The Effect of Density and Stadia on Survival Rate of Nilem (*Osteochillus Hasselti)* In the Morning Transportation

Walim Lili [1], Novie Nurbiyantie [1], Wahyuniar Pamungkas [1], Roffi Grandiosa [1]

[1] *Fisheries Department, Faculty of Fisheries and Marine Science Padjadjaran University, Bandung, Indonesia*

ABSTRACT

This study was conducted to determine the size of the fish and the total density for each liter of water that can be used as a benchmark in the transportation of nilem fish fry which was carried out from September to October 2021 at the Ciparanje wet laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University experimentally using a factorial randomized block design. consists of two factors, namely density with four levels (10, 20, 30 and 40 fish/liter) and fish size with two levels (3-5 cm and 5-8 cm) which were repeated three times. Parameters observed were survival by the number of fish density and size post-transport and post-harvest for 7 days, water quality consisting of temperature, DO, pH, and ammonia. The results showed that nilem fish frys that had high survival were transported in the morning starting at 05.00-10.00 or for 5 hours post-transportation in the treatment with the highest density of 40 fish/liter with fish size 5-8 cm having an SR reaching 100%. Meanwhile, for post-maintenance 7 days, survival was low at a density of 5-8 cm by 95%. In addition, for water quality parameters at fish sizes of 5-8 cm the average temperature is 25.37 ^{o}C DO is 6.68 on average, pH is 6.58, and ammonia is 0.020 mg/l on average.

Keywords: *Survival rate, Closed transportation system, total density, fish size, Nilem fish fry*

1. INTRODUCTION

Nilem (*Osteochilus hasselti*) is an endemic (native) Indonesian fish that lives in the waters of Indonesia fresh water, like river or swamps. However nilem cultivated in ponds for commercial needs. Presence of nilem not enough so popular in Indonesia except West Java Production nilem national originated from West Java, about 80% [1]. Nilem fish is also become favorite because the taste of the meat is delicious, chewy and tasty and the thorns no too many compared with Tawes fish [2].

Nilem fish transportation is an important step for providing frys, especially if the cultivation location is far from the nursery. This is another important factor in fish transportation activities, which is related to the problem of transportation costs related to the amount of density. Therefore, increasing the stocking density when transported will make time and cost efficiency [3]. There is no information about the amount of good and maximum density for nilem fish frys transported in the morning. Other information that can be used as a reference is research from [4] which states in the results of his research that the average survival value of tilapia fry after being transported for 5 hours, has a high survival rate with the death of 1 fish from 20 fish / liter of water. which has been transported.

Information regarding the transportation of Nlem frys is still lacking in literature, so it is necessary to carry out this research. The density of stocking seen from the research [4] can be used as a research reference for the total density of 20 fish / liter of Nilem fish which is transported in the morning at 05.00 – 10.00 AM. In addition, efforts that can be made to increase the survival rate during transportation are by inhibiting the metabolic rate. Therefore, to ensure the successful transport of fish is to suppress the metabolic activity of fish (fasting, anesthesia, lowering the

temperature), adding oxygen and removing toxic gases (Moyle et al. 1998). Inhibiting the metabolic rate can be done by maintaining the water temperature during transportation so that it does not rise quickly, namely by carrying out the transportation of nilem fish frys in the morning or more precisely at 05.00 - 10.00 AM.

2. METHODOLOGY

This research was carried out from October 2021 to November 2021. This research was carried out in the Ciparanje laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University. This research carried out the transportation of nilem frys with a closed transportation systemwhich in the morning.

2.1 Materials and Tools

The material used in the study was test fish (Nilem fish fry/ Osteochillus hasselti) measuring 5-8 cm as many as 300 fish and 3-6 cm in size 300 tails. The nilem/Osteochillus hasselti frys used in this study were selected beforehand to obtain uniform fish size, healthy condition and free from defects and injuries.

The tool that used in this research is one fiber tub with the size of 100 x 100 x 100 cm^3 for main maintenance nilem frys. There are 36 aquariums with a size of 60 x 30 x 30 cm3 for raising awareness and raising fish for one week. Aerator, aeration hose and aeration stone to supply DO to rearing aquariums after resuscitation. Fishnet to catch and move test fish. DO meter to measure dissolved oxygen levels in containers before and after transportation. pH meter to measure the pH of the water in the container before and after transportation. Thermometer to measure the temperature of the water in the container before and after transportation. Oxygen cylinders are used to supply oxygen in containers (plastic) when packing the test fish with a ratio of 1:3 water volume. Millimeter Block size 30 cm to measure the length of the fish. Two layers of polyethylene plastic bag measuring 60 x 40 cm2 with a thickness of 2 mm for the test fish container during transportation. Rubber bands for tying plastic bags to transport containers. 6 pieces of Styrofoam boxes measuring 60 x 40 x 30 cm3 for outer packaging. Duct tape to glue the outside of the box. Pick up car for transportation. Stationery to record the data obtained. Test tube for reacting solution Spectrophotometer to calculate absorbance of water samples. Cuvette for placing the water sample on the spectrophotometer. Filter paper to filter the water sample to be tested. Filter bottle for filtered water sample container. Funnel for filter paper container in filter bottle. Stopwatch to calculate the transport time. And scales for measuring the weight of the test fish.

2.2 Research Method

The study was conducted using an experimental model with a Randomized Block Design (RBD) consisting of two factors, namely the total density with 4 levels and body size with 2 levels and repeated three times.

Total Density Factor consists of
1. P1 : 10 fishes/1 liter of water
2. P2 : 20 fishes/1 liter of water
3. P3 : 30 fishes/1 liter of water
4. P4 : 40 fishes/1 liter of water

Body Size Factor consists of:
1. U1 : 3 - 5 cm fry
2. U2 : 5 - 8 cm fry

The general model of the factorial Randomized Block Design used is as follows:

$$Hijk = \pi + Ki + Pj + Pk + (Pj \times Pk) + eijk$$

Description:
Hijk = The result of the j-th treatment and the k-th treatment in the i-th group
π = General mean
Ki = Effect of group i
Pj = Effect of the j . treatment factor

Pk = Effect of the k-th treatment factor
Pj x Pk = Interaction of j-th treatment and k-th treatment
Eijk = Error due to treatment j and treatment k in group i
i = 1, 2, …., k (k = group)
j = 1, 2, …., 1st p (p = 1st treatment)
k = 1, 2, …., p 2 (p = treatment 2)

2.3 Research Procedure

2.3.1 Procedure Water Quality Parameter Measurement
Measurement of water quality parameters is carried out in the laboratory, observations of water quality that are measured include:
1. Temperature
Temperature measurement is carried out by the following procedure:
- A thermometer is prepared.
- The thermometer is inserted into the body of water at the end for ± 3 minutes.
- Take a reading on the thermometer scale to determine the temperature.
- Recorded in the observation table.
2. Dissolved Oxygen (DO)
DO measurement is carried out with the following procedure:
- DO meter tool prepared (calibration).
- DO meter probe is inserted into the body of water.
- The DO value is read on the DO meter monitor until the number on the monitor does not change (constant for 5 seconds).
- Recorded in the observation table.
3. Degree of Acidity (pH)
The pH measurement is carried out by the following procedure:
- The pH meter tool is prepared (calibration).
- The pH meter probe is inserted into a body of water.
- Read the pH value on the pH meter monitor until the number on the monitor does not change (constant for 5 seconds).
- Recorded in the observation table.
4. Ammonia
Ammonia measurements were carried out using a spectrophotometric technique [5] with the following procedure:
- Take 50 ml of water sample
- Filtered 25 ml of sample water and put into a test tube
- Added 1 ml of Siignette solution and 0.5 ml of Nessler's solution
- Set aside for 10 minutes
- The concentration was measured using a spectrophotometer with a wavelength of 425 nm.
- Calculated the result

2.3.2 Transportation Nilem fish (Osteochilus *hasselti*)
The process for transportation (Nilem fish fry / Osteochillus hasselti) is as follows:
- Materials and tools to be used in the research are prepared.
- Tools and containers for fish are cleaned and dried.
- 300 nilem fish frys measuring 3-6 cm and 300 fish measuring 5-8 cm with different densities for each treatment, this density refers to research conducted by [4] using tilapia with a total density of 20 tails/liter yields high survival with 5 hours of transport.
- Prepared polyethylene plastic bags with a size of 100 cm x 60 cm2, plastic bags in double (double) to prevent leakage and damage then filled with 1 liter of fresh water.
- Before the water is put into the plastic bag, the water quality is monitored first.
- Fish to be transported have been cut or fasted for 24 hours.
- Fish are put into each polyethylene plastic bag filled with water, then filled with pure oxygen gas as much as 1/3 of the volume of water until the ratio between water and oxygen is 1:3.
- Before filling the gas, the air in the plastic bag is emptied by compressing or compressing the part of the bag that does not contain water as much as possible.

- After giving oxygen, the top end of the polyethylene plastic bag is tied with a rubber band in such a way that the polyethylene plastic bag swells and the oxygen inside does not come out.
- The fish plastic bag is put in a styrofoam box with a size of 60 x 40 x 30 cm3, as the outer packaging, after that it is closed and glued with duct tape.
- Styrofoam boxes are arranged on a pick-up car, then transported for 5 hours as a simulation of the duration of fish transportation from Jatinangor District, Sumedang Regency to Tasikmalaya.
- Fish transportation is carried out in the morning from 05.00-10.00 AM.

2.3.3 Post Transportation

The post-transportation process for nilem fish is as follows:
- Observation of water quality before and after transportation is carried out.
- After the fish have been transported, the fish are conditioned by inserting a plastic bag containing nilem frys into an aquarium filled with fresh water and then aeration.
- Then count the number of live and dead nilem frys from each treatment to get the survival rate (SR).

2.3.4 Maintenance Nilem Fish Frys After Transportation

The process at the maintenance stage after transportation of nilem frys is as follows:
- Fish that have been transported are put into the rearing aquarium according to their respective replications and treatments.
- Maintenance is carried out for 7 days to determine the effect of post-transportation on the survival of the fish.
- Feeding every day as much as 3% according to the weight of the biomass.
- After 7 days, the survival parameters of the fish are calculated.
- Information is recorded as data during the main research process.
- Important information is documented in the research process

2.4 Observed Parameters

2.4.1 Transport Time

Transportation is carried out in the morning by observing and recording the length of time of transportation and the temperature in the morning at 05.00-10.00 AM by looking at the clinical symptoms of the fish transported at the time of transportation for 5 hours and with the temperature in the morning.

2.4.3 Fish Survival Rate

The viability of the nilem fish fry was observed during the unpacking activity after transportation and after being reared for 7 days. To determine the survival rate of fish can be calculated from the comparison of the number of fish that live at the end of the period with those that live at the beginning of the period [6]. To determine the survival of fish used the following formula:

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

Description :
SR = Survival Rate
Nt = Number of fish at the end test
No = Number of fish at the beginning test

2.4.4 Water Quality

Observation of water quality is carried out by measuring water quality in transportation before and after transportation. Measurement of water quality in situ includes dissolved oxygen (DO), acidity (pH) and temperature, while ex situ is ammonia at the Water Resources Management Laboratory of FPIK Unpad. The measurement of each water quality parameter uses a DO meter to measure DO, a pH meter to measure pH, a thermometer to measure temperature, and a spectrophotometric method to measure ammonia.

Measurement of ammonia using the spectrophotometric method using the following formula:

$$Amonia = \frac{1000}{25}\ x\ \frac{Sample\ Absorbance}{Standard\ Absorbance}\ x\ 5\ mikrogram$$

Description :
Sample Absorbance : Absorbance counted from sample
Standard Absorbance : Absorbance counted from standard

2.5 Data Analysis
Survival rate data was tested by ANOVA (F test) at 95% confidence level. If there is a significant difference between treatments in the F test, then it is continued with Duncan's multiple spacing at a 95% confidence level [7]. while the water quality data were analyzed descriptively comparatively.

3. RESULT AND DISCUSSION

3.1 Nilem Surival Rate

3.1.1 Post Transportation

The results showed that the total densities of each treatment were 10, 20, 30 and 40 fish/liter with two sizes of fish, namely 3-5 cm and 5-8 cm, providing high survival rates with the highest density of 40 fish/liter of fry. Nilem fish with a size of 5-8 cm transported for 5 hours in the morning can produce high survival rates up to 100% SR. The following is a table of the average survival of nilem fish fry transportation:

Table 1. Survival Rate Average nilem fish frys size 3-5 cm post transportation

Treatment	Density	Survival Rate Average (%)
P1	10	100
P2	20	100
P3	30	100
P4	40	100
Average		**100**

Table 2. Survival Rate Average nilem fish frys size 5-8 cm post transportation

Treatment	Density	Survival Average Life (%)
P1	10	100
P2	20	100
P3	30	100
P4	40	100
Average		**100**

Based on the analysis results obtained regarding the high survival rate up to 100% for each treatment and size of fish, it shows that the strength of the nilem fish is better than that of tilapia which is used as a hypothesis, namely with 20 fish/liter for 5 hours of transportation, it is still gives the mortality rate of 1 fish, with this it can be concluded that the hypothesis made is rejected. This can be explained by the presence of its own strength in the nilem fry used, namely the hybridized padjadjaran nilem fry, where the padjadjaran nilem fry is the result of a marriage between a female nilem fish (*Osteochilus hasselti*) and a male carp (*Cyprinus carpio*) , where the cross produces this type of fish. Dominant female so that the morphology leads to the type of nilem fish.

Based on the treatment given to nilem fry transported for 5 hours with different fish density and size treatments, it can be concluded that padjadjaran nilem fry will have a high survival value if transported for 5 hours in the morning at 05.00 – 10.00. This provides an advantage in time and cost efficiency, where if with a density of 40 fish/liter a high survival rate can be produced, it will facilitate the transportation of padjadjaran nilem frys from Jatinangor to the southern region's fisheries service located in the lake which is one of the centers that maintain nilem frys for natural restocking activities. The strength of padjadjaran nilem frys that get high survival can be used as a reference for restocking padjadjaran nilem frys in rivers in West Java.

3.1.1 Survival Rate Post 7 Days Maintenance

The maintenance of nilem fish fry was carried out for 7 days after transportation. Based on observations, the lowest survival rate was found in fish size 3-5 cm, namely in the treatment of 40 fish/liter by 76.67% and size 5-8 in the treatment of 40 fish/liter as much as 95%. The following is a table of the average survival of nilem fish frys after 7 days of rearing.

Table 4. Survival Rate Average nilem fish frys size 3-5 cm post 7 days maintenance

Treatment	Density	Survival Rate Average (%)
P1	10	100
P2	20	100
P3	30	87.78
P4	40	76.67
Average		**91.11**

Table 5. Survival Rate Average nilem fish frys size cm post 7 days maintenance

Treatment	Density	Survival Rate Average (%)
P1	10	100
P2	20	100
P3	30	100
P4	40	95
Average		**98.75**

Based on the results of the analysis above, it can be explained that the relationship between survival rates is lower at 3-5 cm in size, which is 76.67% compared to 95% in 5-8 cm. This is because the size of the fish is closely related to the need for oxygen, where smaller fish need more oxygen than larger fish, this is because small fish need more oxygen supply for metabolism to be able to grow faster. This is in accordance with the statement [8], where the size of the fish affects the oxygen demand when transported, the smaller the fish, the greater the oxygen required. This is because small fish consume more oxygen than large fish of the same species. This is because small fish need more oxygen to metabolize for growth, oxygen helps active tissues in their metabolic processes such as the intestines and heart, here is a factorial table for the survival rate of nilem frys 7 days after.

Table 6. Factorial Table of Survival Rate Average of each size post 7 days maintenance

Treatment		Replication			Total	Average
Size	Density	I	II	III		
U1	P1	100.00	100.00	100.00	300.00	100.00
	P2	100.00	100.00	100.00	300.00	100.00
	P3	76.67	86.67	100.00	263.33	87.78
	P4	90.00	52.50	87.50	230.00	76.67
U2	P1	100.00	100.00	100.00	300.00	100.00
	P2	100.00	100.00	100.00	300.00	100.00
	P3	100.00	100.00	100.00	300.00	100.00
	P4	90.00	97.50	97.50	285.00	95.00

The oxygen supply given to each size of fish is the same, so that the oxygen demand for small fish will be more, causing the survival rate of fish with smaller sizes to result in a low survival rate.

[3] states that the higher the density or number of fish in the packing container, the higher the competition for space in the packing container. This causes the fish to be stressed which triggers the metabolic rate to increase so that the fish need more oxygen, the temperature also increases and the fish will run out of energy to maintain their lives. This can be seen when the fish are reared after transportation, which shows a mortality rate at a high density of 40 fish/liter of water.

3.2 Water Quality
Water quality can be seen on the table below

Table 7. Water quality before and after transportation

Treatment		Temperature		DO		pH		Amonia	
Size	Density	Before	After	Before	After	Before	After	Before	After
U1	P1	24 - 25	25.1 - 26.1	7.5 - 8.2	7 - 7.8	6.55 - 6.67	6.18 - 6.19	0	0.006 - 0.008
	P2	24 - 25.1	25.2 - 26.5	8.5 - 8.8	7.9 - 8.2	6.55 - 6.67	6.18 - 6.21		0.01 - 0.01
	P3	24 - 24.1	25.3 - 26.5	8 - 8.4	7.4 - 7.7	6.55 - 6.67	6.18 - 6.2		0.017 - 0.019
	P4	24.1 - 25.1	25.5 - 26.5	6 - 8.6	5 - 7.7	6.55 - 6.67	6.15 - 6.18		0.018 - 0.019
U2	P1	24.7 - 25.1	25 - 26.1	7.6 - 7.9	7.2 - 7.5	6.7 - 6.85	6.1 - 6.9		0.008 - 0.009
	P2	24.1 - 24.9	25 - 26.4	7.8 - 8	7.3 - 7.5	6.7 - 6.85	6.55 - 6.65		0.011 - 0.012
	P3	24.1 - 25.1	25.2 - 26.8	6.6 - 7.3	6 - 6.8	6.7 - 6.85	6.1 - 6.25		0.018 - 0.019
	P4	24.4 - 24.9	25.1 - 25.6	7.5 - 8.2	7 - 7.8	6.7 - 6.85	6.2 - 6.5		0.02 - 0.02

Based on research conducted in general, the temperature conditions are still within the threshold of feasibility for the transportation of nilem seeds. This can be seen from the high survival rate in each treatment of fish density and size. In addition, a good temperature for nilem fish is also at 18–28 ^{o}C with an altitude of up to 800 m above sea level, with an optimal altitude between 400-700 m [9]. This shows that the morning temperature with an average temperature increase of up to 25.88 ^{o}C for fish sizes 3-5 cm and an increase of up to an average of 25.66 ^{O}C for fish sizes of 5-8 cm can still be tolerated by providing a level of high survival rate for the transportation of nilem fish fry which are transported in the morning for 5 hours from 05.00 – 10.00
.
Based on the results of the study, it was shown that the oxygen content from the beginning was 8.08 mg/l at a size of 3-5 cm and 7.22 at a size of 5-8 cm with a decrease in DO at the end of transportation reaching 7.43 at a size 3- 5 cm and 6.68 in size 5-8 cm. This is in accordance with SNI (2000), the optimum range of good water quality in carp (Cyprinus Caprio) cultivation is having DO > 3. This has a good impact on nilem fish which is transported for 5 hours in the morning by achieving a survival rate. 100% for all total densities even at the highest density of 40 fish/liter which applies to both sizes of fish.

Based on the results of the study showed that the pH content from the beginning with an average of 6.22 ppm at a size of 3-5 cm and 6.61 at a size of 5-8 cm with a decrease in pH at the end of transportation reached 6.20 at a size of 3-5 cm. and 6.58 at 5-8 cm. This is supported by the results of research from [10] which resulted in a high survival rate obtained during the experiment which was pH 5.52 - 6.96. This supports the high survival rate of nilem fry transported for 5 hours in the morning by achieving a 100% survival rate at the highest density of 40 fish/liter which applies to both fish sizes.

The results showed that the initial ammonia content was 0.018 mg/l at a size of 3-5 cm with a density of 40 fish/liter and 0.020 at a size of 5-8 cm with a density of 40 fish/liter. This had a good impact on nilem fry transported for 5 hours in the morning by achieving a survival rate of 100% for all densities, even at the highest density of 40 fish/liter which was applicable for both fish sizes. according to [11] the concentration of ammonia is toxic for freshwater fish when it is between 0.7 – 2.4 mg/l. This proves that the level of ammonia content in each treatment and the size of the fish are still within the normal threshold, which does not exceed 0.7 mg/l, thus supporting a high survival rate.

4. CONCLUSIONS

Based on the results of the research conducted, it can be concluded that a high survival rate is found at a density of 40 fish/liter with a size of 5-8 cm, achieving a survival rate of 100%. This shows that padjadjaran nilem fry have better strength in detecting changing environmental conditions and water quality in closed transportation conditions, but this is supported by water quality such as ammonia, temperature, D0 and pH which are still considered tolerable

by fish seeds. nilem to be able to live up to 5 hours of transportation with a morning temperature of around 21-25 oC.

In addition, when viewed from rearing 7 days post-transportation, it was found that the survival rate was low at a density of 40 fish/liter for a size of 3-5 cm by 76.67% and a size of 5-8 cm by 95%. This shows that smaller fish require more oxygen than larger fish, this can be seen when rearing smaller fish finds more deaths so that the SR is low. during maintenance due to competition for space and friction during transportation, causing injuries and causing death. Death does not occur immediately when the fish arrive, but death occurs a few days during rearing after transportation.

5. REFERENCES

[1] Cholik, F. et al. 2005. *Aquaculture*. Archipelago Fisheries Society. Freshwater Aquarium Park. Jakarta.
[2] Mulyasari, D.T. Soelistyowati, A.H. Kristanto, and I.I. Kusmini. 2010. Genetic Characteristics of Six Populations of Nilem Fish (*Osteochilus hasselti*) in West Java. *Journal of Aquaculture Research*. 5 (2): 175-182.
[3] Ismi, S., Kusumawati D. & Asih Y.N. 2016. The Effect of Fasting Time And Different Density Of Grouper Seed On Closed Transport. *Journal of Tropical Marine Science and Technology*. 8(2): 625 – 632.
[4] Tanbiyaskur, Achadi, T., and Prasasty, G.D. 2018. Survival and Health of Tilapia (*Oreochrromis niloticus*) in Closed System Transport with Tuba Root Extract Anesthesia. *Journal of Fisheries and Marine Affairs* Volume 23 No. 2, December 2018: 23-30.
[5] Moyle, P. B., and J. J. Cech, Jr. 1998. *Fishes; An Introduction to Ichthyology 2nd Edition*. Prentice Hall, Englewood Cliffs. New Jersey.
[6] Effendi, M.I. 1978. *Fisheries Biology Methods*. Pustaka Nusantara Foundation, Yogyakarta, 112 pp.
[7] Gaspersz, V. 1991. *Experimental Design Methods*. CV. ARMICO. Bandung.
[8] Jobs. 1994. *Respiration and Metabolism. In Fish and Fisheries Series 13: Fish Bioenergetics*, PP 121-145. Chapman and Hall. London.
[9] Pratiwi, Rostika. R, Dhahiyat. Y. 2011. Effect of Feeding Level on Growth Rate and Heavy Metal Deposition in Nilem Fish in Floating Net Karamba Ir. H. Juanda. *Journal of Aquatics*. Vol 2(2): 1-11.
[10] Ismayadi, Angki & Rosmawati, Rosmawati & Mulyana, Mulyana. 2016. Survival and Growth of Nilem Fish (Osteochillus hasselti) Seeds Raised At Different Density Levels. *JOURNAL OF SCIENCE MINA*. 2. 24. 10.30997/jms.v2i1.428.
[11] Boyd.C.E. 1991. *Water Quality Management in Ponds for Aquaculture*. Brimingham Publishing. Alabama.