio of 5 male broodstock to 5 female broodstock Spawning is done in the afternoon towards evening and in the morning towards sunrise. The spawning process occurs if the male broodstock has chased the female broodstock and always approaches the female broodstock.

Seeding or Spawning is the process of releasing eggs by the female broodstock and sperm by the male broodstock. The fish spawning technique in this activity is natural spawning. Natural spawning is spawning that occurs in broodstock that have mature gonads that occurs naturally.

Nursery

Goldfish larvae that have entered the age of 7 days from the time of hatching and have been maintained, are then spread in the stocking pond. Stocking is done by taking fish larvae from the spawning pond, then moving them into the nursery pond. Larvae are generally spread in the morning and evening because that is when the environmental temperature is low so that the larvae are not stressed and can adapt to the new environment. Next, the larvae are spread into the pond by acclimatization, namely by equalizing the temperature of the spawning pond with the temperature of the nursery pond, before carrying out the nursery,

the pond is cleaned first, the pond used in the nursery stage is a concrete pond measuring 2.5 m x 1 m as many as 1 piece with a water height of 40 cm.

After the betta fish eggs have hatched, the fish are spread in the rearing pond before being used, the pond is cleaned first so that the bacteria from the previous cultivation residue can be cleaned. Fish aged 1-3 days are kept in plastic buckets after the larvae are 4 days old, then they are spread in the nursery pond, the pond used is a concrete pond measuring 2.5 m x 1 m as many as 1 with a water height of 40 cm. The spreading of larvae is generally done in the morning and evening because that is when the environmental temperature is low so that the larvae are not stressed and can adapt to the new environment.

After the molly fish have laid eggs and hatched, the fish are spread in the rearing pond before being used, the pond is cleaned first so that the bacteria from the previous cultivation residue can be cleaned. the pond used is a concrete pond measuring 2.5 m x 1 m as many as 1 with a water height of 40 cm. The spreading of larvae is generally done in the morning and evening because that is when the environmental temperature is low so that the larvae are not stressed and can adapt to the new environment.

After the guppy fish have laid eggs and hatched, the fish are spread in the rearing pond before being used, the pond is cleaned first so that the bacteria from the previous cultivation residue can be cleaned. The pool used is a concrete pool measuring 2.5 m x 1 m, 1 unit with a water height of 40 cm. Larvae are generally spread in the morning and evening because that is when the environmental temperature is low so that the larvae are not stressed and can adapt to the new environment.

Preparation of the nursery pond is carried out at the same time as the broodstock fish are spawned with a pond preparation time of around 1 week. Pond preparation includes drying the bottom of the pond, fertilizing and filling with water. Comet fish larvae that have entered the age of 7 days from the time of hatching and have been maintained, are then spread in the nursery pond. Nursery is done by taking fish larvae from the spawning pond, then moving them into the nursery pond. Next, the larvae are spread into the pond by acclimatization, namely equalizing the temperature of the spawning pond with the temperature of the nursery pond.

Enlargement

Goldfish rearing lasts for 3 weeks. Goldfish larvae can be kept in various media such as: ground ponds, tempok ponds, semi-intensive ponds, tarpaulin ponds, or in cages. In this maintenance, the container used for larval maintenance is a concrete pond measuring 2.5 m x 1 m with a water height of 40 cm. Goldfish larvae are very small with a length of 3 mm for a size of 1 day old, for 1 week old fish larvae with a length of 8 mm with a growth period of 87.5% for 2 week old fish larvae 13 mm with a growth period of 38.4% while for 3 week old fish larvae with a length of 20 mm with a growth period of 35% in the relative growth of fish larvae produced in the 1st week the growth phase is faster than in weeks 2 and 3. This larval maintenance is carried out by feeding the larvae. Fish larvae are fed egg yolk, *Artemia* sp. and silk worms (*Tubifex* sp.) that have been mashed.

Betta fish larvae can be reared in various media such as aquariums, tubs, concrete pools, or cement pools. In this maintenance, the container used for larval maintenance is a concrete pool measuring 2.5 m x 1 m with a water height of 40 cm. Betta fish rearing lasts for 23 days. Betta fish larvae are very small with a length of 3 mm for a size of 1 day old, for 1 week old fish larvae with a length of 8 mm with a growth period of 62.5% and for 2 week old fish larvae 10 mm with a growth period of 25% while for 3 week old fish larvae with a length of 1 mm

with a growth period of 30% in the relative growth of fish larvae produced in the 1st week the growth phase is faster than in weeks 2 and 3.

Larvae maintenance is carried out in a 2.5 m x 1 m tank with a water depth of 40 cm. Larvae maintenance is carried out in one pond, namely the spawning pond. Maintenance is carried out when the larvae have hatched in the broodstock pond and then transferred to the maintenance pond to prevent death caused by the very aggressive movement of the broodstock. Molly fish lay eggs almost every day which is very different from other ornamental fish, fish larvae can be moved using a scoopnet and bucket so that it is easy to count and add up the offspring produced by molly fish every day. Maintenance of golden black molly fish larvae when the eggs hatch and are transferred to the maintenance pond cannot be fed for 2-3 days, which is because the fish larvae still have food stocks in their bodies.

Larvae maintenance is carried out in a 2.5 m x 1 m tub with a water height of 40 cm. Larvae maintenance is carried out in one pool, namely in a concrete pool. Maintenance is carried out when the larvae have hatched in the brood pond and then transferred to the maintenance pool so that there is no death caused by the very aggressive movement of the broodstock. Guppy fish larvae are very small with a length of 4-5 mm as well as the size of their mouths which will later be related to the right feed during the larval maintenance period. Larvae are generally spread in the morning and evening because that is when the environmental temperature is low so that the larvae are not stressed and can adapt to the new environment.

Larvae enlargement is carried out in a concrete pool measuring 2.5 m x 1 m with a water height of 40 cm. Larvae maintenance is carried out in one pool, namely in a concrete pool. Maintenance is carried out when the larvae have hatched in the brood pond and then transferred to the maintenance pool so that there is no death caused by the very aggressive movement of the broodstock. After hatching, the larvae are left for three days first, with the aim that the body condition of the larvae becomes strong. During that time the larvae do not need additional feed because they still have food reserves in the egg yolk. This reserve feed will run out in 3-4 days. The calculation of comet fish larvae that have hatched from all eggs produced in one broodstock comet fish that is spawned is 90.8%.

Water Quality

Water conditions play an important role in influencing feed efficiency, growth rate, health and survival of fish. In fish farming, water quality parameters are the key to the sustainability of life and quality of fish growth. Water quality measurements were carried out in the first and fourth weeks in the morning, the parameters measured were dissolved oxygen (DO), pH, and temperature. The tools used to measure dissolved oxygen were DO meters, pH using pH pens, and temperature using thermometers. Water quality data during the study are presented in Table 1.

Table 1. Water Quality

Fish	Parameter	Cultivation Pond Water Quality
Goldfish	DO	5.3 – 5.7 mg/l
	pH	7 – 7.4
	Temperature	28 – 29^{o}C
Betta	DO	5.7 mg/l
	pH	6.8 – 7
	Temperature	27 – 28^{o}C
Molly	DO	5.7 mg/l

Fish	Parameter	Cultivation Pond Water Quality
	pH	7 – 8
	Temperature	27 – 28^{o}C
Guppy	DO	5 mg/l
	pH	6.8 – 7.4
	Temperature	25 – 28^{o}C
Comet	DO	6 mg/l
	pH	6.7 – 7.4
	Temperature	27 – 28^{o}C

Based on the table above, the results of water quality measurements in the maintenance of 5 types of ornamental fish are still in optimum condition for the survival and growth of the fish. In goldfish, the DO results were 5.3 - 5.7 mg / l, pH 7 - 7.4, and temperature 28 - 29^{o}C. In betta fish, the DO results were 5.7 mg / l, pH 6.8 - 7, and temperature 27 - 28^{o}C. The water quality of molly has a DO result of 5.7 mg / l, pH 7 - 8, and temperature 27 - 28^{o}C. Then in guppy, the DO value is 5 mg / l, pH 6.8 - 7.4, and temperature in the range of 25 - 28^{o}C. Finally, comet have a DO result of 6 mg / l, pH ranging from 6.7 - 7.4, and temperature 27 - 28^{o}C.

Harvesting

Goldfish harvesting is done on the 30th day or at the age of 23 days, the harvesting process is done in the afternoon. The first step taken when harvesting is to prepare the tools used for harvesting and make sure the tools used are clean. Then drain the water in the maintenance pond to make it easier to take fish, then the fish are taken from the maintenance pond using a scoopnet and then transferred to a container that has been prepared.

Betta fish harvesting is done on the 30th day or at the age of 23 days, the harvesting process is done in the morning. The first step taken when harvesting is to prepare the tools used for harvesting and make sure the tools used are clean. Then drain the water in the maintenance pond to make it easier to take fish, then the fish are taken from the maintenance pond using a scoopnet and then transferred to a container that has been prepared.

Molly fish harvesting is done on the 30th day or at the age of 23 days, the harvesting process is done in the morning. The first step taken when harvesting is to prepare the tools used for harvesting and make sure the tools used are clean. Then drain the water in the maintenance pond to make it easier to take fish, then the fish are taken from the maintenance pond using a scoopnet and then transferred to a container that has been prepared.

Harvesting of guppy fish is done on the 30th day or at the age of 23 days, the harvesting process is done in the morning. The first step taken when harvesting is to prepare the tools used for harvesting and make sure the tools used are clean. Then drain the water in the maintenance pond to make it easier to take fish, then the fish are taken from the maintenance pond using a scoopnet and then transferred to a container that has been prepared.

Harvesting of comet fish is done on the 30th day or at the age of 23 days, the harvesting process is done in the morning. The first step taken when harvesting is to prepare the tools used for harvesting and make sure the tools used are clean. Then drain the water in the maintenance pond to make it easier to take fish, then the fish are taken from the maintenance pond using a scoopnet and then transferred to a container that has been prepared.

DISCUSSION

According to Hasibuan et al. (2021) drying activities assisted by sunlight will help kill most pathogenic microorganisms, besides drying can also release toxic gases found at the bottom of the pond. In the larval pond, there are dried banana leaves used as a breeding ground for betta fish and are useful for supplying oxygen, as a hiding place and shelter for fish. The first step in preparing this pond is to brush and rinse it thoroughly to clean the moss that sticks to the walls of the pond (Nurhayati et al., 2022). The next process is to dry it for 1-2 days to break the life cycle of pests and diseases that may have been present in the previous cultivation period, most pathogenic microorganisms will die in the sunlight. In addition, drying also helps eliminate toxic gases trapped at the bottom of the pond. Next, the spawning is filled with clean water to a depth of 40 cm and insert the kakaban as a substrate for attaching fish eggs. Kakaban is made of coconut fiber with a width and length of 30 cm (Augusta et al., 2020).

The characteristics of male betta fish that are ready to spawn are at least 4-8 months old, long body shape, long fins and attractive bright colors, and aggressive and agile movements. Meanwhile, the characteristics of female betta fish that are ready to spawn are at least 3-4 months old, rounded body shape, slightly bloated stomach. Betta fish that are gonad mature/ready to mate have the characteristics of male fish are at least 4 months old, brightly colored, wide caudal and anal fins, slender body, aggressive and agile movements. The characteristics of female betta fish are at least 4 months old, bloated stomach with a white protrusion under the stomach, shorter fins than male fish, usually less attractive colors than males and relatively slower movements. Permana et al. (2021) which states that 4-month-old betta fish broodstock are gonad mature and ready to spawn and it can be seen that the female broodstock's stomach is already fat and soft and the male broodstock has a bright reddish color. Several other differences between male and female betta fish can be seen from their morphological characteristics. Male betta fish have an elongated body size and when viewed from the anterior or posterior, their body shape is flat to the side or compressed. The head is relatively large, the small mouth is equipped with slightly thick lips and strong jaws. The lateral pelvic fins are elongated. Furthermore, to distinguish male and female betta fish, it can be seen from the body size, color and fins. The broodstock used are 5 male broodstock and 5 female broodstock with a ratio of 1 to 1. Male broodstock when gonad mature and striped will release thick white sperm fluid while female gonad mature is marked by swelling in the stomach area and when stripped releases yellow fluid. Huwoyono (2018) stated that morphology is carried out directly by observing the anal fins and caudal fins, color and body shape. The broodstock used are broodstock that are ready to spawn with the characteristic of chasing each other (Hartono et al., 2012). The chance of eggs that stick to Hydrilla is higher to be fertilized when compared to coconut fiber and raffia rope. This is because Hydrilla has branched and soft stems so that sperm are not hindered by the substrate to fertilize the eggs.

Goldfish spawn at night until dawn. Goldfish spawning begins when the female fish rubs her body and sprays her eggs on the substrate. Then followed by the male broodstock who fertilizes the eggs. During spawning, the broodstock should not be disturbed by noisy activities because it will cause the fish to be stressed and unwilling to spawn (Khasanah et al., 2016). Fish spawning in ponds must pay attention to ecological conditions as external factors needed to stimulate fish spawning. Ecological conditions as external factors that play an important role in fish spawning are light and temperature. The spawning process is carried out by inserting male and female broodstock with a ratio of 5 males and 5 females into a spawning pond equipped with a kakaban as a place to spawn. Comet fish spawn at night until dawn. Comet fish spawning begins when the female fish rubs her body and sprays her eggs on the substrate. Then followed by the male broodstock who fertilizes the eggs. During spawning,

the broodstock should not be disturbed by noisy activities because it will cause the fish to be stressed and not want to spawn (Khasanah et al., 2016). The density of goldfish is 1 fish/1 liter and gives the best weight and length growth rate.

Egg yolk is given to the larvae to meet the nutrition and energy needs of the larvae. Egg yolk is an important factor in the life of the larvae. Egg yolk is a food reserve for the larvae. Egg yolk is a food reserve as well as a nutrient and energy for growth and development. *Artemia* sp. feed is given so that it is in accordance with the mouth opening of the fish larvae and has nutritional content. *Artemia* sp. has a size that matches the mouth opening of the larvae, always moves so that it attracts the attention of fish, is easy to digest, the level of pollution in the culture water is lower and has high nutrition. Zamzami et al. (2018) stated that newly hatched fish larvae are not given food for 2-3 days, after 4 days the fish larvae are allowed to be given food that is appropriate for the size of the larvae's mouth.

The optimum dissolved oxygen value, the fish's appetite will increase so that the absorption of feed will be greater and the growth of fish seeds will be higher (Pamulu, 2021). Water conditions that are very acidic or very alkaline will endanger the survival of organisms because they will cause metabolic and respiration disorders. The ideal temperature for fish maintenance is 25-30°C, above that temperature the fish's appetite will decrease. In addition, high water temperatures will increase the metabolic activity of existing organisms. The higher the metabolic activity, the dissolved gas content will decrease. Low dissolved gas content over a long period of time will cause fish to become weak, even die. The right temperature for betta fish is between 24-28°C (Pamulu, 2021). According to Pratama (2021) the survival of betta fish is determined by the degree of acidity (pH), temperature and dissolved oxygen content (DO). Arfa et al. (2017) stated that the good temperature range for betta fish cultivation from the beginning of maintenance to the end of maintenance is 25-30°C. Betta fish can survive with a dissolved oxygen content of 5 mg/L. Rachmawati et al. (2016) said that the appropriate pH range for betta fish cultivation is 6.5-7. Good water quality will support the growth of fish seeds, conversely poor water quality will inhibit growth and even cause death in fish seeds (Willem et al., 2019). According to Razi (2014) the suitable temperature for molly fish is between 24-28°C. The ideal pH value for the life of aquatic organisms in general is between 7 and 8.5. Pamulu (2021) stated that the range of dissolved oxygen (DO) content of 5-5.7 ppm is still a good range to support the growth of molly fish seeds. The good temperature range for guppy fish cultivation from the beginning of maintenance to the end of maintenance is 23-27°C. Guppy fish can survive with a dissolved oxygen content of 5 mg/L. The pH range suitable for betta fish cultivation is 6.7-7.2. Subhan et al. (2017) stated that the optimum temperature for fish spawning is 26 - 28°C. The range of water quality parameters that can still be tolerated by fish is 5-6 mg/l. While the optimal pH range according to Husnan et al. (2014) is 6.8-7.4.

CONCLUSION

The conclusion that can be drawn from this study is to be able to know, understand, and practice ornamental fish cultivation techniques carried out in Mahkota Betta Fish which are carried out in several stages to create quality results or seeds, namely pond preparation, broodstock preparation, media preparation for eggs, hatchery, nursery, enlargement, water quality management, and harvesting.

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