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# EFFECT OF COMPARATIVE NUMBER OF MALES AND FEMALES ON LARVAE PERFORMANCES OF TAWES FISH (BARBONYMUS GONIONOTUS)

## Pengaruh Perbandingan Jumlah Induk Jantan Dan Betina Terhadap Performa Benih Ikan Tawes (Barbonymus Gonionotus)

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**ABSTRACT**

One of the phases that determines the success of fish farming is the egg hatching phase. The production of good quality Tawes larvae can occur if the hatchability of eggs is high and quality of eggs produced is good. The hatchability of eggs is relatively low at only 22% and can only produce approximately 10,000 fry, this is an important problem in the spawning process of Tawes fish in Indonesia. As an effort to increase the hatching rate of Tawes fish eggs, this is by treating the ratio of male to female broodstock differently in each hatching container. This research aims to determine the effect of comparison of the number of male and female broodstock on Tawes fish seed production and to find out how many seeds are produced by the ratio of male and female Tawes fish broodstock. The research was carried out for one month using the experimental design method. The parameters observed were the degree of egg hatching and air quality measurements, then data obtained were analyzed using a Completely Randomized Design (CRD) using SPSS 24 for Windows software. The results of the research showed that the ratio of male to female broodstock had an effect on production of Tawes fish (Barbonymus gonionotus) larvae, where the highest larvae production was obtained at a male broodstock ratio of 2:1 female.

**Keywords:** Larvae, Broodstock, Tawes Fish

**ABSTRAK**

Salah satu fase yang menentukan keberhasilan budidaya ikan adalah fase penetasan telur. Produksi larva tawes dengan kualitas yang baik dapat terjadi apabila daya tetas telur tinggi dan kualitas telur yang dihasilkan baik. Daya tetas telur tergolong rendah hanya sebesar 22% dan hanya mampu menghasilkan kurang lebih 10.000 benih, hal ini menjadi permasalahan penting dalam proses pemijahan ikan tawes di Indonesia. Sebagai upaya peningkatan derajat penetasan telur ikan tawes yaitu dengan perlakuan rasio indukan jantan dan betina yang berbeda pada setiap wadah penetasan. Penelitian ini bertujuan untuk mengetahui pengaruh perbandingan jumlah indukan jantan dan betina terhadap produksi benih ikan tawes dan mengetahui berapa

banyak benih yang dihasilkan dengan perbandingan indukan jantan dan betina ikan tawes. Penelitan dilakukan selama satu bulan dengan metode eksperimental design. Parameter yang diamati berupa derajat penetasan telur dan pengukuran kualitas air kemudian data yang diperoleh dianalisis dengan Rancangan Acak Lengkap (RAL) menggunakan software SPSS 24 for windows. Hasil penelitian menunjukkan bahwa rasio indukan jantan dan betina berpengaruh terhadap produksi benih ikan tawes (*Barbonymus gonionotus*) dimana produksi benih terbanyak diperoleh pada rasio indukan Jantan 2 : 1 Betina.
**Kata Kunci:** Benih, Indukan, Ikan Tawes

## INTRODUCTION

Indonesia has abundant types of fish that can be developed to increase fish cultivation income so that success in the industrialization of the fisheries sector increases. One of the aquaculture activities that influences increased production is fish breeding. Of the several local fish for consumption that have high economic prices, one of them is fish from the genus Barbonymus such as Tawes Fish (Diana & Safutra, 2018; Radona *et al.,* 2015). This fish can be used as a superior commodity in freshwater cultivation considering that in several areas in Indonesia tawes fish are still often found.

The survival of a species based on the reproductive aspect is spawning. Spawning is the combination of egg cells of female fish and spermatozoa of male fish. According to Zairin, *et al.,*(2005), several factors that influence the stimulation of spawning are internal factors, namely gonad maturity and external factors from the environment such as water quality and biological factors (Augusta *et al.,* 2020)

Tawes fish is a fish that has been cultivated for a long time because it is suitable for the weather in Indonesia, which is classified as a tropical climate. Therefore, tawes fish can be cultivated throughout the year and is an economical consumption fish whose market price is still affordable for all levels of society (Zulkarnain *et al.,* 2017). Not many cultivation efforts have been made to preserve the existence of this type of fish, so it is feared that its population will decrease and become extinct (Kusmini *et al.,* 2015). Therefore, efforts are needed to develop both hatchery technology and rearing of Tawes fish so that the germplasm of fish native to Indonesian waters can be preserved.

Information related to Tawes fish cultivation is really needed, one of which is information related to hatching, including sufficient sperm count to carry out the fertilization process so that the success rate of the spawning process can be seen (Rimalia, 2014). According to Said & Mayasari (2010), sex ratio in spawning can be used as a method of increasing the quantity and quality of fish production. Applying the sex ratio method in spawning can increase the number of sperm produced by males to fertilize egg cells, so that the number of eggs and larvae obtained is optimal. Information about the fertilization rate and hatchability of tawes fish eggs with the ratio of the number of male and female broodstock is still limited so research needs to be carried out to obtain the best broodstock ratio in spawning tawes fish to produce a high degree of hatching and survival, so that the number of larvae can be produced. optimal and good quality. The benefit of this research is to provide information regarding the optimal ratio of male and female parents for the hatchability of Tawes fish eggs

## METHODS

### Time and Place

The research was carried out in November – December 2023 at the Cenrana Mas Indah (CMI) Fish Hatchery Unit, Pinrang Regency, South Sulawesi. The one month research started from the preparation stage to data collection.

**Tools and Materials**

The tools used in this research were: 12 fiber tubs measuring 1 x 2 x 70 m3, basin, aerator, waring, seser, measuring cup, writing utensils and camera. The materials used are male and female Tawes parent fish, self-made feed, and Methylene Blue (MB).

**Design**

The research carried out consisted of the process of planning, implementing, supervising and collecting research data which was carried out for one month with direct observation and literature study as well as actively participating in fish hatchery activities at CV. Cenrana Mas Indah.

**Procedure**

Research activities began by preparing 12 fiber tubs filled with 56 broodstock consisting of 40 males and 16 females. The ratio of male and female parents used in this research is: Male 1: 1 Female – Male 2 : 1 Female – Male 3 : 1 Female – Male 4 : 1 Female. Each treatment was carried out 3 times.

The Tawes broodstock used came from the Cenrana Mas Indah Fish Hatchery Unit and were reared for 8 months. Feeding is carried out twice every day at 09.00 WITA and 16.00 WITA using feed made independently by Cenrana Mas Indah in the form of pellets with a feed protein content of 32%, so that it can fulfill the requirements as broodstock that are ready to spawn and of good quality.

The broodstock used in this research were broodstock that had been adapted to ponds. Parent selection is carried out in the rearing pond by selecting prospective parents one by one. Based on the completeness of the body parts, there are no defects, no injuries and have reached the final level of gonadal maturity. Tawes fish broodstock from the selection results are acclimatized first before being put into the pond and kept for 1 week. Latent time observations were carried out after the male and female Tawes fish were placed in one spawning container until the fish experienced ovulation. The mother that has ovulated is immediately separated into another medium.

The number of eggs is calculated by taking a sample per 100 ml, then the eggs are given a solution of Methylene Blue (MB) which functions to prevent the eggs from being exposed to fungus. After that, all the fish eggs are put into a hatching container (basin) at a rate of 500 ml and given oxygen. . Then the larvae count is carried out after the larvae are 2 days old by taking samples per 1 liter of water, then counting them manually so that the results match the measurements.

**Data Analysis**

This research uses an experimental design method with qualitative descriptive analysis obtained from observations of several parameters and described in the form of a short description. The observation parameter in this study was the Hatching Rate (HR). The degree of egg hatchability is the ability of the egg to develop during the embryological process until the egg hatches (Marsela *et al.,* 2018). The formula used is to calculate the number of egg samples that hatch based on the formula (Hui *et al.,* 2014):

$$HR = \frac{\text{Hatched eggs}}{\text{Fertilized eggs}} \times 100\%$$

Apart from that, water quality observations were also carried out by measuring several parameters supporting water quality, namely: Temperature, pH and Dissolved Oxygen (DO). Data presentation is presented in the form of graphs and tables using Microsoft Excel software.

## RESULT

### Degree of Egg Hatching

Based on the results of observations, the number of seed production obtained in the four treatments is presented in Figure 1.

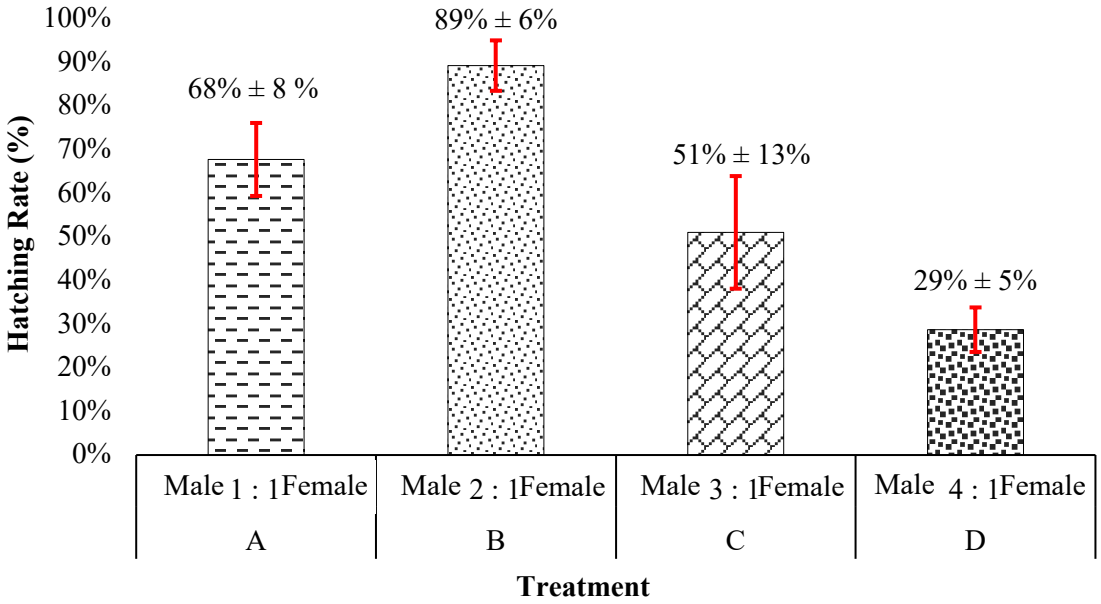


Figure 1. Tawes Fish Seed Production During Research

In Figure 1, it can be seen that the best egg hatchability production in treatment B reached 89% with a standard deviation of 6%, meaning that the data is spread with a high level of homogeneity or tends to be the same in each replication because the standard deviation value is smaller than the average. Meanwhile, the lowest hatchability in treatment D was 29% with a standard deviation of 5%, meaning that the data spread tended to be the same in each replication.

### Water Quality

The observed water quality data consists of temperature, pH, and DO. Water quality data is presented in Table 1. Measurements were carried out at the beginning and end of the study. Water quality in the rearing media can support the hatching process and fish life as part of the physiological balance of farmed fish (Alfath *et al.,* 2020).

Table 1. Water Quality Parameter Measurement Results

| Parameter | Treatments | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | Standart (PP Number 82 2001 (Class II) |
| Tempratur (°C) | 27-30 | 27-29 | 29-31 | 29-30 | ±3°C from normal natural temperature |
| pH | 7,5-8,3 | 7,8-8,3 | 7,5-8,3 | 7,6-8,3 | 6-9 |
| DO (ppm) | 4,6-5,8 | 4,6-6,0 | 4,0-4,7 | 4,2-5,0 | >4 |

Source: Research result (Processed, 2023)

Based on Table 1, it is known that the temperature during the research was in the range of 27-31oC, the value of the degree of acidity (pH) during the research was stable in the range of 7.5 - 8.3, and the DO content ranged from 4.5-6.0 ppm. The range of values in measuring

water quality seems to fluctuate but is still within the range of quality standards for fish farming based on PP No. 82 of 2001.

## DISCUSSION

The results of research on pond A which used a 1:1 male to female ratio showed that male fish sperm was not enough to fertilize all of the female's eggs so that the seeds produced tended to be few with an average of 68%. This is in line with research by Savitri *et al.,* (2022) who found that the hatchability of Tawes fish eggs for a 1:1 broodstock ratio was in the range of 51%-66%. Based on observations in pond B which used a male ratio of 2: 1 female, male Tawes sperm could fertilize all the eggs that came out of the female's stomach so that the seed yield obtained was higher than the other three treatments, namely 89%. This is supported by the statement of Masitoh *et al.,* (2015) who stated that the right ratio of male to female parents will make the fertilization process optimal because the number of sperm cells is sufficient to fertilize all existing egg cells. Although several studies regarding the ratio of male to female broodstock in the same family as tawes, namely the Cyprinidae family, showed different results. The research results of Ristyanadi *et al.,* (2022) who obtained a total egg hatchability of only 47.6% using 2: 1 female male parents. Apart from that, Rimalia (2014) with a ratio of 4 males : 1 female jelawat fish produced the highest degree of fertilization (96%).

There are many factors that influence differences in hatching degree results, including the number of male parents which is one of the factors that influence the degree of egg fertilization (Ochokwu *et al.,* 2015). A high degree of egg fertilization will also result in a high degree of egg hatching (Pertiwi *et al.,* 2018). Research by Alfath *et al.,* (2020) related egg density to the degree of egg hatching, showing that a density with a value of 20 eggs/liter of water had a higher egg hatchability compared to the lowest and highest density treatments. Apart from different densities, the length of hatching time due to the activity process during egg hatching can influence the hatching of fish eggs, and not all fertilized eggs will hatch (Setyono, 2009), the quality of ovulated eggs is one of the factors that influence the degree of hatching. eggs (Firmantin *et al.,* 2015)

Pond C, which uses a male ratio of 3: 1 female, has very bad reproductive problems, as does treatment D, which uses a male ratio of 4: 1 female. Richter (1985) in Ramadhan & Sari (2018) stated that generally the percentage of fish hatching is in the range of 50% -80%. In this study, the broodstock ratios of 3:1 and 4:1 were classified as ineffective because the egg hatchability results were on average 51% and 29%. Comparisons of 3:1 and 4:1 indicate low hatchability, presumably because male fish interfere with each other to fertilize females. Apart from that, male sperm is also excessive, which can affect water quality, making the water foamy and rot so that egg fertilization is not optimal and many eggs are produced. not hatching. (Zairin *et al.,* 2005) explained that the factor that causes the eggs not to develop after the fertilization process is due to damage to the physiological changes of the egg during embryogenesis, perhaps also due to damage to the egg sample when transferred to the aquarium which results in a low hatching rate. Apart from that, according to Zubaidah *et al.,* (2021), the high or low hatching rate is one of the environmental factors where water lacking oxygen and acid will inhibit embryo growth and will make it easier for pathogens to attack the eggs. In this study, the lowest dissolved oxygen values were in the 3 : 1 and 4 : 1 treatments. Another opinion was expressed by Laila & Purwasih (2020) who stated that hatching failure could also be caused by failure to prepare the broodstock, whose gonads were truly mature and ready to be spawned and failure to stimulate parent ovulation so that spawning is not optimal. Furthermore, Ayer *et al.,* stated. (2019) that the hatchability of fish eggs is always determined by sperm fertilization, unless there are environmental factors that influence it. Statement by Cahyanti *et al.,* (2022) added that the egg division process can be influenced by internal and

external factors. Internal factors are: type of fish, egg size, genetics, gonad maturity and fish health. Meanwhile, external factors are: temperature, pH and oxygen levels.

In this study, temperature, pH and oxygen levels were observed as external factors that influence the degree of egg hatching. Research by Hui *et al.,* (2014); Nyanti *et al.,* (2018) stated that temperature, pH and oxygen have a significant influence on fish fertilization and hatching. The temperature during the research was in the range of 28-30oC. According to Marsela *et al.,* (2018), stated that temperature is an important factor that influences the secretion of hatching enzymes. At low temperatures, spawning and hatching will be inhibited, also reducing survival. On the other hand, embryos from a low temperature transferred to a medium with a higher temperature will speed up hatching and increase the degree of hatching. Higher temperatures also cause the egg membrane to dissolve more quickly than at low temperatures so that the hatching time is faster. According to Azaza *et al.,* (2008) the temperature range suitable for embryo development is usually much stricter than at other growth stages. Tawes fish can live with an optimum temperature of between 25ºC - 33ºC and a minimum temperature of around 15ºC.

The acidity degree (pH) value plays an important role in fish homeostasis where changes in pH can cause ion disturbances and ammonia excretion in fish during research (Nyanti *et al.,* 2018). The pH in this study ranged from 7.6 – 8.3. This can be said to be quite feasible for hatching Tawes fish eggs. Diana & Safutra (2018) stated that a good pH for the viability of Tawes fish ranges from 7-8.5. A pH that is too high can affect the metabolic performance of the fish's body, thereby affecting the condition of the fish. pH decreases if fish density increases, this is because the formation of CO2 during respiration will increase so that pH decreases (Alfath *et al.,* 2020). Nyanti *et al.,* (2018) stated that temperature and pH can influence enzymatic activity and in turn influence metabolism, as well as growth and development,

The dissolved oxygen levels in the tawes fish egg hatching container during the research ranged from 4.6 – 6.0 mg/l, this can be said to be quite suitable for hatching tawes fish eggs and rearing fry. According to Rosmawati & Muarif (2010) the range of dissolved oxygen that does not harm fish life is 5.7 – 6.4 mg/l for fish survival and growth. Naturally, reproduction of fish from the Cyprinidae family depends on dissolved oxygen ranging from 4.9 mg/l - 10 mg/l (Mubarik *et al.,* 2019; Idoko *et al.,* 2021). Burmansyah *et al.,* (2013) stated that during hatching eggs require a high oxygen content to hatch. Qiang *et al.,* (2019) stated that temperature and dissolved oxygen (DO) levels are generally important determinants of the growth and reproduction of aquatic organisms, and are the most important abiotic factors influencing the rate of fertilization and hatching of fish eggs. Increasing water temperature accelerates the breakdown of fish embryo hatching enzymes and increases the oxygen consumption of developing embryos (Qiang *et al.,* 2019). At higher temperatures, water DO decreases (Wexler *et al.,* 2011). Therefore, interactions and possible synergies between water temperature and DO must be considered. The high oxygen content in this study resulted in a higher egg hatching rate compared to the other three treatments, so it can be assumed that the water quality factor influenced the egg hatching rate results in the ratio of male to female parents in the four treatments.

## CONCLUSION

The conclusion that can be drawn from the results of this research is that the ratio of male to female broodstock that produces the best egg hatching rate in Tawes fish is a male to 1 female ratio. Several factors that influence the degree of egg hatching in this study are gonad maturity and egg size and environmental factors consisting of temperature, pH and dissolved oxygen.

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