Fisheries Journal, 15 (2), 552-562 (2025)
http://doi.org/10.29303/jp.v15i2.1382

THE EFFECT OF DIFFERENCES IN STOCKING DENSITY ON THE GROWTH AND SURVIVAL OF SNAKEHEAD FISH (*Channa striata*) JUVENILE IN THE BUCKET FISH CULTIVATION METHOD (BUDIKDAMBER)

Pengaruh Perbedaan Padat Tebar Terhadap Pertumbuhan Dan Sintasan Benih Ikan Gabus (*Channa Striata*) Dalam Metode Budidaya Ikan Dalam Ember (Budikdamber)

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(Received January 21th 2025; Accepted April 27th 2025)

ABSTRACT

The problem in cultivating snakehead fish in budikdamber media is the most effective stocking density and how the budikdamber system affects the growth and survival of snakehead fish seeds, this study aims to determine the effective stocking density of snakehead fish in the budikdamber method. The method used in this study is the experimental method of Completely Randomized Design (CRD), which consists of three treatments and five replications. The treatments used are (A) stocking density of 50 fish/70 liter (control), (B) stocking density of 60 fish/70 liter, and (C) stocking density of 70 fish/70 liter, which are maintained for 40 days. The test fish used are snakehead fish with a length of 6-8 cm and a weight of 3-4 g. The container used is a plastic bucket with a volume of 80 liters with the water volume of 70 liters where the snakehead fish are placed with a stocking density according to the treatment. The amount of feed given is 5% of the fish biomass. The results obtained during the study showed that treatment C with a density of 70 fish/70 liters produced the highest absolute length growth of 2,56±0,5 cm, the highest absolute weight growth of 4,55±0,99 gram, the highest specific growth rate of 2,08±0,09 %, and survival of 94±0,05%.

Keywords: Snakehead Fish, Budikdamber, Stocking Density, Growth

ABSTRAK

Permasalahan yang ada pada budidaya ikan gabus pada media budikdamber adalah jumlah padat tebar yang paling efektif dan bagaimana pengaruh sistem budikdamber pada pertumbuhan dan sintasan benih ikan gabus, penelitian ini bertujuan untuk menentukan padat tebar yang efektif ikan gabus pada metode budikdamber. Metode yang digunakan dalam riset ini adalah metode eksperimental Rancangan Acak Lengkap langkap (RAL), yang terdiri dari tiga perlakuan dan lima ulangan. Perlakuan yang digunakan adalah (A) padat tebar 50 ekor/70 liter (kontrol), (B) padat tebar 60 ekor/70 liter, dan (C) padat tebar 70 ekor/70 liter, yang dipelihara selama 40 hari. Ikan uji yang digunakan merupakan ikan gabus dengan ukuran panjang 6-8 cm dan bobot 3-4 g. Wadah yang digunakan merupakan ember plastik dengan volume 80 liter dengan volume air sebesar 70 liter yang dimana ikan gabus ditempatkan dengan padat tebar sesuai dengan perlakuan. Jumah pakan yang diberikan sebanyak 5% dari biomassa ikan. Hasil yang didapatkan selama penelitian menunjukan bahwa perlakuan C dengan padat tebar sebesar 70 ekor/70 liter menghasilkan pertumbuhan panjang mutlak tertinggi sebesar 2,56±0,5 cm, pertumbuhan bobot mutlak tertinggi sebesar 4,55±0,99 gram, laju pertumbuhan spesifik tertinggi sebesar 2,08±0,09 %, dan kelangsungan hidup sebesar 94±0,05%.

Kata Kunci: Budikdamber, Ikan Gabus, Padat Tebar, Pertumbuhan.

INTRODUCTION

Snakehead fish, a freshwater carnivore from Southeast Asia that is popular as a food fish and has high economic value, unfortunately its history and biological characteristics are not widely understood. (Makmur, 2004). The peak production of snakehead fish from public waters in the period 1998 to 2008 occurred in 2004, with a total production reaching 41,014 tons. The highest level of fresh snakehead fish consumption is in Central Kalimantan, reaching 5.21 kg per capita, while West Java is the largest consumer of salted/preserved snakehead fish with an absorption of 3,193 tons. Snakehead fish production in South Kalimantan in 2010 from pond cultivation was 10 tons, in cages 163 tons, and in rice fields 6 tons (Ministry of Maritime Affairs and Fisheries, 2012).

Snakehead fish cultivation is generally carried out in ponds, which are divided into three main types: earthen ponds, tarpaulin ponds, and concrete ponds, each of which has its own advantages and disadvantages. In addition to ponds, cages are also used as a medium for cultivating snakehead fish. The density of seeds commonly used is 50-60 per square meter with a seed weight of around 100 grams. (Muslim, 2017). Along with fluctuating population growth and development expansion, the availability of land and water for aquaculture is increasingly limited. This is due to the increasing area of land used for industry, agriculture, and settlements, thus reducing the area available for cultivation activities. along with fluctuating population growth and development expansion, the availability of land and water for aquaculture is increasingly limited. This is due to the increasing area of land used for industry, agriculture, and settlements, thus reducing the area available for cultivation activities. In urban aquaculture there are several methods that can be used in carrying out cultivation on limited land. One method that is quite well known in the community is the Bucket Cultivation or Budikdamber method. Budikdamber is a method of integrated fish cultivation with vegetables in one maintenance container. This tilapia cultivation technique in a bucket is relatively easy, practical, economical, can be done at home, and does not require a large area of land (Nursandi, 2018). Habiburrohman (2018), stated that the budikdamber method offers efficient fish cultivation in water use, is waste-free, and easy to maintain naturally without the need for chemicals. The main attraction lies in the use of buckets, which allows cultivation to be carried out in limited land because this container is easy to move and adjust to the available space. This very minimalist land use is expected to be an alternative solution for anyone who wants to cultivate fish in their yard.

There is no definite source regarding the optimal stocking density to achieve good survival and growth of snakehead fish seeds using the Budikdamber method. By conducting this research, it is hoped that it can increase insight into the optimal stocking density to achieve good survival and growth in snakehead fish.

RESEARCH METHODS

Place and Time

This research was conducted at the Laboratory of Building 4, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jatinangor in September - October 2024.

Tools and Materials

The tools used in the study were 15 buckets with sizes, a set of aeration tools, namely aerators, aeration taps, hoses, and aeration stones, 7 in 1 water test kits, DO meters, electric soldering irons, digital scales, drinking cups, hydroton, millimeter blocks, cellphone cameras, stationery, and scoops. The materials used were snakehead fish with a length of 6-8 cm and a weight of 3-4 grams as many as 1300 fish obtained from the Batujaja area, Bandung, West Java, commercial feed HI-PRO-VITE 781-1, Probiotic BIOM-S, Rajawali Water Spinach Seeds.

Experimental Design

This research was conducted using an experimental method, namely by using a Completely Randomized Design (CRD). The treatments used in this study were 50 fish/70L (Control), 60 fish/70L, and 70 fish/70L (Prateja *et al*., 2023).

Procedure

The implementation stage of the research includes maintenance of test fish, water quality management, data collection by measuring the length and weight of fish, observing the number of fish per bucket, measuring the length and weight of dead fish, and measuring water quality.

Fish that have been acclimatized in the fiber tub will be sorted and spread into buckets as many treatments as applied with a feed dose of 5% of fish biomass with a feeding frequency of 3 times a day. The study was conducted for 40 days with data collection of length and weight carried out every 10 days. Water quality data collection includes temperature, pH, DO, EC, ORP, TDS, and Water Salinity.

The parameters measured include: (1) Absolute length growth (Lucas et al., 2015), (2) absolute weight growth (Everhart *et al*., 1975 in Effendie, 1997), (3) Specific Growth Rate (Effendie, 1997), (4) Survival rate (Effendie, 1997).

$$(1)\ \Delta W = Wt - Wo$$

Information :
ΔW : Absolute Weight Gain (g)
Wt : Final average weight of the study (g)
Wo : Initial average weight of the study (g)

$$(2)\ SR = \frac{Nt}{No} \times 100\%$$

Information :
SR : Survival rate (%)
Nt : Number of fish alive at the end of the study (tails)
No : The number of fish alive at the start of the study (tails)

$$(3)\ SGR = \frac{\ln Wt - \ln Wo}{t} \times 100\%$$

Information :
SGR : Specific growth rate
Wt : Average weight at time t (g)

Wo : Initial average weight (g)
t : Time (days)

Data Analysis

Data obtained from the measurement of absolute length growth, absolute weight growth, survival rate, and daily specific growth rate will be analyzed using the F Test or ANOVA (Analysis Of Variance) with a 95% confidence level. If the analysis results show significant differences between treatments, then it will be continued with the Duncan test to determine which treatment gives the best results. Meanwhile, water quality data will be analyzed descriptively.

RESULT

Absolute Length Growth

The results of the study on the effect of differences in stocking density on the growth and survival of snakehead fish seeds in the Budikdamber system are presented in Figure 1. The study, which lasted for 40 days, showed that different stocking densities, namely 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L, had a significant effect ($P<0.05$) on the absolute length growth parameters of snakehead fish.

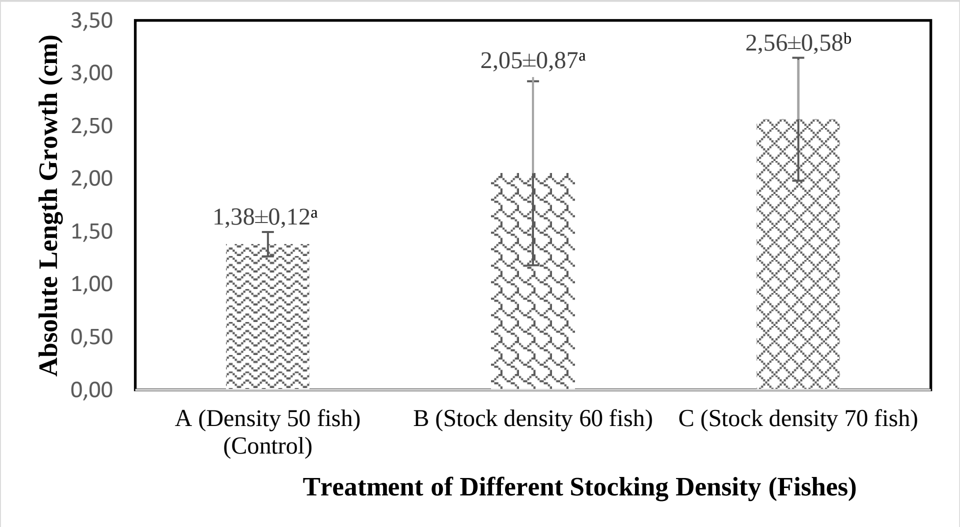

Figure 1. Absolute Length Growth Graph of Snakehead Fish Seeds

Absolute Weight Gain

The results of the study on the effect of differences in stocking density on the growth and survival of snakehead fish seeds in the Budikdamber system are presented in Figure 2. The study, which lasted for 40 days, showed that different stocking densities, namely 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L, had a significant effect ($P<0.05$) on the absolute weight growth parameters of snakehead fish.

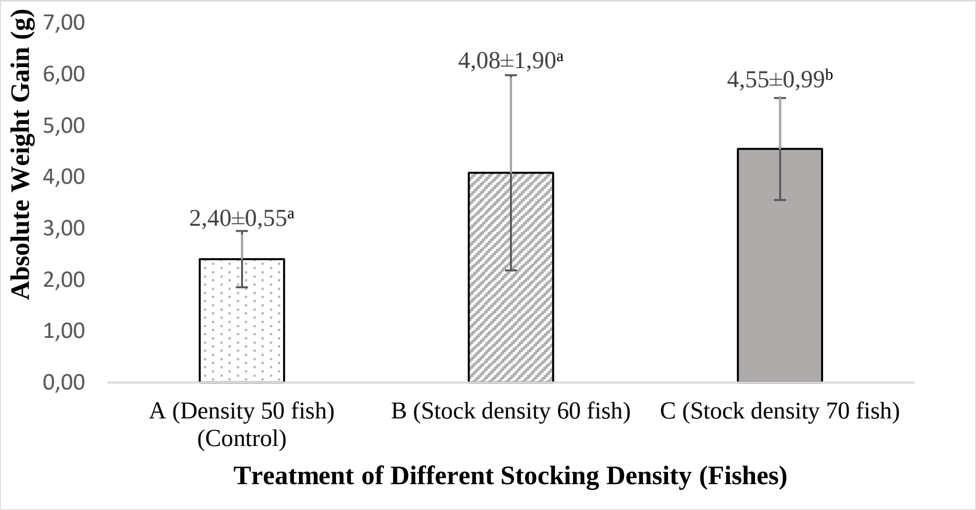

Figure 2. Absolute Weight Growth Graph of Snakehead Fish Seeds

Daily Growth Rate

The results of the study on the effect of differences in stocking density on the growth and survival of snakehead fish seeds in the Budikdamber system are presented in Figure 3. The study, which lasted for 40 days, showed that different stocking densities, namely 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L, had a significant effect ($P<0.05$) on the daily growth rate parameters of snakehead fish.

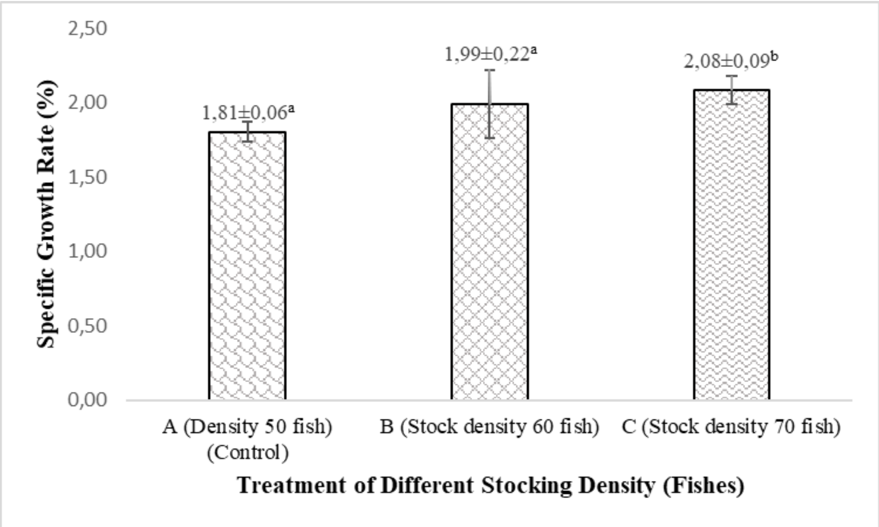

Figure 3. Daily Growth Rate Graph of Snakehead Fish Seeds

Survival Rate

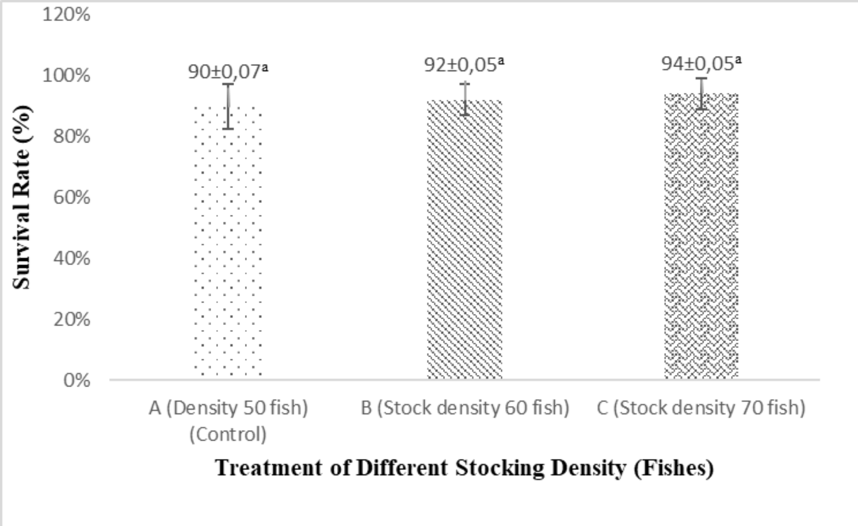

Figure 4. Survival Chart of Snakehead Fish Seeds

The results of the study on the effect of differences in stocking density on the growth and survival of snakehead fish seeds in the Budikdamber system are presented in Figure 4. The study, which was conducted for 40 days, showed that differences in stocking density of snakehead fish, namely 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L, did not show significant differences (P>0.05) in the daily growth rate parameter, but there was a tendency for an increase in the daily growth rate along with an increase in stocking density from 50 fish/70 L to 70 fish/70 L.

Water Quality

The range of water quality values for the maintenance of snakehead fish seeds with different density differences in the Budikdamber system for 40 days of research can be seen in Table 1. Based on Table 1, it can be seen that the water quality during the maintenance of snakehead fish seeds in the research has been in accordance with the water quality standards for snakehead fish cultivation based on the quality standard data listed in Table 1.

Table 1. Water Quality Data

Parameter	Value Range			References
	A	B	C	
Temperature (°C)	24,2 - 29,7	25,4 - 29,2	25,3 - 29,5	25,5-32,7 Almaniar (2011)
DO (mg/L)	4,7 - 8,5	4,8 - 6,9	4,7 - 5,8	0,2 - 8,6 BPBAT Mandiangin (2014)
pH	5,63 - 7,58	5,63 - 7,55	5,43 - 7,64	4 - 7 BPBAT Mandiangin (2014)
EC (µS/cm)	-184 - 36	-177 - -43	-181 - 70	0,7 - 42 Sallam & Elsayed (2018)
ORP (mV)	-100 - 1981	-155 - 1991	-192 - 2068	300 – 500 (lampiran VI PP

				Nomor 22 Tahun 2021)
TDS (ppm)	193 - 989	200 - 990	226 - 1029	1000 (PP Nomor 28/2001)
Salinity (ppm)	193 - 989	200 - 990	226 - 1029	<5ppt or 5000 ppm (Marium *et al*. 2023)
S.G	1000 - 1000	1000 - 1000	1000 - 1000	

DISCUSSION

Absolute Length Growth

The increase in stocking density tested, namely 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L, showed a significant effect (P<0.05) on the absolute length growth of snakehead fish. Treatment A (50 fish/70 L, control) produced the lowest length growth, namely 1.38±0.12 cm during the maintenance period. In contrast, the highest absolute length growth of 2.56±0.5 cm was achieved in treatment C, with a stocking density of 70 fish/70 L. Excessive density will activate the stress system, increasing plasma catecholamines and cortisol as the first consequence. One of the functions of cortisol is to increase the rate of metabolism, glycogenolysis, and lipolysis, and is related to muscle protein degradation (Laiz-Carrión et al., 2003) (Mommsen *et al*., 1999).

High cortisol levels due to stress trigger increased metabolism to provide additional energy (Mommsen *et al*., 1999) (Wendelaar Bonga, 1997). Such internal disturbances can inhibit other physiological processes, such as growth, reproduction, and the immune system (Barton & Iwama, 1991) (Barton & Iwama, 1991; Pickering, 1998). However, studies have also shown that low stocking densities can have a negative impact on growth, as found in the Japanese minnow (*Argyrosomus japonicus*). This may be due to the social nature of the species, which requires group existence to reduce stress (Pirozzi *et al*., 2009). According to Fishbase (2024), young snakeheads form schools on the water surface that are protected by a male parent underwater. In the juvenile stage, snakeheads usually swim in groups, but as adults they tend to swim alone or in pairs.

Absolute Weight Gain

Increasing stocking density with treatments of 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L showed significant differences (P<0.05) in the absolute weight growth parameters of snakehead fish. The lowest weight growth was obtained in treatment A (50 fish/70L, control) of 2.4±0.12 grams, while the highest absolute weight growth was obtained in treatment C (70 fish/70L), which was 4.55±0.99 grams. It is suspected that the increase in the growth performance of snakehead fish is due to the addition of probiotics to the maintenance media.

According to Hartini *et al*., (2013) Probiotics are not only useful for improving water quality, but also encouraging fish growth. Gatesoupe, (1999) also stated that bacterial activity in fish digestion is very sensitive to changes caused by the entry of microbes through feed or water, which can disrupt the balance of natural bacteria in the intestine. This balance is important because it allows probiotic bacteria to inhibit pathogenic bacteria, thereby increasing the ability of fish to digest and absorb nutrients from feed. According to Djauhari *et al*., (2022) stated that with the help of probiotic bacteria in the digestive tract, probiotics are able to increase the absorption of nutrients from feed, which in turn increases fish growth..\

Daily Growth Rate

Increasing stocking density with treatments of 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L showed significant differences ($P<0.05$) in the daily growth rate parameters in snakehead fish. The lowest daily growth rate was obtained in treatment A (control), which was 1.81±0.06% during maintenance. Meanwhile, the highest specific growth rate was obtained in treatment C (70 fish/70L), which was 2.08±0.09%.

The results of this study showed a higher specific growth rate compared to the study by Latifah *et al*., (2022), with the highest specific growth rate of 0.90±0.04% in snakehead fish maintained in the Bucket system for 28 days. Differences in daily growth rates are influenced by internal factors, such as genetics, disease resistance, and feed utilization efficiency, as well as external factors including physical, chemical, and biological conditions of the water. Water temperature and feed quality are the main factors that affect fish growth. Fish growth can occur if the amount of food exceeds the needs for body maintenance (Prihadi 2007).

Survival Rate

The highest survival rate of 94b% was obtained in treatment C (stocking density 70 fish/70L). The lowest survival rate of 90a% was obtained in snakehead fish seeds given treatment A (control) (50 fish/70L). The low survival rate in treatment A was due to fish mortality caused by the cannibalistic nature of snakehead fish. Cannibalistic fish species that are kept begin to show cannibalistic behavior at different ages or sizes, and can show variations in cannibalism intensity at different life stages (Baras & Jobling, 2002). Cannibalism increases during domestication in aquaculture, because the higher amount of feed given creates heterogeneity in size (Hecht & Pienaar, 1993).

High survival rates are influenced by various factors, including adequate preparation of containers to support fish life, sufficient and regular feeding, and good and optimal water quality. The availability of feed, the amount of food, the health of the fish, and the overall condition of the cultivation environment are the determining factors for the survival of the fish (Armando *et al*., 2021). According to Effendie (2002), human handling is one of the factors that influences the survival of the fish.

Water Quality

Water quality is one of the parameters that must be considered in cultivation activities. Water quality can affect the growth and survival of fish being cultivated. Based on BPBAT Mandiangin (2014), the water quality standards for snakehead fish cultivation are pH 4-7, DO 0.2-8.6 mg/L. Based on Almaniar (2011), the optimal temperature value for snakehead fish cultivation is in the range of 22.5-32.7°C. Based on Sallam & Elsayed, (2018), the standard water quality value for the EC parameter is in the range of 0.7 mS/cm-42 mS/cm (Sallam & Elsayed, 2018). Based on Attachment VI of Government Regulation No. 22 of (2021), a good Oxidation Reduction Potential (ORP) value in waters ranges from 300-500 mV. Based on PP Number 28/2001, a good TDS value is >1000 ppm. Based on Marium et al., (2023) a good salinity value is >5ppt or >5000ppm. From the water quality data obtained from the maintenance of snakehead fish, the temperature range is 24.2 - 29.7oC, pH 5.54 - 7.58, DO 4.7 - 8.5 mg/L, salinity 193 - 1029ppm, and TDS 193 - 1029 are still in the normal range for fish to live and grow well. While the range of EC-184 - 70 µS/cm, and ORP -192 - 2068 values are not in accordance with the quality standards that have been mentioned. The treatment of differences in stocking density did not have a significant effect on the differences in the range of water quality values in each treatment. This is thought to be caused by aeration, and the provision of salt in each research bucket. Aeration can increase oxygen levels in the water, and fish salt can maintain pH levels and sterilize bacteria. In addition, the water in the bucket is refilled and replaced every day so that the quality of the maintenance water is maintained properly.

CONCLUSION

The addition of stocking density with the treatment of 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L showed significant differences ($P<0.05$) in the absolute length growth parameters, absolute weight growth and daily growth rate in snakehead fish. The addition of stocking density with the treatment of 50 fish/70 L, 60 fish/70 L, and 70 fish/70 L showed no significant differences ($P>0.05$) in the survival parameters but the results obtained tended to increase up to a stocking density of 70 fish/70L.

ACKNOWLEDGEMENT

Thanks are addressed to all parties who have provided assistance and support so that this writing can be completed properly. Special appreciation is given to the supervisor, family, relatives, and colleagues who have helped during the writing process.

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