RJOAS: Russian Journal of Agricultural and Socio-Economic Sciences
ISSN 2226-1184 (Online) | Issue 1(145), January 2024

UDC 639; DOI 10.18551/rjoas.2024-01.18

ENRICHMENT EFFECTIVENESS OF DAPHNIA SP. WITH VITERNA, SPIRULINA AND GLUTAMINE AS NATURAL FOOD PREPARATION FOR CLIMBING PERCH LARVAE (ANABAS TESTUDINEUS BLOCH)

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ABSTRACT
The aim of this research was to analyze the effectiveness of giving natural Daphnia sp feed enriched with viterna, spirulina and glutamine on the survival and growth of Climbing perch larvae. Proximate analysis was carried out at the end of the research to see the nutritional content of the enriched Daphnia sp. Sampling was carried out at the beginning and end of the research with a maintenance period of 30 days. This research used completely randomized design for 4 treatments and 3 repetitions, namely: treatment A (control), B (viterna enrichment 10 ml/L), C (spirulina enrichment 3 g/L) and D (glutamine enrichment 25 mg/L). The proximate test results showed that treatment B produced the highest protein content, namely 59.61%, while the control treatment was 49.45%. Survival rate ranges between 72-84%. Relative weight growth ranged between 196.78-506.88% while relative length ranged between 29.24-88.51%. The 10 ml/L spirulina enrichment treatment resulted in the highest relative growth in weight and length, while the highest survival rate was found in the 3 g/L spirulina enrichment treatment.

KEY WORDS
Enrichment, daphnia sp., viterna, spirulina, glutamine, climbing perch larvae.

Climbing perch is one of the favorite fish, including in South Kalimantan because it is related to typical foods such as climbing perch baubar, fried, wadi climbing perch, and pakasam climbing perch. In the development of Climbing perch cultivation, there are several factors that are still obstacles, namely, slow growth and low survival, especially in the critical period phase, namely the post-larval phase. The growth of Climbing perch that has been published to reach a length of 8-10 cm and a weight of 15-16 grams takes 6-7 months (Miranti et al., 2017).

The success of developing Climbing perch cultivation is very dependent on the continuity of seeds for rearing activities. The obstacle faced by cultivators is when they enter the post larval stage, where in this phase the larvae need a food supply from outside. The larval critical period begins when the egg yolk is completely absorbed. If the larvae do not get suitable food during this period, it will cause mortality (Amornsakun et al., 2005). Larval feeding activities can be considered the most important aspect and critical factor in the production of climbing perch larvae in hatcheries. Information about the early life history of fish such as critical periods is needed to optimize large-scale cultivation and fish stock management.

One factor that must be considered at the beginning of a fish's life is the survival or death rate of the fish. Factors that cause low survival are usually influenced by feed. Natural food is the main thing in the larval phase, which must be in accordance with the needs of Climbing perch larvae, including in accordance with their digestive physiology so that it is easy to digest and natural food has nutrients such as high protein. However, the food must also fit the mouth openings of the fish larvae.

Feed is an input in cultivation activities so it is a factor that influences fish growth. In reality, a lot of feed is thrown away so that it becomes waste, only around 25% is converted into production output (Maharani, 2012 in Ihsanudin, 2014). This of course affects cultivation activities both in terms of time and costs incurred. Feed and water quality are the main factors in producing maximum production, thus determining the success of a fishing business. Feed that is highly nutritious, easy to process, free of toxins, easy to digest and of course easy to obtain are the requirements for quality feed. Apart from these factors, the size of the feed's suitability to the mouth opening must also be considered. According to Arief et al., (2009), the type of feed is adjusted to the fish's mouth opening and the age of the fish, where the smaller the fish's mouth opening, the smaller the size of the feed given.

The availability of food, especially natural food, is expected to support the survival and growth of Climbing perch larvae. According to Rihi (2019), by providing natural food, the survival and growth of catfish is higher than artificial food. Natural feed is feed ingredients in the form and condition similar to the characteristics of conditions in nature which are taken from living organisms and used as feed in the aquaculture process. One type of natural food that has potential and is easy to cultivate for seeds is Daphnia sp. According to Jusadi et al., (2008) Daphnia sp. is one of various types of natural food commonly used for freshwater fish larvae. Body size of Daphnia sp. according to the mouth opening of the Climbing perch larva, and is suitable for larval digestion and has the nutrients needed by fish larvae.

Natural food Daphnia sp. in wet conditions it has a protein content of 4%, fat 0.54%, carbohydrates 0.67% and ash 0.15% (Haryati, 2005 in Maulidiyanti et. al., 2015). To increase the nutritional value of Daphnia sp., it can be enriched by adding certain ingredients. Natural food enrichment in the form of Daphnia sp. can use several good sources of nutrition from ingredients that can be added, such as supplements, fish oil, vitamin C, vitamin B, and probiotics (Munirasu et al., 2018). Providing enrichment is expected to increase the nutritional content of Daphnia sp. There are many enrichment ingredients that have been tested on fish, including viterna, spirulina and glutamine.

Research on enrichment of Daphnia sp. Siswanto et al., (2023) used viterna material for Climbing perch (*Anabas testudineus*) larvae. Enrichment research using spirulina was also carried out by Maulidiyanti et al., (2015) on Comet fish larvae (*Carassius auratus*), while enrichment using glutamine was also carried out by Fahmi et al., (2019) on gourami fish larvae (*Osphronemus goramy*). All of the enrichment materials above have been proven to have a real influence on the nutritional content of Daphnia sp so that ultimately, they can provide more optimal survival and growth in the fish larvae tested. However, until now it is not known what effect it has on climbing perch larvae (*Anabas testudineus*) and which enrichment materials are most effective for the survival and growth of Climbing perch larvae.

Based on the information above, it is necessary to research the application of enrichment materials such as viterna, spirulina and glutamine on Daphnia sp. on the biological response of Climbing perch larvae (survival and growth). This information will be a very important achievement for the success of climbing perch larvae in passing the critical period so that successful seed production will significantly increase the production of cultivated climbing perch.

METHODS OF RESEARCH

This research was carried out from June to August at the Wet Laboratory of the Faculty of Fisheries and Maritime Affairs, University of Lambung Mangkurat (ULM) for larval rearing, while the proximate test was carried out at the Animal Nutrition and Forage Science Laboratory, Department of Animal Husbandry, Faculty of Agriculture, ULM.

Apart from spawning, another process that must be carried out is culturing Daphnia sp. Daphnia culture is carried out in large buckets with a capacity of 80 liters. Before use, the bucket is washed thoroughly and then filled with 60 liters of water, 3 g/liter of quail droppings (Utami, 2018). The culture media is left for 7-15 days to grow phytoplankton in it. Daphnia sp. stocked at 100 ind/L (Mokoginta, 2003). During culture, Daphnia are given food in the form of fine bran or fermented bran at 125 mg/liter (Sitohang, 2012).

The container used for Daphnia enrichment is a plastic jar with a capacity of 2 liters. The enrichment dose used in the research was the prebiotic viterna 10 ml/L (Siswanto et al., 2023), spirulina 3 g/L (Maulidiyanti et al., 2015) and glutamine 25 mg/L (Fahmi et al., 2019). Enrichment is carried out for 3 hours (Fahmi, 2019) before feeding is carried out twice a day. The enrichment procedure is carried out based on (Jusadi et al., 2015; Fahmi et al., 2019):

- The enrichment ingredients added included treatment A (control) (0.1 g egg yolk and 0.25 g bread yeast), and each treatment, namely: treatment B (0.1 g egg yolk, 0.25 g bread yeast and 10 ml/L viterna), treatment C (0.1 g egg yolk, 0.25 g baker's yeast and 3 g/L spirulina) and treatment D (0.1 g egg yolk, 0.25 g baker's yeast and 25 mg/L glutamine);
- Put the ingredients in 200 ml of water to emulsify with a blender for 3-5 minutes;
- The enrichment mixture is then put into a plastic container with a capacity of 2 liters and filled with 1 liter of water for each treatment;
- The enrichment solution is then taken and put into a plastic container;
- Daphnia sp. enriched for 3 hours, then after being enriched Daphnia was given to climbing perch larvae.

At the end of the research Daphnia sp. proximate test was carried out to determine crude protein content, crude fat content, water content and ash content. The proximate method follows procedures in accordance with AOAC (1999).

The container used to keep climbing perch larva is a 12-piece aquarium measuring 30 cm x 25 cm x 30 cm filled with 5 liters of water. The larvae used came from spawning in the Wet Laboratory to ensure the larvae were in the same condition when the research began. The larval stocking density used was 5 individuals/liter. Before use, the aquarium is cleaned, filled with water, given moderate aeration, placed according to the treatment layout and given a paper label as a marker.

The climbing perch larvae used were 15-day old larvae because this is the right age for natural Daphnia feeding. The larvae will be kept for 30 days to see their biological response to food in the form of Daphnia sp, namely observing their survival and growth in both length and weight. Sampling was carried out at the beginning of stocking and at the end of the research. During rearing the larvae are fed Daphnia sp 2 times a day. Length measurements use digital calipers while weight measurements are carried out using analytical scales with an accuracy of five decimal places.

This research used a RAL experimental design using 4 treatments and 3 replications, namely:

- A = Control treatment;
- B = Viterna enrichment 10 ml/L;
- C = Spirulina enrichment 3 g/L;
- D = Glutamine enrichment 25 mg/L.

The survival of climbing perch larvae was observed during 30 days of rearing. The survival calculation formula is as follows (Effendie, 2004).

$$Survival\ Rate = \frac{Total\ fish\ still\ alive\ at\ the\ time\ of\ research}{Total\ initial\ fish\ density} x\ 100\%$$

The relative length growth of climbing perch larvae in this research was calculated using the formula proposed by Effendie (2004) as follows:

$$Relative\ Length = \frac{\mathrm{Lt} - \mathrm{Lo}}{\mathrm{Lo}}\ x\ 100\%$$

Where: Lt = Final larval length of research (cm); Lo = Larval length at the start of the research (cm).

According to Effendi (2004) relative weight growth is the % increase in weight growth during maintenance during time sampling, formulated as follows:

$$Relative\ Weight = \frac{\mathrm{Wt} - \mathrm{Wo}}{\mathrm{Wo}}\ x\ 100\%$$

Where: Wt = Final larval length of research (cm); Wo = Larval length at the start of the research (cm).

Proximate analysis has the benefit of assessing the quality of feed or food ingredients, especially on the standards of food substances that should be contained therein. At the end of the Daphnia sp research, a proximate test will be carried out to determine its nutritional levels. The proximate method follows procedures in accordance with AOAC (1999) in Hall (2009). Nutritional quality analysis or proximate testing is carried out at the Animal Nutrition and Food Science Laboratory, Department of Animal Husbandry, Faculty of Agriculture, ULM.

As research supporting data, the water quality parameters observed were pH, temperature, DO and ammonia. Water quality parameters were measured at the beginning and end of the research. DO is measured using a water quality tool, Horiba U-20 Water Quality Meters, while ammonia is done by taking water samples and then analyzing them in the water quality laboratory of the Faculty of Fisheries and Maritime Affairs, Lambung Mangkurat University.

Data analysis using Microsoft Excel and SPSS 25.0 for Windows software. Before the ANOVA test, the data was first tested for homogeneity and normality of the data, then analyzed using analysis of variance/ANOVA with a 95% confidence interval. The rules for ANOVA testing are as follows:

- If F count < f table (5%,1%) accept H_0, reject H_1;
- If F count > f table (5%,1%), accept H_1, reject H_0.

If the calculation results are significantly different, then the diversity coefficient value is calculated to determine the test method to be used. If the KK is large, the test carried out is the Duncan Multiple Distance Area test. If the KK is moderate, the test carried out is the Least Significant Difference (BNT) test. If the KK is small, the test used is the Honestly Significant Difference (HSD) test.

RESULTS AND DISCUSSION

The survival Rate of Climbing perch larvae enriched with different materials during the research can be seen in Table 1.

Table 1 – Survival rate (SR) of Climbing perch larvae during the research

Treatment	Replication			Average (%)
	1	2	3	
A	76	80	80	78.67 ± 2.31[a]
B	76	80	84	80.00 ± 4.00[a]
C	80	80	84	81.33 ± 2.31[a]
D	76	76	72	74.67 ± 2.31[a]

The survival status of Climbing perch larvae during the 30 days of research showed that survival values ranged from 72 to 84%. From the table it is known that treatment C (3 g/L spirulina enrichment) was the best treatment compared to other treatments because it produced a survival value at the end of the research of 81.33 ± 2.31%, followed by treatment B of 80.00 ± 4.00%, treatment A was 78.67 ± 2.31 and treatment D was 74.67 ± 2.31%. For more detailed data on the survival of Climbing perch larvae can be seen in Figure 1.

The survival data obtained from the normality test results with a significant value of (0.08) > (0.05), so the data is normal. Homogeneity test with a significant value (0.802) >

(0.05), then the data is homogeneous. Based on the results of the analysis of variance (ANOVA) it shows that Fhit (3.111) < Ftab5% (4.07) and Fhit (3.111) < Ftab1% (7.59) so accept H0 and reject H1 at α = 0.05 and α = 0.01, then it is not significantly different or in other words that the enrichment treatment of Daphnia sp. with different enrichment materials, there was no significant difference in survival (SR) of Climbing perch larvae.

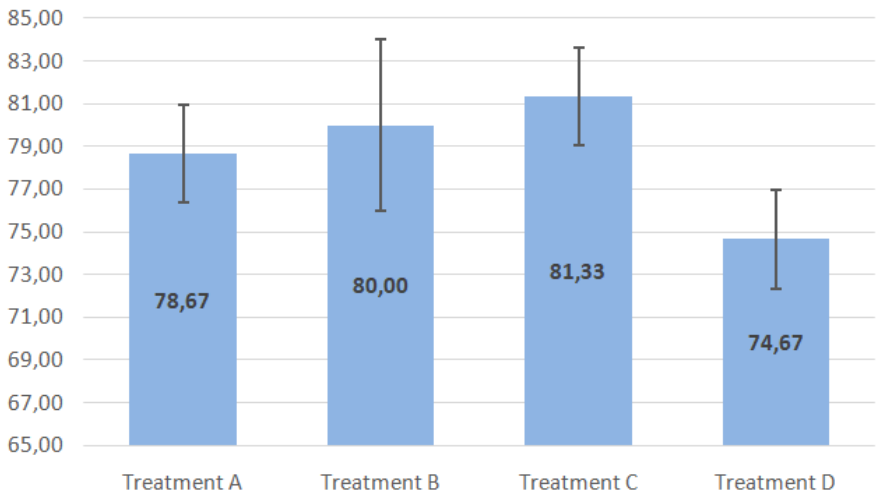

Figure 1 – Graph of survival of Climbing perch larvae during the research

The results showed that the highest survival rate was in treatment C (3 g/L spirulina enrichment) with an average value of 81.33%, followed by treatment B with an average value of 80%, then treatment A with an average value of 78. 67% and the lowest was treatment D with an average value of 74.67%. Based on the results of the ANOVA test, it shows that there are no significant differences between all treatments.

This occurs allegedly because the nutritional content contained in Daphnia sp, both enriched and without enrichment, is sufficient for the fish's needs so that it can maintain its daily activities, which ultimately has an impact on the fish's ability to maintain its survival. Research by Saputri et al., (2019) shows that natural food enrichment of Daphnia sp. with Viterna on depik fish (*Rasbora tawarensis*) can produce survival of 88.89%. According to Rizki et al. (2021) the quality of enriched feed can increase the survival and growth of larvae which can be observed from the digestibility of the feed. Another thing that influences is the water quality which is optimal for fish life. According to Alpian et. al., (2022) mortality is one of the main problems in cultivation, which means it affects the availability of larvae or seeds themselves. According to Sepang et al., (2021) mortality can be reduced by providing optimal feeding by paying attention to the nutritional content of the natural food provided and its suitability for the mouth opening. Survival of fish is influenced by internal factors such as age and resistance to disease as well as external factors including feed, density and water quality.

Water quality also plays an important role because it will influence the growth process of farmed fish. Therefore, growth will be good if the water quality conditions are also good, but if it is poor then growth will be disrupted which could result in mass deaths. From the results of water quality measurements during the research, it is known that conditions are normal for Climbing perch cultivation activities.

Daphnia sp. or also known as water fleas, which are small in size and live in fresh waters, are a type of natural food commonly used in freshwater fish hatcheries. Daphnia sp. It is often used because it has advantages such as being easy to digest, easy to obtain, does not reduce water quality and has sufficient nutritional content. According to Lestari (2020), the wet weight nutritional content of Daphnia sp is 4.58% protein, 0.41% fat, and 1.06% carbohydrates.

The relative weight growth values of Climbing perch larvae enriched with different materials during the research can be seen in Table 2.

Table 2 – Value of relative weight growth of Climbing perch larvae during the research

Treatment	Replication			Average (%)
	1	2	3	
A	391.19	214.41	285.75	297.11 ± 88.94[a]
B	285.79	350.05	506.88	380.91 ± 113.73[a]
C	212.24	242.52	404.39	286.38 ± 103.31[a]
D	258.78	196.78	202.99	219.52 ± 34.14[a]

Table 2 shows the relative weight growth status of Climbing perch larvae during the 30 days of research. The results show that the relative weight growth value ranges from 196.78 to 506.88%. From the table it is known that treatment B (viterna enrichment 10 ml/L) is the best treatment compared to other treatments because it produces a relative weight growth value at the end of the research of 380.91 ± 113.73%, followed by treatment A of 297.11 ± 88.94 %, treatment C was 286.38 ± 103.31% and treatment D was 219.52 ± 34.14%. For more detailed growth data on the relative weight of Climbing perch larvae can be seen in Figure 2.

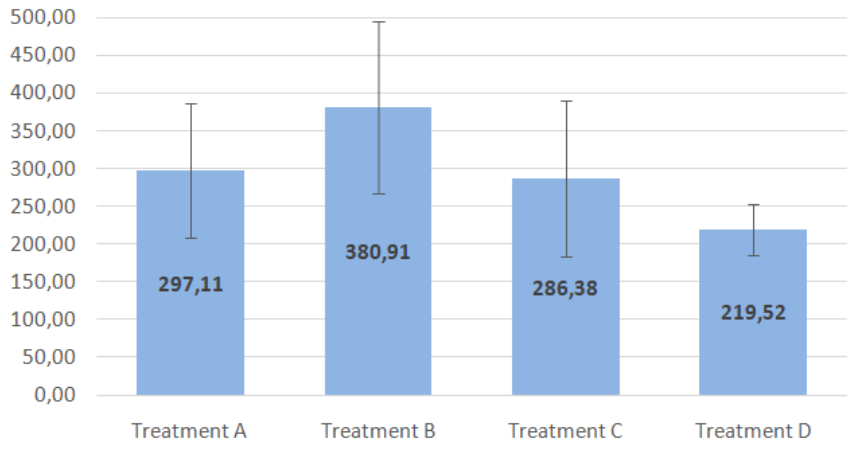

Figure 2 – Graph of relative weight growth of Climbing perch larvae

The relative weight growth data obtained from the normality test results with a significant value of (0.159) > (0.05), so the data is normal. Homogeneity test with a significant value (0.316) > (0.05), then the data is homogeneous. Based on the results of the analysis of variance (ANOVA) it shows that Fhit (1.610) < Ftab5% (4.07) and Fhit (1.610) < Ftab1% (7.59) so accept H0 and reject H1 at α = 0.05 and α = 0.01, then it is not significantly different or in other words that the enrichment treatment of Daphnia sp. with different enrichment materials, there was no significant difference in the relative weight growth of Climbing perch larvae.

The results showed that the highest relative weight growth was obtained in treatment B (viterna enrichment 10 ml/L) with an average value of 380.91%, followed by treatment A with an average value of 297.11%, then treatment C with an average value -average 286.38% and the lowest was treatment D with an average value of 219.52%. Although the relative weight growth values ranged from 196.78 to 506.88%, they were not statistically significantly different between treatments. This is thought to be because the nutritional content contained in Daphnia sp, whether after the enrichment process or not (control), supports the growth of Climbing perch. According to Tacon (1987) in Kardana et. al., (2012) the protein requirement of omnivorous fish at the seed stage is 42%. Climbing perch is an omnivorous fish and the proximate test results of Daphnia sp. at the time of the research it was between 49.45-59.61%. The proximate test results prove that the protein content in Daphnia sp. at the time

of research everything was above the needs of Climbing perch (omnivorous). According to Wati et al., (2014) if nutritional needs are sufficient, there will be increased growth and organ refinement until the larvae reach the adult phase.

Daphnia sp, was chosen because its size fits the larva's mouth opening and is easy to digest because most of its body contains water. According to Herliwati et al. (2021) the larval stage of fish really needs Daphnia sp because it contains various enzymes such as protease, peptide, amylase, lipase and cellulase. According to Pennak (1989) Daphnia sp. has a hollow/segmented body structure even though it is not visible to the eye. This is what makes it easy to absorb the supplements added during soaking, which affect the nutritional content of the natural feed.

Advantages of Daphnia sp. as a natural food, it is very easily digested by fish, the size is suitable for the mouth opening of the fry, has good nutritional content, feeding it to cultivation media does not reduce water quality (Herawati et al., 2015). It also contains a number of digestive enzymes such as proteinase, peptidase, amylase, lipase, and cellulase which function as exoenzymes in the digestion of fish larvae (Wahyuny et al., 2017).

Growth is a change in length, weight, or volume over a certain period of time and can also be interpreted as an increase in mitotic cell division tissue that occurs during an excess supply of energy and protein (Handajani, 2010). According to Hidayat et al. (2013), growth is influenced by internal factors such as heredity, resistance to disease and the ability to utilize food, while external factors include the physical, chemical and biological properties of waters.

According to Koroh & Lumenta (2014), the ability of fish to digest and absorb feed is the key to the success of cultivation activities. Food is one of the factors that influence growth and functions as a building block. One of the important nutrients that fish need is protein (Dewi et al., 2018). All food consumed is not necessarily used for growth, because some of the energy will be used for activity, metabolism (maintenance) and reproduction (Fujaya, 2004).

The relative length growth values of Climbing perch larvae enriched with different materials during the research can be seen in Table 3.

Table 3 – Value of relative length growth of Climbing perch larvae

Treatment	Replication			Average (%)
	1	2	3	
A	48.90	29.24	33.72	37.29 ± 10.31[a]
B	38.84	52.84	88.51	60.07 ± 25.61[a]
C	40.75	41.90	52.07	44.91 ± 6.23[a]
D	42.09	44.68	37.90	41.55 ± 3.42[a]

Table 3 shows the relative length growth status of Climbing perch larvae during the 30 days of research. The results show that the relative length growth value ranges from 29.24 to 88.51%. From the table it is known that treatment B (viterna enrichment 10 ml/L) is the best treatment compared to other treatments because it produces a relative length growth value at the end of the research of 60.07 ± 25.61%, followed by treatment C of 44.91 ± 6, 23%, treatment D was 41.55 ± 3.42% and treatment A was 37.29 ± 10.31%. For more detailed data on the relative length growth of Climbing perch larvae can be seen in Figure 3 below.

The survival data obtained from the normality test results with a significant value of (0.110) > (0.05), so the data is normal. Homogeneity test with a significant value (0.054) > (0.05), then the data is homogeneous. Based on the results of analysis of variance (ANOVA), it shows that Fhit (1.468) < Ftab5% (4.07) and Fhit (1.468) < Ftab1% (7.59) so that H0 is accepted and H1 is rejected at α = 0.05 and α = 0.01, then it is not significantly different or in other words that the enrichment treatment of Daphnia sp. with different enrichment materials, there was no significant difference in the relative length growth of Climbing perch larvae.

The results showed that the highest relative length growth was obtained in treatment B (viterna enrichment 10 ml/L) with an average value of 60.07%, followed by treatment C with an average value of 44.91%, treatment D with an average value of the average was 41.55% and the lowest was treatment A (control) with an average value of 37.29%. The relative

length growth values ranged from 29.24 to 88.51%, but after statistical tests showed the results were not significantly different between treatments. Just like the relative weight growth, this is thought to be because the nutritional content contained in Daphnia sp in each treatment, whether after the enrichment process or not (control), has supported the growth of Climbing perch.

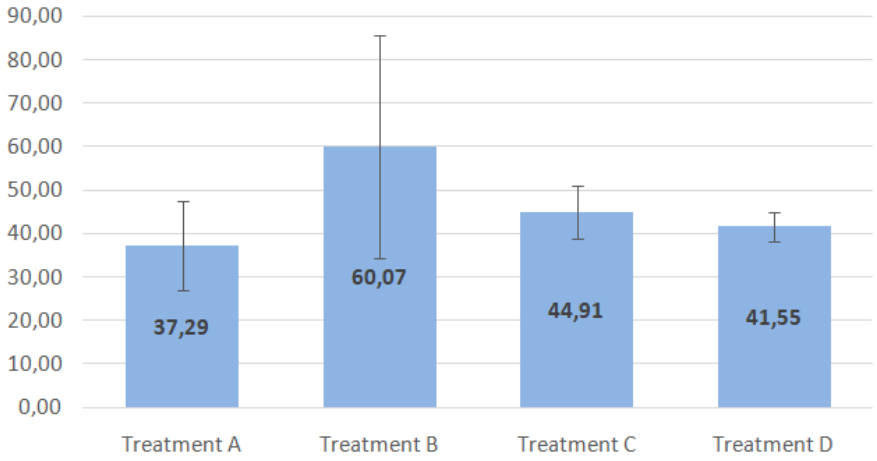

Figure 3 – Graph of relative length growth of Climbing perch larvae

The results showed that the length growth value was relatively higher in the viterna enrichment treatment. This is because viterna has been absorbed by Daphnia sp. affect its nutritional content. This is in accordance with the opinion of Mufidah et al., (2009) who stated that Daphnia sp. which has been enriched with viterna, its nutritional value increases.

Viterna is a supplement made from various natural ingredients which is useful for increasing nutritional content so that fish growth becomes faster (Mufidah et al., 2009). Viterna can be used in feed mixtures and is organic so it is easy to digest, which in fish digestion can trigger digestive enzymes, increase appetite and endurance, thus affecting growth (Setiaji et al., 2014). Viterna itself is prepared from various kinds of animal and plant ingredients. Viterna contains various minerals, proteins and vitamins. The contents of Viterna are minerals (N, P, K, Ca, Mg, Ng, Cl, S, Fe, Zn), fatty acids (aspartate, glutamate), protein (seryn, tyrosine, histidine, isoleucine, lysine, methionine, phenyl, alanine, tryptophan, valine, arginine, threonine) and vitamins (A, D, E, K, B complex, C).

Feed and water quality are factors that play a very important role in the success of a fishing business, so they are factors that must be considered if you want to get maximum results. The requirements for quality feed are feed that is highly nutritious, easy to obtain, easy to process, easy to digest and free of toxins. The type of feed is adjusted to the fish's mouth opening and the age of the fish, where the smaller the fish's mouth opening, the smaller the size of the feed given (Arief et al., 2009). Rihi (2019) stated that the growth rate and survival rate of catfish is higher when given natural food compared to artificial food.

Table 4 – Results of proximate analysis of Daphnia sp.

Sample	Analysis Parameters (%)		
	Proteins	Fat	Ash
A	49.45	25.63	14.90
B	59.61	20.36	13.52
C	54.55	27.27	11.44
D	58.60	26.38	16.63

Proximate analysis has the benefit of assessing the quality of feed or food ingredients, especially on the standards of food substances that should be contained therein. Apart from that, proximate analysis can be used to evaluate and prepare ration formulas properly. The results of the proximate analysis of Daphnia sp can be seen in Table 4.

Water is a living medium for fish so the quality and quantity used in fish farming activities must meet the fish's living needs. Environmental factors that influence the life of aquatic organisms include temperature, pH, dissolved oxygen (DO) and ammonia. Water quality measurements were carried out at the beginning and end of the research. The results of water quality measurements can be seen in Table 5.

Table 5 – Water quality data during the research

No.	Parameters	Unit	Measurement results					Standard of Living
			Beginning	End				
				A	B	C	D	
1.	Temperature	^{o}C	28.02	28.8	28.8	28.6	28.7	Deviation 3*
2.	pH	-	6.96	6.09	6.07	6.01	6.09	6-9*
3.	Dissolved Oxygen	(mg/L)	4.45	4.39	4.35	4.39	4.36	>4*
4.	Ammonia (NH_3)	(mg/L)	0.1	0.25	0.25	0.25	0.25	<0.5**

*Information: * Effendi and Wardiatno (2015), **Samsundari and Wirawan (2013).*

Water quality plays an important role in supporting growth, which is why water quality plays an important role in cultivation activities. Based on the results of the water quality analysis, it shows that the results of measuring the physical and chemical water parameters in this research are still in normal conditions for the growth of Climbing perch larvae.

CONCLUSION

Test results for the nutritional content of Daphnia sp. Through the proximate test, it showed that the 10 ml/L viterna enrichment treatment produced the highest protein content, namely 59.61%, while the treatment without enrichment (control) produced a protein content of 49.45%. The addition of 10 ml/L viterna resulted in the best relative growth in weight and length but was not statistically significantly different from other treatments, including the treatment without enrichment (control). The addition of 3 g/L spirulina resulted in the best survival with a difference that was not too significant compared to other treatments, namely between 72 and 84%, which after statistical tests was also not significantly different between treatments.

REFERENCES

1. Alfian, M., Herliwati, H. & Olga, O. (2022). Suplementasi Artemia sp and Daphnia sp untuk pertumbuhan and sintasan larva ikan papuyu (Anabas testudineus). Fish Scientiae, 12(1), 32-48.
2. Amornsakun, T., Sriwatana, W., & Promkaew, P. (2005). Some aspects in early life stage of climbing perch, Anabas testudineus larvae. Journal Sci. Technol, 27(1), 403-418.
3. Arief, M., Triasih, I. & Lokapirnasari, W. P. (2009). Pengaruh pemberian pakan alami and pakan buatan terhadap pertumbuhan benih ikan betutu (Oxyeleotris marmorata Bleeker). Jurnal Ilmiah Perikanan and Kelautan, 1(1), 51–57.
4. Dewi, S., Anggoro & Rudiyanti, S. (2018). Kesesuaian perairan and daya dukung lingkungan Tanjung Gelam untuk wisata rekreasi pantai di Taman Nasional Karimun Jawa. Management of Aquatic Resources Journal (MAQUARES), 7(4), 361-369.
5. Effendie, M. (2004). Biologi Perikanan. Yayasan Pustaka Nusantara. Yogyakarta.
6. Effendi, H. & Wardiatno, Y. (2015). Water quality status of Ciambulawung River, Banten Province, based on pollution index and NSF-WQI. Procedia Environmental Sciences, 24, 228-237.
7. Fahmi, R., Setiawati, M., Sunarno, M. T. D., & Jusadi, D. (2019). Pengayaan Daphnia sp. dengan glutamin untuk meningkatkan kinerja pertumbuhan and sintasan larva ikan gurami Osphronemus goramy Lacepede, 1801. Jurnal Iktiologi Indonesia, 19(3), 349-359.
8. Fujaya, Y. (2004). Fisiologi Ikan. Rineka Cipta.

9. Hall, M. B. (2009). Determination of starch, including maltooligosaccharides, in animal feeds: Comparison of methods and a method recommended for AOAC collaborative study. Journal of AOAC International, 92(1), 42-49.
10. Handajani, H., & Widodo. (2010). Nutrisi Ikan. UMM Press, Malang. 271 Hal.
11. Herawati, V. E., Hutabarat, J., & Radjasa, O. K. (2015). Growth and survival rate of tilapia (Oreochromis niloticus) larvae fed Daphnia magna cultured with organic fertilizer resulted probiotic bacteria fermentation. Hayati Journal of Biosciences, 22(4), 169-173.
12. Herliwati., Rahman, M., Hidayat, A. S., & Sumantri, L. (2021). Effect of poultry excreta on water quality and Daphnia magna production in Chlorella powdeer medium. Journal of Human University, 48(8), 2-6.
13. Hidayat, D., Ade. D. S, & Yulisma. (2013). Kelangsungan hidup, pertumbuhan and efisiensi pakan ikan gabus (Channa striata) yang diberi pakan berbahan baku tepung keong mas (Pomacea sp). Jurnal akuakultur rawa Indonesia, 1(2), 161–172.
14. Ihsanudin. (2014). Pengaruh pemberian rekombinan hormon pertumbuhan (Rgh) melalui metode oral dengan interval waktu yang berbeda terhadap pertumbuhan and kelulushidupan benih ikan nila larasati. Journal of Aquaculture Management and Technology, 3(2), 94–102.
15. Jusadi, D., Meylani, I., & Utomo, N. B. P. (2008). Kadar vitamin C dalam tubuh Daphnia sp. yang diperkaya dengan vitamin c pada lama waktu pengkayaan yang berbeda. Jurnal Akuakultur Indonesia, 7(1), 11–17.
16. Jusadi, D., Aprilia, T., Suprayudi, M. A., & Yaniharto, D. (2015). Pengkayaan rotifer dengan asam amino bebas untuk larva kerapu bebek Cromileptes altivelis. Ilmu Kelautan, 20(4), 207-214.
17. Kardana, D., Haetami, K., & Suherman, H. (2012). Efektivitas penambahan tepung maggot dalam pakan komersil terhadap pertumbuhan benih ikan bawal air tawar (Colossoma macropomum). Jurnal Perikanan Kelautan, 3(4), 177-184.
18. Koroh, P. A. & Lumenta, C. (2014). Pakan suspensi daging kekerangan bagi pertumbuhan benih sidat (Anguilla bicolor). E-Journal Budidaya Perairan, 2(1), 7-13.
19. Lestari, T. A., Hudaidah, S., & Santoso, L. (2020). Efektivitas Daphnia sp. yang diberi pakan tepung ikan untuk meningkatkan pertumbuhan and tingkat kelangsungan hidup larva ikan gurami (Oshronemous gouramy). Berkala Perikanan Terubuk, 48(1), 350-360.
20. Maulidiyanti., Limin, S., & Siti, H. (2015). Pengaruh pemberian pakan alami daphnia sp yang diperkaya dengan tepung spirulina terhadap kelangsungan hidup and pertumbuhan larva ikan Komet. E-Jurnal Rekayasa and Teknologi Budidaya Perairan, 6(1), 461-470.
21. Miranti, F., Muslim., & Yulisman. (2017). Pertumbuhan and Kelangsungan Hidup Larva Ikan Betok (Anabas testudineus) Yang Diberi Pencahayaan Dengan Lama Waktu Yang Berbeda. Jurnal Akuakultur Rawa Indonesia, 5(1) 33-44.
22. Mokoginta, I., Jusadi, D., & Pelawi, T. L. (2003). Pengaruh pemberian Daphnia sp. yang diperkaya dengan sumber lemak yang berbeda terhadap kelangsungan hidup and pertumbuhan larva ikan nila (Oreochromis niloticus). Jurnal Akuakultur Indonesia, 2(1), 7–11.
Mufidah, B. S., Rahardja & Satyantini, W. H. (2009). Pengkayaan Daphnia sp. dengan Viterna terhadap kelangsungan hidup and pertumbuhan larva ikan lele dumbo (Clarias gariepinus). Jurnal Ilmiah Perikanan and Kelautan, 1(1), 59-66.
23. Pennak, R. W. (1989). Freshwater Invertebrates of United States: Protozoa to Mollusca; Third Edition. Wiley & Sons Inc. Singapore.
24. Rihi, A. P. (2019). Pengaruh pemberian pakan alami and buatan terhadap pertumbuhan and kelangsungan hidup benih ikan lele dumbo (Clarias gariepinus) di Balai Benih Sentral Noekele Kabupaten Kupang. BioEdu: Jurnal Pendidikan Biologi, 4(2), 59–68. https://doi.org/10.32938/jbe. v4i2.387.
25. Rizki, R., Azwar, T., Iwan, H., & Nurhayati. (2021). Pengaruh pengkayaan vitamin C and probiotik pada Artemia sebagai pakan terhadap pertumbuhan and kelangsungan hidup larva ikan peres (Osteochilus kappeni). Jurnal TILAPIA, 2(2), 57-62.

26. Samsundari, S. & Wirawan, G. A. (2013). Analisis penerapan biofilter dalam sistem resirkulasi terhadap mutu kualitas air budidaya ikan sidat (Anguilla bicolor). Jurnal gamma, 8(2), 86-97.
27. Saputri, R., Dewiyanti, I., Hasri, I., Nurfadillah, N., & Melissa, S. (2019). Pengaruh pemberian Daphnia sp. diperkaya dengan Viterna terhadap pertumbuhan and kelangsungan hidup benih ikan depik (Rasbora tawarensis). Jurnal Ilmiah Mahasiswa Kelautan Perikanan Unsyiah, 4(1), 21-28.
28. Sepang, D. A., Mudeng, J. D., Monijung, R. D., Sambali, H., & Mokolensang, J. F. (2021). Pertumbuhan Ikan Nila (Oreochromis niloticus) yang diberikan pakan kombinasi pelet and maggot (Hermetia illucens) kering dengan presentasi berbeda. E-Journal Budidaya Perairan, 9(1), 33-44.
29. Setiaji, J., Hardianto, J., & Rosyadi. (2014). Pengaruh penambahan probiotik pada pakan buatan terhadap pertumbuhan ikan baung (Hemibagrus nemurus). Jurnal Dinamika Pertanian, 29(3), 307-314.
30. Siswanto., Aminah, S., Sofarini, D., & Nopitasari. (2023). Efektivitas Pengayaan Daphnia sp dengan Viterna untuk Post Larva Ikan Papuyu (Anabas testudineus). Rekayasa, 16(3), 378-386.
31. Sitohang, R. V., Herawati, T., & Lili, W. (2012). Pengaruh pemberian dedak padi hasil fermentasi ragi (Saccharomyces cerevisiae) terhadap pertumbuhan biomassa Daphnia sp. Jurnal Perikanan Kelautan, 3(1), 65-72.
32. Utami, N. A. D. R. (2018). Pengaruh Pemberian Pupuk Kotoran Burung Puyuh dengan Konsentrasi Berbeda Terhadap Laju Pertumbuhan Daphnia spp. Jurnal Perikanan Kelautan, 9(2), 112-118.
33. Wahyuny, F. S., Dewiyanti, I., & Hasri, I. (2017). Enrichment of Daphnia magna with different dosages of Azolla microphylla fermentation on the growth and survival rate of tilapia larvae (Oreochromis niloticus). Jurnal Ilmiah Mahasiswa Kelautan and Perikanan Unsyiah, 2(2), 329-338.
34. Wati, S., Marlinda, S., Abrory, S. F., Kemala, P. H. & Fajar, N. I. (2014). Superoti: Suplemen berprotein tinggi bagi Rotifer dalam meningkatkan kelangsungan hidup larva ikan betok (Anabas testudineus). Laporan PKM-Penelitian. Institut Pertanian Bogor. Bogor.