Utilization of Freshwater Snail Meal in Paste Feed as a Protein Source for Growth and Survival Rate of Baung (*Hemibagrus nemurus*) Larvae

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Abstract

A research was conducted from Januaryt until March 2013 at Fish Hatchery and Breeding Laboratory, Fisheries and Marine Science Faculty Riau University. Its aim was to evaluate replacement of protein source from fish meal (FM) to freshwater snail meal (FSM) on Baung larval rearing. Combination of the diet used in this study were: P0 (0% FSM, 100% FM), P1 (25% FSM, 75% FM), P3 (50% FSM, 50% FM), P4 (75% FSM, 25%FM), and P5 (100%FSM, 0% FM). The larvae were reared in 15 litre aquarium for 40 days at stocking density 2 larvae/l. Feeding was given 3 times/day.

Freshwater snail flour can be replaced fish meal as a protein source paste feed in fish larvae rearing of Baung. Replacement of freshwater snail meal to fish meal can be done up to 50-100% resulting weight growth 0.89 to 1.16 g, length growth rate 3.7 to 4.0 cm, specific growth rate 9.52 to 10.19% and survival rate 69-75%.A 100% freshwater snail meal was the the most efficient paste feed to produce 40 days green catfish larvae.

Keywords : Freshwater snail meal, growth, survival rate, green catfish larvae,

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Introduction

Baung (*Hemibagrus nemurus*) is one kind of the fresh water fish. In Riau, it can be found in rivers, reservoirs, and swamps. This fish is very popular by consumers due to its fleshy thick and delicious taste, so this fish have high economic value, at price of Rp 75,000 – 100,000/kg. Therefore Baung exploited by fishermen to meet consumers' needs regardless of its populations, consequently Baung population decreased. Therefore, Baung cultivation need gets priority.

Baung cultivation requires adequate larvae either in quality or quantity. In breeding activity, larvae rearing is important because it is the most critical period (high mortality) especially after the depleted yolk, this is because the digestive tract and enzyme haven't formed perfectly. Therefore it takes the feed in accordance with the opening of larvae’s

mouth and digestive organ. However Baung larvae can be kept in controlled environments and responsive towards artificial feed (Suryanti *et al*., 2003).

To increase growth and survival rate of Baung larvae, natural feeding such as *Tubifex* sp is already widely used, but its availability limited in nature. One effort that can be reached is artificial feeding such as pasta by utilizing the available resources, including the utilization of freshwater snail. Protein, which is the most important ingredients, sourced from fish meal. But at the moment its availability is still limited and obtained by imports and the price is relatively expensive.

Freshwater snail (*Pilsbryoconcha exilis*) encountered in Sungai Paku Village, Kampar Kiri Disctrict of Riau Province, is used in the village as the Baung broodstock feed. From the results of the analysis of proximate, freshwater snail flour contains protein of 50.08%, carbohydrate 17%, fat 2.96%, 18% gray and 16% water (Aryani, 2012).

In order to be improved the growth and survival rate of Baung larvae, it's important to study on the use of freshwater snail flour as a protein source on pasta as a substitute for fish meal. From the results of this study are expected to provide information on the percentage of freshwater snail flour which can be used in pasta as the substitution of fishmeal to enhance growth and survival rate of Baung larvae.

MATERIALS AND METHODS

The fishes used are Baung larvae at age of eight days with initial length 1.00 cm on average and initial weights 0.02 g/tail on average. The larvae derived from the broodstock : females with weight of approximately 1000 g and the male with a weight of approximately 800 g. To accelerate the maturation of the gonads during maintenance of the broodstock, females are stimulated with 17- β estradiol at dose of 400 µ g/kg through the methods of implantation into the back muscles. For maintenance broodstock feed with fresh meal such as pellet and freshwater snail meal, then it spawned artificially in Sungai Paku Village of Kampar Kiri Disctrict. Eggs from the spawning hatched in wood container of 100x100x30 cm and equipped with aeration. The four-day age larvae were transported to the Hatchery and Breeding Laboratory Fisheries and Marine Science Faculty University of Riau and adapted for four days inside the aquarium for the next experiment is performed based on the treatment. The larvae are reared in aquarium-sized 30x30x30 cm and equipped with aeration. Stocking density in the aquarium is 2 fishes/liter so that each aquarium contains 30 fishes.

The experimental design used was Complete Random Design (CRD) with five treatments and three times in replication that is the use of freshwater snail meal and fish meal with a different percentage as follows:

P0: 0% freshwater snail meal: 100% Fish meal

P1: 25%freshwater snail meal: 75% Fish meal

P2: 50%freshwater snail meal: 50% Fish meal

P3: 75%freshwater snail meal: 25% Fish meal

P4: 100%freshwater snail meal: 0% Fish meal

At the beginning of the experiment, larvae was weighed and measured to obtain the initial weights and lengths. The larva then put into each container and kept for 40 days.

Making of Pasta Feed

Freshwater snail meal is obtained in the following way: fresh water snail was cleaned, cutted (so its quick dried) and dried by using sunlight. Once dried, the fresh water snail is ready made to be flour by mashed using a blender without using a sieve. If still there are grains, freshwater snail flour blended again until completely smooth. The making of pasta feed: before committing to making feed, the formulations and composition of each ingredient are determined as it is presented in Table 1.

Table 1. Ingredient amount (g) Pasta feed (100 g)

Ingredient	**%CP(dry)**	**P0(g)**	**P1(g**	**P2(g)**	**P3(g)**	**P4(g)**
Fish meal	51	75.49	56.63	37.74	18.86	0.00
Freshwater snail meal	50	0.00	19.24	38.50	57.76	77.00
Wheat flour	14	10,71	10,71	10.71	10.71	10.71
Fish oil	0	2	2	2	2	2
Vitamin Mix	0	2	2	2	2	2
Mineral Mix	0	1	1	1	1	1
Other ingredients	0	8.8	8.42	8.05	7.67	7.29
Amount		100	100	100	100	100

P0: 0% freshwater snail meal: 100% Fish meal

P1: 25%freshwater snail meal: 75%Fish meal

P2: 50%freshwater snail meal: 50%Fish meal

P3: 75%freshwater snail meal: 25%Fish meal

P4: 100%freshwater snail meal: 0%Fish meal

All ingredients used are mixed in order to become the same particle and weighed according to the predetermined amount. Next the ingredients blended gradually starting from the least to the most amount ingredients until the mixture becomes homogeneous. For maintaining the quality of feed, the feed is stored in the freezer.

Feed provided by *adlibitum* in 4 times a day: 07.00, 11.00, 15.00, 19.00 GMT. Fish rearing do for 40 days and sampling was done every 10 days using the analytical scales with accuracy of 0.1 mm. Weighing procedure is by putting fish into plastic containers containing water, prior to weighing fish weights, plastic containers with water in position number 0.00 g on the scales. The fish weighed in g unit and measured in units of cm in length, the survival rate was observed during the study and the number of dead larvae is noted.

The observed parameters are:

1. The growth rate of the daily weights using the Zonneveld *et al* formula (1991) :

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

2. The growth of the absolute length can be calculated by using the relational growth that their definitions as follows (Effendie, 1979):

$$L_m = L_t - L_0$$

3. Increase the absolute weights can be calculated by using the relational growth that their definitions as follows (Effendied, 1979):

$$W_m = W_t - W_0$$

4. the amount of seed fish that survive on the experiment (40 days) can be known from the initial density difference with the amount of mortality with the formula:

$$SR = {}^{N_t}/_{N_o} \times 100\%$$

The response of each of the parameters of the treatment is done by applying Anava and continued with Newman-Kuels test (Steel and Torrie, 1980).

Result and Discussion

Daily weight growth

The results showed that utilization of freshwater snail mail as a substitute for fish meal protein source gives Baung daily weight growth rate that differ markedly ($p < 0.05$). The daily growth rate of larvae fed by paste with the protein source of freshwater snail with a different percentage gives the lowest results that are P0 (8.72%) differed markedly with P3 (9.93%), and P4 (10.19%), as noted in Table 2.

Table 2. Daily growth rate of green catfish larvae on average

Treatment	Initial length (cm)	Final length (cm)	Daily growth rate (%)
P0	0.02±0.0	0.65±0.38	8.72±0.30[a]
P1	0.02±0.0	0.70±0.67	8.82±0.67[a]
P2	0.02±0.0	0.91±0.48	9.52±0.48[ab]
P3	0.02±0.0	1.08±0.44	9.93±0.44[b]
P4	0.02±0.0	1.18±0.18	10.19±0.18[b]

From Table 2 it can be seen that the highest daily growth rate found in treatment P4 (100% freshwater snail meal and 0% fish meal) as 10.19%. In this research can be seen that increases of growth begins to occur in treatment P2 (50% of freshwater snail meal, 50% fish meal), this indicates that the Baung larvae were able to utilize pasta feed properly so as to spur the larvae's growth. Hicking in Silfia (2010) states that the daily growth rate affected by temperature, food, fish age and nutrient substances. One of the most important feed nutrients are protein, pasta feed protein greatly influences the growth of larvae. When the availability of protein in feed is not sufficient then the larvae growth will be hampered, because proteins in the body are utilized to maintain the body's tissues which is more important.

According to Hasnelli (2003) the daily growth rate differences caused by the different utilization of feed at a time when the fish are feeding the paste, because the growing age of fish then utilization of feed the pasta would be better along with the completeness of the functions of the digestive system and organs which have been perfectly and fish have been able to manipulate food with digestive enzymes that are formed as well as adult fish.

Absolute growth length

The research results obtained that utilization of freshwater snail meal as a source of fish feed on pasta gives long absolute growth rates of larva that differently marked ($p < 0.05$). The absolute growth length rate of larvae fed with paste with the freshwater snail meal as protein source delivers the lowest result : P0 (3.10 cm) and P1 (was 3.20 cm) differed markedly with treatment P2 (3.70 cm), P3 (4.00 cm), P4 (4.00%), as noted in Table 3.

Table 3. Absolute length growth of Baung larvae on average

Treatment	Avarage initial length (cm)	Average of final length (cm)	Average of absolute length growth (cm)
P0	1.00±0.0	4.10±0.26	3.10±0.26[a]

P1	1.00±0.0	4.20±0.67	3.20±0.35[a]
P2	1.00±0.0	4.70±0.26	3.70±0.26[b]
P3	1.00±0.0	5.00±0.25	4.00±0.25[b]
P4	1.00±0.0	5.00±0.05	4.00±0.05[b]

Description: different superscript letters on the same column shows the differently marked between treatment

Fraom Table 3 it can be seen that the absolute length growth of Baung larvae increased in treatment P2 (50% freshwater snail meal and 50% fish meal). This is due to the pasta feed on P4 has protein levels have 26.98% higher than other treatments, in addition also has a more specific scents that stimulate appetite and favored of larvae, their texture is more solid so it has longer durability in the water (water stability), gives chances for the larvae to exploit it.

According to Wilson in Boer (2009) protein needs to feed the growth of larvae ranging between 25-40% and wil be absorbted in the form of amino acids. Meanwhile, according to Suryaningsih (2010) that the quality of the feed is not only seen from the nutritional value they contain but also on physical properties such as solubility, digestivity, durability, texture, color, smell, taste and nutrients that contained. Afrianto and Liviawaty (2005) states five benchmark that can be used in the selection of a good quality artificial feed that are the nutrient content, size, water stability, the appearance of the surface (texture) and aroma.

If this research results compared with research from Nusirhan (2009) whom use of protein source with a paste of squid obtained absolute weight growth of 1.37 g and a length of 8 cm. Bbut in this study the best results in the treatment P4 of 1.16 g is lower if compared to the results of Nursihan (2009), this is caused by the protein content of the squid is higher than freshwater snail meal of 39.49%. When compared with the results of Anniversary (2013) using mixed paste feed of *Tubifex* sp and chicken intestine retrieved the absolute weight growth of 0.70 g and absolute length growth of 2.93 cm. The results obtained in this study is higher, this is due to the treatment P4 contains of 42.74%, while levels of protein on Anniversary's is 13.71%.

Absolute weight growth

The research resulted that utilization of freshwater snail meal as protein source on paste gives differently marked ($p < 0.05$) green catfish absolute weight growth. The absolute weight growth rate of larvae fed paste with freshwater snail meal as the protein

source delivers the lowest result : P0 (0.63 g) and P1 (0.68 g) differ markedly by treatment P3 (1.06 g), P4 (1.16 g), as indicated in table 3.

Table 3. Absolute weight growth of Baung larvae on average

Treatment	Avarage of initial weight (g)	Average of final weight (g)	Average of absolute weight growth (g)
P0	0.02±0.0	0.65±0.09	0.63±0.09[a]
P1	0.02±0.0	0.70±0.17	0.68±0.17[a]
P2	0.02±0.0	0.91±0.17	0.89±0.17[ab]
P3	0.02±0.0	1.08±0.18	1.06±0.18[b]
P4	0.02±0.0	1.18±0.08	1.16±0.08[b]

Description: different superscript letters on the same column shows the differently marked between treatment

The increasing growth of larvae due to the nutrients content contained in the feed. One of the nutrient that plays an important role in the growth is protein. Satisfy protein needs on fish larvae Baung will accelerate the pace of growth, since the protein is the formation of cells and plays an important role in the production of the enzyme (Steffens, 1989).

Pasta feed in P4 have high durability in water which is good because the feed is more smooth and creamy and compact so that the feed is not easily destroyed. The lower the resistance of the feed in the water then the faster feed solub in the water. Solubility of feed makes the nutrient dissolves. As a result the feed can not entirely consumed by the larvae. Thus causing the low growth of larvae, and this happens on the treatment of P0, P1 and P2 with the amount of the freshwater snail meal percentages is under 50%.

Lovell (1989) states that the growth speed depends on the amount of feed given, space, temperature, water depth and other factors. These foods utilized by fish is first used to nourish the body and replacing damaged body's organ after that the rest is used for growth.

Fish-increasing weights added in line with the increase of fish's age which influencing the formation and development of the digestive system and tract. De Silva and Anderson (1995) stated that the shape and size of artificial feed needs to be adjusted to the feeding habits and the size of the fish's mouth, so that fish can reach optimal growth. Boer and Adelina (2008) states that the amount of feed consumed by fish was strongly influenced by type or size, the condition of the stomach and the environmental conditions. With the best treatment found in P4 then, it can be stated that the freshwater snail meal could replace fish meal as protein source feed mainly in the form of pasta feed for green catfish

larval rearing. If compared with fish meal, freshwater snail meal has a more specific aroma and texture that is not easily destroyed and dissolves in the water. Based on the observations, the fish tend to that kind of feed, so that fish could consume more feed and generate good growth.

Survival rate

The research results obtained that utilization of freshwater snail meal as a source of protein in paste feed gives a real influence the Baung larvae survival ($p < 0.05$). The absolute weights growth rate of Baung larvae fed with paste with the freshwater snail meal as protein source delivers the lowest : P0 (58%) and the highest in P4 (69%), and does not differ markedly between the treatment as noted in table 4

Table 4. Average of Baung survival rate on each treatment for 40-day rearing

Treatment	Average of survival rate (%)
P0	58.00 ±12.05[a]
P1	62.00± 8.54[a]
P2	75.00±1.73[a]
P3	69.00± 8.50[a]
P4	69.00± 3.51[a]

Table 4 it can be seen that high larvae survival rate in the treatment P2 is caused by several factors such as good water quality and feeding time so that the larvae can escape from cannibalism. Whereas the low level of survival rate in treatment P0 can be caused by several factors such as capability in competition with the environment, adjustment in food handling and processing at the time of the measurement of the weight and length of the larva.

Tang (2000) states that the larvae need to adapt to the environment and natural feed on the outside due to the ability to prey on and digest the food has not been developed due to enzyme haven't been producing perfectly. Next Nicolsky (1963) states there are several factors that affect the occurrence of mortality i.e. internal factor such as age and ability to adapt with the environment. The next factor is water quality, external competition in getting food, population density, fish diseases, as well as other biological properties associated with life cycle, handling, and capturing. In addition, optimal utilization of feed provided is one of the things that cause high or low levels of survival rate, because every

individual need food for lively, moving, repairing damaged cells, and grow and develop so that the optimal utilization of the feed will also support the high survival rate.

Water quality

The temperature of the water during the study ranged from 24-28^{0}C, where the lowest water temperature reaches 24^{0}C. It caused by rain is falling at the same time the research is taking place so that the temperature down, but the condition of the larvae remain good. According to Lovell (1988) a good temperature for the growth of catfish ranging between 26-32^0 C. The pH range for research between 5-6, this pH range still shows a normal value for catfish and can support larvae life which according to Boyd (1982) the pH range which is good for the life of fish between 5.4 – 7.5.

DO Range during research is 3.01 – 4.70 mg/l. Dissolved oxygen content is good for the growth of green catfish larval. The oxygen supply is derived from system aeration at the aquarium. According to the Kordi and Baso (2005) good range DO for the life of the larvae is between 3 – 4 mg/l.

The levels of ammonia during the study ranged 0.8599 – 0.0012 mg/l, which is still good for the maintenance of the larvae. According to Boyd (1979) the levels of ammonia that is safe for fish and aquatic organism is less than 1 mg/l. Next Zonneveld *et al* (1991) states that as long as the content of ammonia should not exceed 3 mg/l, it is still safe for the life of fish and not disrupt its growth.

Table 5. Water quality in rearing media

Conclusion

Addition of freshwater snail meal on pasta feed provide highest daily growth rate, length and weight growth and the highest survival rate. Pasta feed with the composition of 100% freshwater snail meal and 0% fish meal can be used to enhance the growth and survival of green catfish larvae started in larvae was eight days.

Acknowledgement

Thank you submitted to the Directorate of Research and Outreach, Department of Education and Culture of INDONESIA who has funded the research through The National Strategic research in 2012 – 2013.

REFERENCE

Annyversary, F. Batubara. Pengaruh Sumber Bahan Pakan Pasta Yang Berbeda Terhadap Pertumbuhan Dan Kelulushidupan Larva Ikan Selais (*Ompok Rhadinurus* Ng). Skripsi Fakultas Perikanan dan Ilmu Kelautan. Universitas Riau. Pekanbaru. 74 hal (Tidak Diterbitkan).

Afrianto, E. dan Liviawaty, E., 2005. Pakan Ikan. Kanisius. Yogyakarta. 148 hal.

Afrianto, E. dan Liviawaty, E., 1992. Pengendalian Hama dan Penyakit Ikan. Kanisius. Yogyakarta. 89 hal.

Alawi, H, M. Ahmad, C.P. Pulungan dan Rusliadi. 1990. Beberapa Aspek Biologi Ikan Baung Yang Tertangkap Disekitar Parairan Teratak Buluh Sungai Kampar, Terubuk XVIII; (52) hal. 34-37.

Boer, I dan Adelina., 2005. Ilmu Nutrisi dan Pakan Ikan. Unri Press. Pekanbaru.

Boyd, C.E., 1982. Water Quality Management in Fish Pond Culture Research and Developtmen. Series No. 22. International Centre for Aquaculture, Aquaculture Experiment Station. Auburn University, Auburn. 300p.

De Silva, S. and Anderson, T., 1995. Fish Nutrien in Aquaculture, Chapman an Hall. Malaysia. p: 143-150.

Effendie, M.I. 1979. Metode Biologi Perikanan. Yayasan Dwi Sri. Bogor. 112 hal.

Effendie, M. I. Biologi Perikanan. Edisi Revisi. Yayasan Pustaka Nusatama. Yogyakarta. 163 hal.

Hasnelli. 2003. Pengaruh Pemberian Pakan Pasta Yang Berbeda Terhadap Pertumbuhan Dan Kelulushidupan Larva Ikan Baung (*Mystus nemurus* CV). Skripsi Fakultas Perikanan dan Ilmu Kelautan. Universitas Riau. Pekanbaru. 54 hal (Tidak Diterbitkan).

Halver, E.J., 1989. Fish Nutrition Academic Press Inc. London. 798 p.

Kottelat, M., A.J. Whitten, S.N. Kartikasari and S. Wirjoatmodjo (1993). Freshwater fishes of Western Indonesia and Sulawesi. *Periplus Editions, Hong Kong. 221 p.*Lieberman, E. 1995. A Guide to the Application of Endokrine Techniques in Aquaculture Argent Laboratories Press. 40 p.

Lesmana , D.S dan Dermawan, I. 2002. Kualitas Air Untuk Ikan Hias Air Tawar. Penebar Swadaya. Jakarta. 80 hal.

Lovell, R. T. 1988. Fish Feed and Nutrition Feed Cost Can Reduced in Catfish Production. Aquaculture Magazine. Edition Sep-Okt / 83. P 31-33.

_____. 1989. Nutrition and Feeding of Fish.. New York. P 239

Nusirhan, T. S. E. 2009. Pengaruh Jenis Bahan Pakan Pasta Yang Berbeda Terhadap Pertumbuhan Dan Kelulushidupan Larva Ikan Selais (*Ompok hypopthalmus*). Skripsi Fakultas Perikanan Dan Ilmu Kelautan. Universitas Riau. Pekanbaru. 64 hal (Tidak Diterbitkan).

National Research Council (NRC). 1993. Nutrient Requitment Of Fish. National Academy Of Science Washington DC. 114 p.

Steffens, W. 1989. Principle of fish Nutrition. Market Croos House, Cooper Street, England. 378 p.

Steel, R.G.d and J.H. Torrie. 1993. **Principles and Procedure of Statistics**. Second Ed. McGrawhill Inc.

Tang. U,M. 2002. Pengetahuan Bahan dan Gizi Pakan. Unri Press. Pekanbaru. 72 hal.

Tang, U.M. 2000. Kajian Biologi, Pakan dan Lingkungan pada Awal daur Hidup Ikan Baung. Disertasi Program Pasca Sarjana IPB. Bogor.

Wardoyo, S. T. H. 1981. Kriteria Kualitas Air Untuk Keperluan Pertanian dan Perikanan. PPLH-PUSDI-PLS. Institut Pertanian Bogor. Bogor. 27 hal. (Tidak diterbitkan).

Zonneveld, N., E. A. Huisman dan J. H. Boon. 1991. Prinsip-Prinsip Budidaya Ikan. PT. Gramedia Pustaka Utama. Jakarta. 318 hal.