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APPLICATION OF GONADOTROPIN HORMONES ON ARTIFICIAL SPAWNING SANGKURIANG CATFISH (Clarias sp.)

Aplikasi Hormon Gonadotropin Pada Pemijahan Buatan Ikan Lele Sangkuriang (Clarias sp.)

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ABSTRACT

The demand for catfish increases every year, the production that occurs is not yet able to handle market demand. To meet the demand optimally, artificial spawning is carried out using gonadotropin hormones at different doses. This research aims to determine the right use of dosage in the artificial spawning process of sangkuriang catfish based on fecundity, FR, HR and SR. This research was carried out using 3 doses, namely for treatment P (0.1 ml/kg), Q (0.2 ml/kg) and R (0.3 ml/kg), each treatment was carried out in 3 repetitions. The results showed that the administration of gonadotropins achieved the highest fertility level in in spawning with a gonadotropin dose of 0.3 ml/kg of 62,150 grains. Meanwhile, the lowest fecundity value occurred in spawning with a gonadotropin dose of 0.1 ml/kg of 46,240 grains. The highest FR value was obtained when using a gonadotropin dose of 0.1 ml/kg which resulted in the highest FR value of 98.36% and the lowest FR using a gonadotropin dose of 0.3 ml/kg of 87.85%. The highest HR value was obtained at a dose of 0.1 ml/kg of 94.20%, and the lowest HR value at a dose of 0.2 ml/kg of 68.5%. The highest SR value was obtained at a dose of 0.1 ml/kg at 94.61% and the lowest SR value at a dose of 0.2 ml/kg of 54.39%. Based on the FR value at a dose of 0.1 ml/kg of 98.36%, for the HR value at a dose of 0.1 ml/kg of 94.61%. The results of the observations concluded that the use of gonadotropins with the highest fecundity value was obtained at a dose of 0.3 ml/kg with a total of 62,150 grains. The good dose of FR, HR and SR values for artificial spawning of sangkuriang catfish with gonadotropin hormone were found at a dose of 0.1 ml/kg where the fertilization rate (FR) value is 98.36%, Hatching rate (HR) is 94.2% and survival rate (SR) is 94.61%. The value of FR, HR and SR is influenced by environmental conditions and the care carried out. Because the condition of the larvae is still very vulnerable, the immunity is still weak, rudimentary organs are still in their infancy.

Keywords: Catfish, Dosage, Gonadotropin, Spawning

ABSTRAK

Permintaan terhadap ikan lele pada setiap tahun meningkat, produksi yang terjadi belum mampu menangani permintaan pasar. Untuk memenuhi permintaan secara optimal maka

dilakukan pemijahan buatan menggunakan hormon gonadotropin dengan dosis berbeda. Penelitian ini bertujuan mengetahui penggunaan dosis secara tepat dalam proses pemijahan buatan ikan lele sangkuriang berdasarkan fekunditas, FR, HR dan SR. Penelitian ini dilakukan dengan menggunakan 3 dosis yaitu untuk perlakuan P (0,1 ml/kg), Q (0,2 ml/kg) dan R (0,3 ml/kg), masing-masing perlakuan ini dilakukan 3 ulangan. Hasil penelitian menunjukkan bahwa pemberian gonadotropin mencapai fekunditas tertinggi pada saat pemijahan dengan dosis gonadotropin 0,3 ml/kg sebesar 62.150 butir. Sedangkan nilai fekunditas terendah terjadi pada pemijahan dengan dosis gonadotropin 0,1 ml/kg sebesar 46.240 butir. Nilai FR tertinggi diperoleh pada penggunaan gonadotropin dosis 0,1 ml/kg yang menghasilkan nilai FR tertinggi yaitu 98,36% dan FR terendah pada gonadotropin dosis 0,3 ml/kg sebesar 87,85%. Nilai HR tertinggi diperoleh pada dosis 0,1 ml/kg sebesar 94,20%, dan nilai HR terendah pada pada dosis 0,2 ml/kg yaitu 68,5%. Nilai SR tertinggi diperoleh pada dosis 0,1 ml/kg yaitu 94,61% dan nilai SR terendah pada dosis 0,2 ml/kg sebesar 54,39%. Hasil pengamatan disimpulkan bahwa penggunaan gonadotropin dengan nilai fekunditas tertinggi diperoleh pada dosis 0,3 ml/kg sebanyak 62.150 butir. Nilai FR, HR dan SR dosis yang baik untuk pemijahan buatan ikan lele sangkuriang dengan hormon gonadotropin terdapat pada dosis 0,1 ml/kg □ncrea nilai *Fertilization Rate* (FR) sebesar 98,36%, *Hatching Rate* (HR) sebesar 94,2% dan *Survival Rate* (SR) sebesar 94,61%. Nilai FR, HR dan SR dipengaruhi oleh kondisi lingkungan serta perawatan selama pemeliharaan. Karena kondisi larva yang masih sangat rentan, kekebalan tubuhnya masih lemah, organ tubuh belum sempurna dan masih dalam masa pertumbuhan.

Kata Kunci: Lele, Dosis, Gonadotropin, Pemijahan

INTRODUCTION

Sangkuriang Catfish (*Clarias* sp.) is the result of genetic crossbreeding between second generation female African fish (*Clarias gariepinus*) (F2) and sixth generation male African fish (F6) using the backcross method. The female parent (F2) is a collection at BBPBAT Sukabumi, originating from the second generation African fish introduced in Indonesia in 1985, the male parent is the parent stock at BBPBAT Sukabumi (Marsela *et al*., 2018).

According to Sunarma (2004) Sangkuriang catfish grows faster than dumbo catfish. The first nursery, the growth of sangkuriang catfish reached 29.26%, the growth of dumbo catfish reached 20.38%. The faster growth rate of sangkuriang catfish compared to dumbo catfish indicates that sangkuriang catfish can be harvested faster. In addition, sangkuriang catfish hatch faster than dumbo catfish, with the fecundity rate of sangkuriang catfish reaching 40,000-60,000 grains/kg of parent tail weight while for dumbo catfish it reaches 20,000-30,000 grains/kg of parent tail weight.

The need or demand for catfish never recedes, in fact it tends to □ncreasee every year. Current production has not met market demand because catfish is a type of fish for consumption that has high protein. Based on the Data, Statistics and Information Center of the Ministry of Maritime Affairs and Fisheries (2024), the value of catfish production in 2020 was 993,653.04 tons and in 2021 the production value increased to 1,041,422.43 tons.

The demand for catfish increases every year, the production that occurs has not been able to handle market demand. Therefore, it is necessary to support it with quality catfish seeds and meet the market. Efforts that can be made to meet the demand for catfish seeds are the provision of catfish seeds by means of artificial spawning. Artificial spawning is carried out on catfish by providing stimulation assistance using gonadotropin hormones with a certain dose. This hormone will stimulate gonad maturity and egg development (Arif, 2003). The purpose of this study was to determine the right dose in artificial spawning of sangkuriang catfish based on fecundity, fertilization rate (FR), hatching rate (HR) and survival rate (SR).

METHODS

Time and Place

This research was conducted from March to May 2023 at CV. Dejeefish Jl. Raya Cibaraja No.11 Cisaat, Nagrak, Sukabumi Regency, West Java.

Tools and Materials

The tools used include: aquarium measuring 90cm x 40cm x 35cm; aeration; spluit; mercury thermometer; pH meter; DO meter; analog scales; basin; cotton cloth; cool box; chicken feathers; seser; heater; hose; scissors and knife. The materials used include: male parent weighing 690-800 grams per fish; female parent weighing 890-1100 grams per fish; gonadotropin hormone; NaCl; pellet feed.

Analysis Method

The study was conducted with 3 different hormone dose treatments and repeated 3 times. The use of hormone doses refers to Marsela et al. (2018) treatments include: P (gonadotropin 0.1 ml/kg fish weight); Q (gonadotropin 0.2 ml/kg fish weight); R (gonadotropin 0.3 ml/kg fish weight). Data analysis was carried out on fecundity values (Fe), fertilization rate values (FR), hatching rate values (HR) and survival rates (SR).

Fecundity

Fecundity is the number of eggs in the stomach of the parent that have mature gonads and are ready to be spawned. The calculation of this fecundity aims to estimate the number of eggs that will be obtained from a parent when spawning. So that it can estimate fish stock only by looking at the fecundity value. According to Makmur (2006) fecundity can be calculated using the formula:

$$F = x \,.\left(\frac{G}{g}\right)$$

Description:
F = Fecundity
x = Number of eggs taken (1000)
G = Total gonad weight weighed (g)
g = Weight of 1000 eggs weighed (g)

Fertilization Rate (FR)

Fertilization rate (FR) is the percentage of eggs that are successfully fertilized from the number of eggs obtained from the spawning process. The percentage of fish eggs that are successfully fertilized is >50% in the high category, while 30-50% is in the medium category and <30% is in the low category. According to Fani *et al*. (2018) fertilization rate (FR) can be calculated using the formula:

$$\text{FR}\ (\%) = \frac{\text{Number of fertilized eggs}}{\text{Total number of eggs}}\ \text{x}\ 100\%$$

Hatching Rate (HR)

Hatching Rate (HR) is one of the parameters for measuring the degree of egg hatching. HR calculation is carried out 2 days after FR calculation. The HR value in this study was calculated by calculating the number of egg samples that hatched and then entered into the formula. According to Susanti & Sitinjak (2019) hatching rate (HR) can be calculated using the formula:

$$\text{HR}\ (\%) = \frac{\text{Pt}}{\text{Po}}\ \text{x}\ 100\%$$

Description:
HR = Degree of Hatching (%)
Pt = Number of Eggs Hatched
Po = Number of Eggs Scattered

Survival Rate (SR)

Survival rate (SR) is the percentage of fish that survive at the end of maintenance from the number of fish at the beginning of stocking in a cultivation container. According to Susanti & Sitinjak (2019) survival is calculated as follows:

$$SR = \frac{NT}{No} \times 100\%$$

Description:
SR = Survival of seeds (%)
Nt = Number of fish alive at the end of the study (fish)
No = Number of fish alive at the beginning of the study (fish)

Measurement of Water Quality

Measurement of water quality during the spawning of sangkuriang catfish is carried out every morning and evening to determine fluctuations in environmental changes. This measurement is carried out on temperature, pH and DO (dissolved oxygen). Water quality measurements were conducted in situ (morning and evening). The tools used include a dip thermometer to measure the temperature of the water media; a pH meter to measure pH and a DO meter to measure dissolved oxygen (Burhanuddin, 2013).

RESULT

The results of the calculation of the weight of the broodstock at the beginning and end of the observation are shown in Table 1, while the values of fecundity, fertilization rate, hatching rate and survival rate in each treatment are as in Table 2. The results of water quality measurements are presented in Table 3.

Table 1. Data on the Weight of Male and Female Broodstock

Treatment	Initial Weight (g)		Final Weight (g)		Difference (g)		Egg Sample Weight (g)	Number of Eggs in Egg Sample Weight (Grains)
	Male	Female	Male	Female	Male	Female		
P1	750	900	670	810	80	90	1	569
P2	700	890	650	790	50	100	1	535
P3	690	890	630	810	60	80	1	578
Q1	800	1100	740	1000	60	100	1	581
Q2	680	900	630	800	50	100	1	584
Q3	760	900	700	800	60	100	1	559
R1	700	900	630	800	70	100	1	597
R2	800	1000	740	890	60	110	1	565
R3	750	930	700	830	50	100	1	605

Table 2. Results of Calculation of Fecundity, FR, HR and SR of Sangkuriang Catfish Spawning

Treatment	Fecundity (Grains)	Fertilized Eggs (Grains)	Scattered Eggs (Grains)	FR (%)	HR (%)	Early Larva (Fish)	Final Larva (Fish)	SR (%)
P1	51210	2713	3000	90.43	77.07	2091	1202	57.48
P2	53500	2951	3000	98.36	94.20	2780	2509	90.25
P3	46240	2781	3000	92.7	90.86	2527	2391	94.61
Q1	58100	2788	3000	92.93	68.50	1910	1039	54.39
Q2	58400	2668	3000	88.93	93.85	2504	2175	86.86
Q3	55900	2737	3000	91.23	90.75	2484	2252	90.66
R1	59700	2693	3000	89.76	70.88	1909	1144	59.92
R2	62150	2661	3000	88.7	85.41	2273	1893	83.28
R3	60500	2579	3000	85.96	87.78	2264	1989	87.85

Table 3. Water Quality in Spawning Ponds

Parameter	Spawning 1		Spawning 2		Spawning 3		Optimum Value	Information
	AM	PM	AM	PM	AM	PM		
Temperature (°C)	24-30	23-29	26-30	26-29	26-29	26-30	25-30°C (Sinurat *et al.,* 2021)	Less than optimal in spawning 1
pH	7,8-8,18	7,72-8,05	7,69-8,17	7,42-7,95	7,68-8,17	7,42-7,96	4-11 (Sinurat *et al.,* 2021)	Optimal
DO (mg/L)	4-6	4-8	4-6	4-8	4-8	4-8	>3 mg/l (SNI. 6484.3-2014)	Optimal

DISCUSSION

Fecundity is an index that measures the number of eggs carried by fertilized female fish or shrimp. Absolute fecundity and relative fecundity of *Clarias gariepinus* are related to fish body weight. Relative fecundity will increase with increasing weight and length of the fish (Absalom *et al*., 2017). The fecundity value is obtained from sampling the number of eggs in 1 gram which is then multiplied by the difference in the weight of the broodstock used, so that the range of eggs produced is 46,240-62,150 eggs. The fecundity values of three different doses can be seen in Table 2. The highest fecundity value was obtained from the 2nd repeat spawning at a dose of 0.3 ml/kg (R2) which was 62,150 eggs, while the lowest fecundity was in the 3rd repeat spawning with a dose of 0.1 ml/kg (P3) producing 46,240 eggs. In general, this fecundity value is included in the high category. According to SNI.6484.1 (2014), the fecundity value is 50,000-80,000 eggs per kg of fish weight. The high fecundity value is due to the readiness of the broodstock to spawn and the weight of the broodstock itself, based on the data obtained, the highest fecundity was obtained from broodstock weighing 1,000 grams and its shrinkage weight was 110 grams.

The large number of eggs released by the R2 broodstock is due to the greater weight of the broodstock used (Table 1) so that the possibility of the number of eggs released is also greater. In spawning with a hormone dose of 0.1 ml/kg, ovulation can still occur, but the results are less than optimal compared to the results of spawning with hormone doses of 0.2 ml/kg and 0.3 ml/kg. Safei (2013) stated that fecundity in fish with artificial spawning will increase

compared to natural spawning, because with hormone injection, all eggs contained in the female catfish, both young eggs and mature eggs, will be released due to stimulation from the injection.

This FR value is obtained from the number of eggs spread in the aquarium as many as 3,000 eggs so that the FR ranges from 85.97% - 98.36%. The FR value can be seen in Table 2. The highest FR percentage value was found in the 2nd repeat spawning with a dose of 0.1 ml / kg (P2) which was 98.36% or 2,951 eggs and the lowest FR value was obtained in the 3rd repeat spawning with a dose of 0.3 ml / kg (R3) which was 85.96% or 2,579 eggs. In general, the FR value from this observation is still included in the high category. According to Dayani *et al*. (2022) the percentage value of fish eggs is >50% high category, 30-50% medium category, and <30% low category. This fertilization process is not affected by the use of fertilization hormones, it is affected by the quality of eggs and sperm in the broodstock. High and low fertilization occurs because the active time of sperm is short and the eggs are exposed to water before fertilization and the quality of the eggs produced. According to Aer *et al*. (2015) failure in the fertilization process is caused by the short active time of sperm. Sperm move slowly and are inactive because the sperm is in the plasma fluid.

This HR value is obtained from the number of eggs spread in the aquarium ranging from 68.5% -98.86%. The HR value can be seen in Table 2. The highest HR was obtained in the 3rd repeat spawning with a dose of 0.1 ml/kg (P3) which was 94.20% or 2,780 fish, while the lowest HR was obtained in the 1st repeat spawning at a dose of 0.2 ml/kg (Q1) which was 68.5% or 1,910 fish. The HR value is still considered good. Hendry *et al*. (2021) stated that egg hatchability> 50% is considered good, egg hatchability of 30-50% is moderate and <30% is not good. The large number of eggs that failed to hatch was caused by the uneven egg spreading process so that the eggs did not separate and it was difficult to get oxygen. Eggs need oxygen for embryo development so if they do not get oxygen, the eggs will fail to hatch. Baharudin *et al*. (2016) stated that the death of sangkuriang catfish eggs could be caused by the nature of the eggs where the eggs stick to each other (adhesive) the eggs will pile up so that the eggs have difficulty receiving oxygen for embryo growth so that the eggs fail to hatch. In addition, the speed of egg hatching is still influenced by temperature and dissolved oxygen. According to Effendi *et al*. (2015) several factors that affect egg hatching include: water environment temperature, light intensity, dissolved oxygen and pH. If the eggs are at a high temperature with high light, the eggs will hatch faster, but if the temperature suddenly changes to an extreme, it will result in embryo death and hatching failure.

SR is a comparison of the number of organisms that are still alive at the end of maintenance with the number of organisms at the beginning of stocking in percent (%) (Mullah, 2019). To obtain this SR value, the larvae are maintained for 14 days. The SR value is seen in Table 2. The SR value obtained ranges from 54.39% -94.61%. The highest SR value was obtained in the 3rd repeat spawning with a dose of 0.1 ml / kg (P3) which was 94.61% or 2,391 fish, while the lowest SR value was in the 1st repeat spawning at a dose of 0.2 ml / kg (Q1) of 54.39% or 1,039 fish. The survival rate of sangkuriang catfish larvae in the 1st repeat spawning was quite low in all treatments, which was at 50% compared to the SR value in spawning 2 and 3. Hendry *et al*. (2021) stated that the survival rate> 50% is in the good category, survival 30-50% is in the moderate category and <30% is in the poor category. The low SR value in the 1st repeat spawning was due to the use of a heater that was not from the beginning of egg spreading, causing a very significant change in temperature, namely from 23^{o}C to 30^{o}C. while at the time of the observation, the weather conditions entered the transitional season where this season greatly affects the water temperature. According to Hanifa (2021), the transitional season or called bediding in Java is a combination of hot weather and uncertain rainfall causing water supply to be disrupted and pond water discharge to be uncertain so that there are changes in pH and fluctuating temperatures. This triggers fish stress and has the potential for bacteria

and pests to grow. The survival rate of these larvae is influenced by environmental conditions and the care given to the larvae themselves. Because the condition of the larvae is still very vulnerable, their immunity is still weak, their organs are not yet perfect and they are still growing. So that death often occurs in this larval phase. Natalia *et al*. (2021) stated that newly hatched larvae are still weak and their organs are still not yet perfect, so they need extra care.

Water quality management is important to optimize larval growth and maintain the survival of larvae. An environment that is suitable for fish life can support the development and health of fish. Water quality checks are carried out in the larval maintenance container every day in the morning and evening with the parameters measured including temperature, pH and DO (as in Table 3).

The temperature value of all spawning ranges from 23-30^{o}C. In general, this value is included in the optimal category but is stated as less than optimal for the growth of catfish larvae in spawning 1 because the temperature value is below 25^{o}C. According to Sinurat *et al*. (2021), the growth of sangkuriang catfish larvae is more optimal in the range of 25-30^{o}C. The environmental temperature of the waters that are in accordance with the cultivation commodity will increase the appetite of the fish, so that the sangkuriang catfish grow faster.

The pH value obtained ranges from 7.42-8.17. This pH value is optimal, because it can still support the growth of sangkuriang catfish seeds according to SNI 6484.3 (2014) that the good pH range for catfish is between 6.5-8.

The DO value obtained is in the range of 4-8 mg/L. This DO range is still normal according to SNI. 6484.3 (2014) that in order to support the growth of catfish, the dissolved oxygen value is >3 mg/L. Sangkuriang catfish with dissolved oxygen <1 mg/l are at risk of dying more quickly, while in the range of 1-5 mg/l it will affect slow fish growth even though dissolved oxygen is still useful for survival (Sinurat *et al*., 2021).

CONCLUSION

The use of gonadotropin hormone in artificial spawning of sangkuriang catfish with the highest fecundity value was obtained at a dose of 0.3 ml/kg as many as 62,150 grains. Based on the FR, HR and SR values, a good dose for artificial spawning of catfish is at a dose of 0.1 ml/kg where the Fertilization Rate (FR) value is 98.36%, Hatching Rate (HR) is 94.2% and Survival Rate (SR) is 94.61%.

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