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EFFECT OF USING LOW TEMPERATURE IN THE BEGINNING OF TRANSPORTATION WITH CLOSED SYSTEM OF SWORDTAIL (XIPHOPHORUS HELLERI).

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ABSTRACT

This research aims to analyze the optimum use of low temperature (12 °C, 16 °C, 20 °C and control temperature (24°C) at the begun of handled the survival rate of Swordtail (Xiphophorus helleri) size ± 3 cm with a density of 20 X.helleri / 2 liters of water transported using closed system water media for 5, 7 and 9 hours in the afternoon at 15:00 WIB. This research used an experimental method factorial randomized block design (RBD), which consists of two factors, namely a four-level temperature factor and a three-time time factor and repeated three times. The parameters observed were fish survival, water quality, duration of stunning, duration of burial and post-transportation maintenance. The results showed the effect of low temperature and length of time of transportation significantly affected the survival of Swordtail (X.helleri) in closed wet system transportation. The optimum temperature and length of time for transporting Swordtail Fish (X. helleri) is a temperature of 20^{o}C and a long transportation time of 5 hours, obtained survival of 100%.

INTRODUCTION

Swordtail fish (Xiphophorus helleri) is a freshwater ornamental fish commodity that has a unique fin shape. Swordtail fish can have a length of 3-5 cm. When compared with other types of fish, ornamental fish has advantages that are in terms of aesthetics, so it has a high economic value (Budiyanto 2002).

In the 2014-2017 period, the volume of ornamental fish traded between provinces in Indonesia experienced an average growth of 27.51% per year. The highest sales growth occurred in seawater ornamental fish commodities, where the average reached 69.64% per year. While freshwater ornamental fish sales growth reached 29.06% per year. The total volume of ornamental fish traded between provinces in Indonesia in 2017 reached 23.32 million, consisting of 20.61 million freshwater ornamental fish and 2.61 million seawater ornamental fish (2018 KKP).

Live fish transportation is placed fish in a different environment from the original environment, accompanied by sudden changes in there the environment with high survival rates (Handisoeparjo 1982)

The problem in the transportation of live fish is the death of fish due to the results of fish metabolism and relatively high temperatures at the time of transportation thereby increasing oxygen consumption during transportation. The method of lowering the metabolic system can be done by using low temperatures to make the fish unconscious. According to Putra (2015) states that temperature is a factor that affects metabolism.

The used of low temperatures when transporting fish aims to inhibit the metabolic process of fish so that when transportation takes place the death rate of fish due to lack of oxygen will be reduced. According to Philips (1972) states that metabolism is a chemical reaction and its work process is influenced by temperature. If the water temperature decreases, the metabolic process of fish will decrease, and vice versa if the water temperature increases, the metabolic process of fish will increase. Rising environmental temperatures cause the concentration of dissolved oxygen in the water to decrease and oxygen consumption by fish to increase. if the temperature rises and falls, the rate of metabolism also changes according to its energy needs. Rising temperature will increase the process of respiration. In this case, the energy for respiration is energy that is included in the metabolic value so that it can be concluded that an increase in temperature will cause an increase in metabolism (Putra 2015).

Low temperature is one of the keys in the transportation of live fish, in this condition the metabolism and respiration rates are so low that fish or crustaceans can be transported for a long time and a high survival rate (Suryaningrum et al. 2007). The purpose of this research is to analyze the optimal temperature and length of time that can be used as a reference for the transportation of swordtail fish (X. helleri) with a low mortality rate.

MATERIAL AND METHODS

The materials used in this research are the swordtail / (X. helleri) measuring ± 3 cm as many as 20 X.helleri/ 2 L of water. bulk ice cubes or blocks as a material for reducing temperature in water and oxygen cylinders for oxygen delivery. The research was carried out with an experimental model with a factorial randomized block design method (RAKF), which consisted of two factors, there are four-level temperature factors and a three-time time factor and repeated three times.

This research transported swordtail fish with a density of 20 / 2 liters of water each each treatment used a low temperature at the begun of a closed wet transportation system (temperature control (24 °C), 20 °C, 16 °C, and 12 °C), where the swordtail seeds are transported for 5, 7 and 9 hours in the afternoon at 15:00 WIB. The parameters observed were fish survival, water quality and the process of sedation, when the anesthesia was taken, and the length of time for the breeding process.

Survival Rate

Survival Rate (SR) is the ratio of the number of live fish at the end of maintenance to the total number of fish stocked at the beginning of maintenance (Effendi 2004):

$$SR\ (\%) = \frac{Nt}{No} \times 100\%$$

Description:

SR = Survival of fish during the experiment.
N_t = Number of fish at the end of the experiment.
N_0 = Number of fish at the beginning of the experiment

Water Quality Parameters

The observed water quality parameters are the key parameters of water quality namely pH, DO, NH3 and Temperature.

Dissolved oxygen (DO)

Measurement of dissolved oxygen is carried out using a DO meter, by way of being put into water so that it shows a constant number

Ammonia (NH3)

The results of the levels from the spectrophotometer are then calculated using the formula:

$$\frac{1000}{25} x \frac{(Example\ absorption)}{Standard\ absorption} x\ 0.005$$

Water temperature

Water temperature measurements are carried out using a mercury thermometer dipped in water to show a constant number

Acidity (pH)

The degree of acidity of the water is carried out using a pH meter, by inserting electrodes into the water to show a constant number.

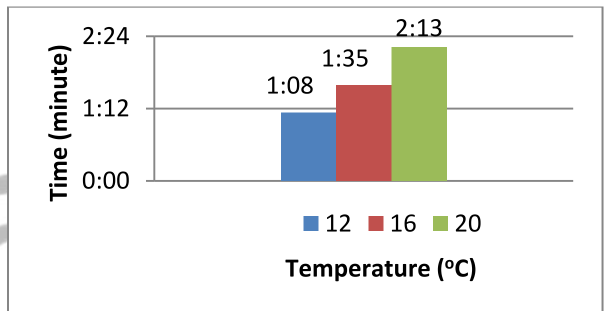
Data analysis

The effect of the use of low temperatures at the beginning of the transportation of closed systems of swordtail fish (X. helleri) was analyzed using the F formula if there were significant differences between treatments tested using the Duncan multiple test with a level of 5% (Gasperz 1991). Survival parameters after post-transport maintenance and water quality data (temperature, dissolved oxygen, ammonia, and pH) were analyzed descriptively.

RESULTS AND DISCUSSION

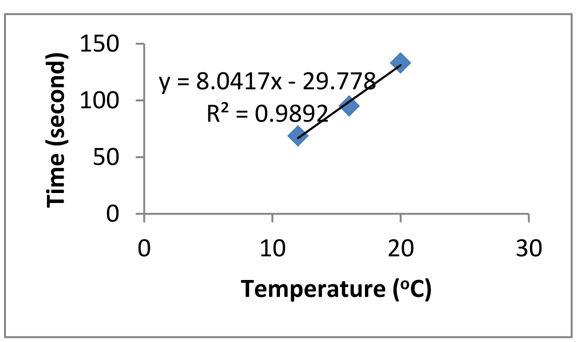
Duration of Stun Time and behavior of Swordtail Fish

The following is an observation diagram of the average length of stun obtained:



It can be seen that the time required for stunning with a temperature of 12°C is 1:08 minutes. The time needed for stunning with temperature of 16°C is 01:35 minutes and the time needed for stunning of 20°C is 02:13 minutes. This proves that the lower the temperature used for stunning fish, the faster the time needed because the absorption of temperatures the lower the room temperature will be faster. According to (Novesa, 2012) the lower the temperature of a media from the ambient temperature naturally requires a withdrawal of heat large enough both to reach and to maintain that temperature.

The relationship between temperature and stunning time can be known by the graph of the relationship between temperature and stunning time, namely:



In the graph above the equation y = 8.0417x - 29.7778 from the equation can be seen that each increase in temperature of 1°C adds time for 8.0417 seconds.

Swordtail is fasted for 24 hours to immobilisation. Mastery in fish aims to eliminate impurities that are still present in the digestive organs of fish. The response of swordtail fish activity during stunning with low temperatures can be seen in the following table:

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temperature (^oC)	Swordtail Activity
12	The swordtail position is lying, there is almost no movement, the movement of the operculum is very slow, the response is absent.
16	Swordtail fish tend to be still, the body of the fish starts to tilt, the fish is at the bottom and the movement of the operculum slows
20	Activity begins to decrease, fish are at the bottom and calmer, normal operculum movements
24	When the fish is thrashed, Active Movement, Rapid operculum movement

The table above shows the condition of swordtail during the process of temperature drop. Swordtail fish experience differences in behavior at a certain temperature drop. Differences in behavior are divided into several temperature levels, namely 24^{o}C as a control, 20^{o}C, 16^{o}C, and 12^{o}C.

At the 24^{o}C the activity and condition of the fish were very active. Upright body position, fish movement is very agile, and responsive to external stimuli. Limb movements such as the operculum are very fast and the caudal fins appear erect. At 20^{o}C, the activity and condition of the fish appear to be reduced. This is indicated by the condition of fish that are calm and less active, the body's position is still upright, and responsibility for external stimuli begins to decrease. movement of operculum has begun to normal and the position of the caudal fin is still sturdy.

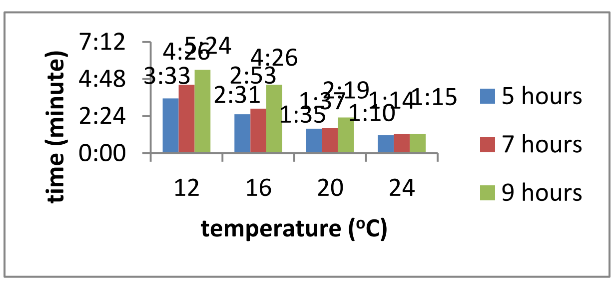
At 16^{o}C the activity and condition of the fish have begun to weaken. This is indicated by the position of the fish's body that has begun to tilt, the fish in a stationary position and less responsive to external stimuli. In this temperature range, the fish are easily caught and do not resist when caught. At 12^{o}C the activity and condition of the fish are passive. The body of the fish is mostly lying, not actively swimming, and not responsive to external stimuli. At this temperature, the operculum of the fish moves very slowly and does not resist when captured.

Differences in fish activity in a decrease in temperature results in impaired balance due to a decreased oxygen content. The rate of oxygen consumption in aquatic animals will decrease with decreasing media temperature (Berka 1986). The condition of the fish that collapsed due to the reduced oxygen present in the body can be seen by the slower movement of the operculum in the fish.

Observation of the condition and activity of swordtail fish showed that the immotile temperature of the fish was 20^{o}C - 12^{o}C. The results of this study indicate different criteria for fish where at 20^{o}C the fish are in calm conditions, 16^{o}C the fish is in a slightly fainting condition and at 12^{o}C the fish is in a severe fainting condition. Below or above this temperature the risk of fish death will be higher. The lower the temperature in the environment will affect the activity of fish in which a decrease in temperature results in the movement of fish that were originally normal to slowly change to calm as a decrease in temperature occurs. According to Syamdidi (2006), a decrease in temperature causes the activity of the respiration rate and metabolism of fish tends to decrease, along with a decrease in the water temperature of the live media of fish.

Duration of Restoration

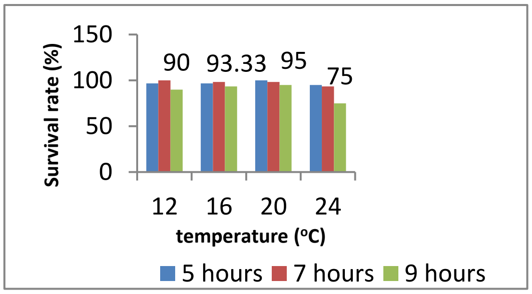
The following is a diagram of the average length of time needed for refurbishment:



In the graph above it is known that the average length of refurbishment is between 01:10 - 05:24 minutes. The longest time for the refurbishment process is 05:24 minutes, which is the treatment time of 9 hours with a temperature of 12^{o}C, the longer the transportation time is carried out, the longer the process of refurbishment and the fastest time of refurbishment is 01:10 at a treatment time of 5 hours and a temperature of 24^{o}C. From the graph above, it can be seen that the longer the transportation process is carried out, the longer the process of bringing up the swordtail fish. The length of the restoration process is due to the weak condition of the fish and energy loss during transportation, so the swordtail fish takes more and more time with the duration of transportation. The lower the transportation temperature, the longer the process of refurbishment is due to adjusting to environmental conditions because the lower the temperature of the water will reduce the ability of fish to take oxygen in the waters (hypoxia). During the fish restoration process, the swordtail condition generally shows the same activity where the condition of the swordtail begins with the slow movement of the fish and then gradually becomes normal such as the movement of the fins and the operculum which gradually becomes normal. According Achmadi (2005) states that during the process of refurbishment, that fish do not show any signs of limb movements after 10 minutes are deemed not pass on

Survival Rate of Swordtail Fish in the Post-Transportation

Here is an diagram of the survival analysis of Swordtail fish seed transportation can be seen:



In the picture above shows the average survival value of swordtail fish ranges from 75% - 100%. In the survival rate above the results of swordtail transport for 5, 7, 9 hours transported using low temperatures (24, 20, 16 and 12 °C) using a closed system after notation can be seen as the following table:

Water quality in transportation of swordtail

The following is the average water quality of swordtail transportation as shown in the table:

Time (Hour)	DO (mg/L)		Temperature (°C)		pH		Amonia (mg/L)
	t_0	t_1	t_0	t_1	t_0	t_1	
5	6,97	12,10	12	23	6,68	6,60	0,027
	7,13	12,90	16	24	6,66	6,57	0,038
	7,40	11,77	20	24	6,58	6,51	0,013
	7,17	9,30	24	24	6,68	6,59	0,009
7	6,93	11,70	12	21	6,74	6,51	0,108
	7,23	11,83	16	22	6,67	6,52	0,015
	7,77	10,93	20	22	6,69	6,54	0,01
	7,17	10,83	24	22	6,66	6,53	0,011
9	6,97	12,50	12	21	6,70	6,44	0,025
	7,17	7,86	16	24	6,63	6,45	0,016
	7,37	11,67	20	21	6,69	6,44	0,025
	7,17	9,77	24	22	6,50	6,38	0,009
Average	7,1	7,20	18	22,5	6,66	6,51	0,025
SNI	>3		25°C-30 °C		6 - 8		-

In the table above the average water quality is known that the initial DO average is 7.1 and the final DO is 6.4 increase DO after the transportation process is due to DO checking at the beginning before giving oxygen so that it has a small DO value and after transportation DO will be higher due to the administration of pure oxygen before transportation is carried out so that dissolved oxygen increases. The lower the temperature, the higher the oxygen content. Temperature is inversely proportional to the saturation concentration of dissolved oxygen and directly proportional to the oxygen rate of aquatic animals and the rate of chemicals in water (Afrianto 1998).

The average temperature before transportation is 18^{o}C and the average temperature after transportation is 25^{o}C. The increase in temperature after transportation occurs because the packaging container cannot maintain the inside temperature and the outside temperature is higher than the inside temperature thus accelerating the change in temperature inside. The packaging media in styrofoam packaging which is assisted by the use of ice cannot be maintained at a stable temperature during storage at room temperature. According to (Herodian et al. 2004) The temperature of the packaging used will continue to increase to affect the passage of life of the transported biota. The increase in temperature occurs due to higher outside air penetration into the package so that it can increase the temperature. The initial temperature of the filling material and the temperature of the outside environment that is too high will cause a faster rise in packaging temperature (Nitibaskara et al. 2006).

The average pH before transportation is 6.66 and the pH after transportation is 6.51. The decrease in pH during transportation is still within reasonable limits because it is still at the level where the swordtail fish can survive. According to (SNI 2015) Swordtail fish can survive in the pH range of 6-8. The average ammonia in the table above is known to be 0.025, the value obtained is still within reasonable limits according to (Englund 2008) swordtail can tolerate total ammonia levels of 1.0 mg / L.

Conclusion

Based on the results of research that has been done, it can be concluded that the use of low temperature and long transportation time influence the survival of swordtail fish seeds. The best treatment in this research was obtained at a temperature of 20^{o}C with a duration of 5 hours with swordtail survival of 100%. The lower the temperature, the slower the metabolic rate of fish. Water quality parameters are an important factor for fish life when transportation takes place.

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