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WHEAT CORNCOB AS THE REPLACEMENT OF BRAN IN ENVIRONMENTALLY FRIENDLY FISH FEED FORMULATION

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ABSTRACT

Increased business development of aquaculture will raise the need of production facilities; one of the examples is the provision of feed. In recent years, the cost requirements for fish feed is quite high, reaching 60% of total operating costs of business. It is due to the reason that all the raw materials are imported. Bran is one component of ingredients in animal feed formulations, both for forage fish, poultry, or large livestock (cattle, horses, pigs, etc.). Furthermore, the needs of the bran will also be limited. This limitation could also be caused by the often inaccurate farmers planting seasons, one of which is caused by climatic conditions which are difficult to predict lately. To overcome it, there should be a breakthrough, namely by making flour from corncobs. The corncob flour is added to the feed formulation: 13,7%; 14,7%; 15,7%; 16,7%; 17,7% and 18,17%. This study aims to obtain necessary corncob flour in feed formulation for the growth of Nila fish. Tests will be evaluated in this study, include: absolute weight gain of tested fish, daily growth rate, feed efficiency, feed conversion, retention of fat and retention of protein. Absolute weight gain, the best feed conversion and efficiency are produced by feed containing corncob flour by 17,7%.

Keywords: Nila fish, environmentally friendly fish feed, wheat corncob

1. INTRODUCTION

The development of aquaculture, such as carnivore, omnivore and herbivore fish, could be implemented if the aspect of food for the three fish species are known or controlled.With the data or update information from the nutritional needs, proper feed formulation can be made. Food that is eaten will first be used to nourish the body and replacement of damaged tissue, then the excess of the feed will be used for growth and reproduction.[1]

Nutritional that needs to keep in mind include: proteins, fats, carbohydrates, vitamins and minerals. Protein is a nutrient that is needed for body maintenance, network building, replacement of damaged tissue as well as the addition of body protein in the growth process.[2][3] In intensive farming activities, the largest production cost is the cost for the procurement of feed, because all the raw materials are still imported fish feed. Bran is one component of an ingredient in animal feed formulations, both for forage fish, poultry and large livestock [cattle, horses, pigs and so forth][4][5]. By changing the cropping pattern of rice due to climatic influences have brought changes to the availability of fish feed for farmers. This is because one of the ingredients of fish feed formulations is bran[6]. As the result of the irregular cropping

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pattern, the need for raw materials formulations bran fish feed will also be difficult to fulfill[7]. Therefore, it needs to look for a solution, one source sufficient feedstock available for farmers is a corncob. Furthermore, by using the pattern of cropping with crops (maize), the limited availability of rice bran as raw material for fish feed formulations can be overcomed by making flour from corncobs[8][9][10].

Corncobs are more local (endogenous)[11]. The availability of corncobs in the farming community is quite high, depending on its territory, and is still not widely used, while rice bran should be imported[12][13]. This is one of the causes of the undeveloped fish farming because it depends on the imported feed ingredients, causing higher prices of fish feed. While the nutritional content of the corncob flour [TTJ] is also complete (protein, fat, carbohydrates, vitamins and minerals)[14]. The protein content of rice bran and TTJ is not much different, where TTJ nutrient content is as follows: 11.38% protein, 5.39% fat, BETN 37.78%, 21.09% fiber, ash 8.30% and water 16 , 06% (IPB Fish Nutrition Laboratory, 2012). Therefore, if the feed has a good nutritional value, it can accelerate the rate of growth for these substances will be used to produce energy cells to replace damaged body[15]. Nutrients needed are protein, fat, carbohydrates, vitamins, minerals (Handajani and Widodo, 2010). These are consistent with the results of research of Ahmad and Tawwab (2010), that generally fish require feed with protein content of 20-60%, while the optimum is between 30-60%[16][17].

To increase the income of fish farmers, therefore, the fish feed with raw, cheap and available materials require bigger attention. One of the raw materials of vegetable protein that could donate the equivalent of fine bran is TTJ[18]. Furthermore,a research on substitution TTJ as a substitute for bran in feed formulation for fish growth is needed. This study aims to obtain necessary TTJ in feed formulation for the growth of the fish Tilapia [Oreochromis niloticus][19][20].

2. RESEARCH METHODS

Time and Location of Research

The study was conducted on May and August 2016. The study was conducted in the Wet Laboratory of Aquaculture Department of the Faculty of Agriculture, University of Professor Dr. Hazairin, SH Bengkulu.

Research Procedure

The fish used are namely Tilapia, in Indonesian language, they are called *Nila fish* [Oreochromis niloticus] with weights between 1.80 to 2.60 g per tail. The experiments were performed using a plastic box with the size of 40 x 30 x 30 cm filled with water as much as 24 L. Fish incorporated with stocking density of 10 fish per box. Adaptation process for both fish feed and the environment were conducted over 10 days. During the adaptation period, the fish were fed from the feed which was artificially made. Before the fish fed in accordance with the treatment, first, fish were fasted for three days in order to minimize the effect of previous feeding, so that the effect occurs against the test parameters are believed to actually originate from

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the feed treatment. During the maintenance, fish were fed three times a day, i.e. at 08 am, 12 pm at noon and 16 pm, and the fish were fed until full condition. The research was conducted for 60 days, every 15 days was measured weight and length of the test fish. While the measurement of physical and chemical properties of water, such as pH, and dissolved oxygen were conducted three times during the study. During the study, the water quality media for tested fish shoukd be in optimal conditions, as to support the growth of the tested fish. Substitution of water from each box done in the morning before the tested fish were fed, as many as approximately 75%. The water changes process was conducted by vacuuming the impurities in each box. Test feed composition is presented in Table 1.

Table 1. Fish Feed Composition of Nila Fish

Materials	**Flour Composition of Corncob Fish Feed [%]**					
	13,7	**14,7**	**15,7**	**16,7**	**17,7**	**18,7**
Fish Flour	65,23	65,23	65,23	65,23	65,23	65,23
Corncob Flour	13,70	14,70	15,70	16,70	17,70	18,70
Wheat Flour	10,00	10,00	10,00	10,00	10,00	10,00
Corn Oil	4,69	4,69	4,69	4,69	4,69	4,69
Mixed Vitamin	2,15	2,15	2,15	1,15	1,15	1,15
Mixed Mineral	2,13	1,63	1,13	1,13	0,63	0,13
CMC	2,10	1,60	1,10	1,10	0,60	0,10
Total	**100**	**100**	**100**	**100**	**100**	**100**

Research Design

This research used experimental research design, using a complete randomized experimental design. The experiment consisted of six treatments with a content type of feed corncob meal in feed formulation of 13.7%; 14.7%; 15.7%; 16.7%; 17.7% and 18.7%. Each treatment was repeated four times, in order to obtain 24 units of container experiment.

Parameter Test

Test parameters had been evaluated in this study, included absolute weight gain of tested fish, the final weight of the tested fish minused with initial weight of tested fish, and feed efficiency, which is the number the amount of feed eaten by fish expressed as a percent, while feed conversion, i.e. the large number of feed eaten by the fish to be meated or fish with another definition, i.e. one kilogram of feed given to be able to produce one kilogram of tested fish (Yulfiperius, 2014).

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Data Analysis

Furthermore, all data obtained from the parameters of the observations in this study were tabulated, then analysis of variance and a difference between treatments had been tested further by using Duncant Multiple Range Test (Steel and Torrie, 1989), as well as to see the correct addition of corncob flour in fish feed formulations the test polynomials was also used. Data were processed using SPSS version 18.

3. RESULTS AND DISCUSSION

Result

The results of the test fish maintenance for 60 days by feeding with corncob flour by 13.7; 14.7; 15.7; 16.7; 17.7 and 18.7% in feed indicated that there were differences in biological conditions of the tested fish [Table 2].

Table2. The Absolute Weight Growth [AWG], Feed Eficiency [FE] and Feed Conversion [FC]

Parameter	Composition of Corncob Feed [%]					
	13,7	**14,7**	**15,7**	**16,7**	**17,7**	**18,7**
AWG [g]	$1,68^{a}$	$1,96^{ab}$	$2,12^{bc}$	$2,98^{de}$	$3,15^{de}$	$2,73^{cd}$
FE [%]	$13,8^{a}$	$17,9^{b}$	$19,2^{bc}$	$29,7^{d}$	$32,1^{d}$	$24,03^{e}$
FC	$14,3^{a}$	$8,3^{b}$	$7,9^{bc}$	$5,0^{d}$	$4,0^{e}$	$7,3^{c}$

Source: *Rahmadika, R [2016]*

Note: Numbers followed by similar supercript letters in similar line shows no differences [P>0.05]

Discussion

In the table above, it shows that the difference of the addition of corncob flour in Tilapia fish (Nila fish) feed formulation provides absolute weight growth, feed efficiency and feed conversion that shows significantly real among treatment [P <0.05]. Tilapia growth by corncob flour in feed formulations different from the 17.7% growth in the absolute weight of fish fed corncob flour by 13.7; 14.7; 15.7; 16.7 and 18.7%.

Fish given corncob flour in feed formulation by 13.7% responded absolute lowest weight, namely 1.68 gram. Furthermore, respectively followed by a corncob meal in feed formulation of 14.7; 15.7; 18.7 and 16.7%, which was respectively 1,96; 2.12; 2.73 and 2.98 gram. In the range of 13.7 to 18.7% the given corncob flour in feed formulation provides volumetric response to the absolute weight gain [Figure 1], following equation Y = 0,0604x3 + 2,8722x2 - 44,948x +233.65; meaning that the average weight gain increased with increasing addition of fish meal in feed corncobs until it reached a maximum value of 3.15 gram on the addition of corncobs flour

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of17.7% and this is shown by the R^2 value of 0.96, after that the weight gain of the fish would decrease. This was due to the fish were not able to utilize the feed with the addition of too muchcorncob flour in feed formulations. Effendi [1997] in Yulfiperius [2006] states that growth occurs when there is excess inputs of energy and amino acids derived from the feed. Furthermore, Lovell [1989] in Yulfiperius [2006] suggested that the energy requirements for maintenance must first be met before growth occurs.

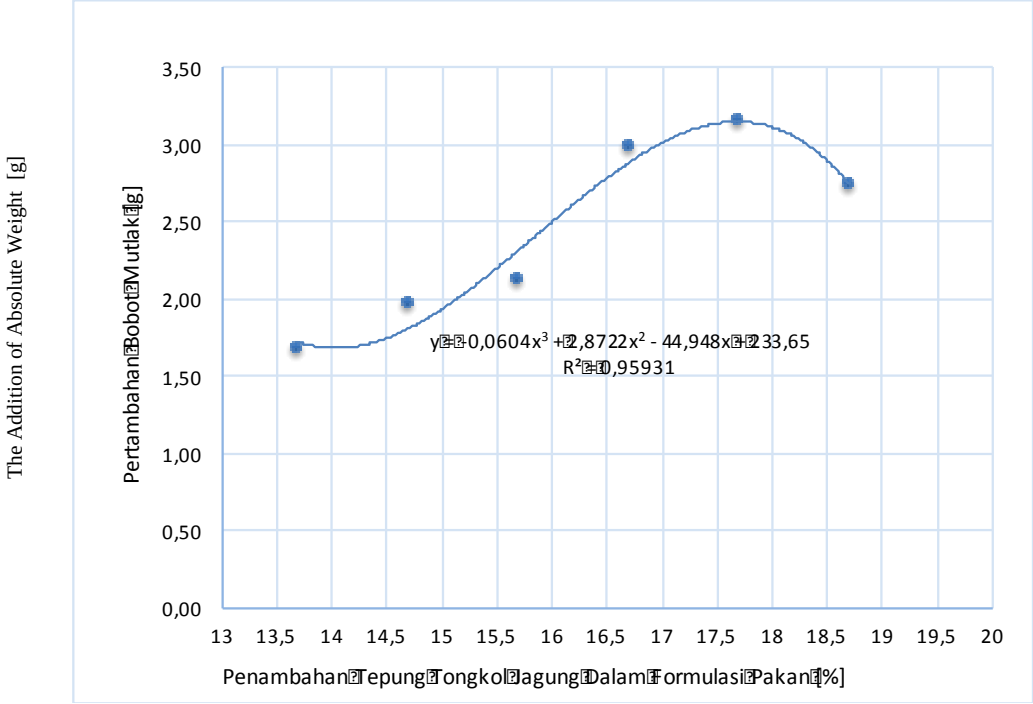

Figure1.The Additon of Absolute Weight Gain of Nila Fish during the Research

Feed efficiency is directly related to the absolute weight gain and feed intake. The higher the growth rate at the same feed intake, the higher then the feed efficiency. Based on the analysis of variance, it showed that the addition of feed with corncobs different value feed efficiency significantly different [P <0.05]. The highest feed efficiency was obtained at treatment cob adding flour as much as 17.7% in feed formulation, namely 32.1%, and then successively followed by the addition of 16.7% on the cob flour; 18.7%; 15.7%; 14.7% and 13.7%, amounting to 29.7%; 24.03%, 19.2%; 17.9% and 13.8%.

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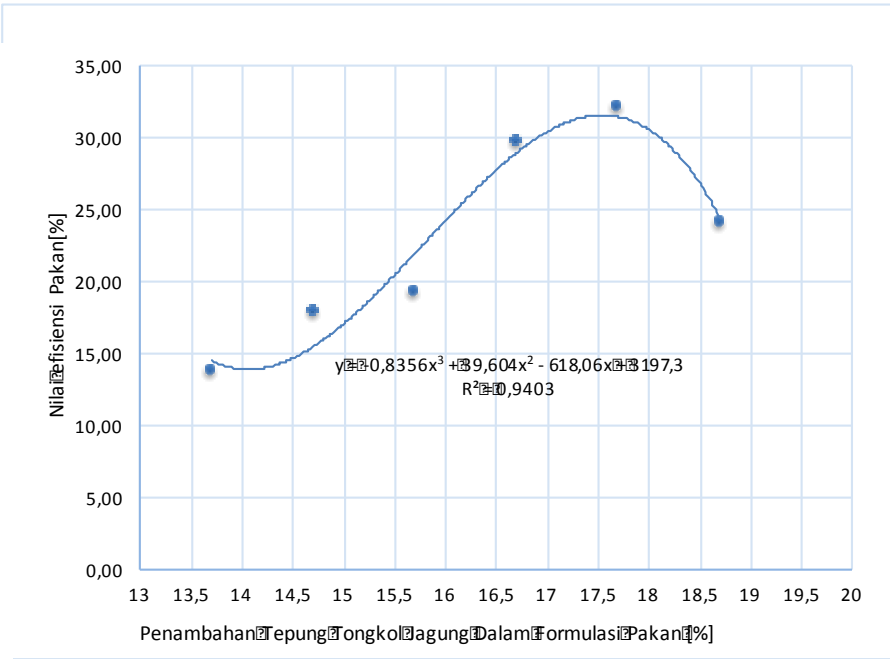
From the analysis of orthogonal polynomials, it was obtained that the range of the addition of corncob flour in feed formulation between 13.7 to 18.7% responded to the volumetric feed efficiency following the equation Y = -0,8356x3 + 39,604x2 - 618,06x +3197.3; which means that the feed efficiency increases with the increasing addition of flour in the feed corncobs until it reaches a maximum value of 32.1% on the addition of flour of corncobs in the feed was 17.7%; after that the value of efficiency deteriorates eventhough the addition of flour of corncobs in the feed increased, while the value R^2 is of 0.94 [Figure 2].



The Addition of Corncob flour in Feed Formulation [%]

Figure2. Efficiency Value of Nila Fish Feed

The high value of efficiency is in line with the low value of the feed conversion and weight gain increased fish. Feed conversion is the ratio of the number of kilograms of feed that can be converted into kilograms of meat [Yulfiperius, 2014]. Feed conversion is directly related to the absolute weight gain and feed intake. The higher the growth rate at the same feed intake, feed conversion is getting lower. Based on the analysis of variance, it showed that the addition of starch feed with corn cobs different value feed conversion were significantly different [P <0.05]. Obtained at the lowest feed conversion treatment cob adding flour as much as 17.7% in feed formulation, that is equal to 4.0., The next in succession followed by the addition of 16.7% on the cob flour; 18.7%; 15.7%; 14.7% and 13.7%, that is 5.0; 7.3; 7.9; 8.3 and 14.3. From the analysis of orthogonal polynomials, it was obtained that the range of the addition of corncob flour in feed formulation between 13.7 to 18.7% responded to the volumetric feed conversion follows the equation Y = 0,062x3 -

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2,2275x2 + 21,563x - 22.98. Feed conversion means smaller with increasing addition of flour in the feed corncobs until it reaches a minimum value of 4 on the addition of flour of corncobs in the feed was 17.7%., after the conversion value increases with increasing addition of flour of corn cobs in Tilapia fish feed formulations , while the R2 value is 0.93 [Figure 3].

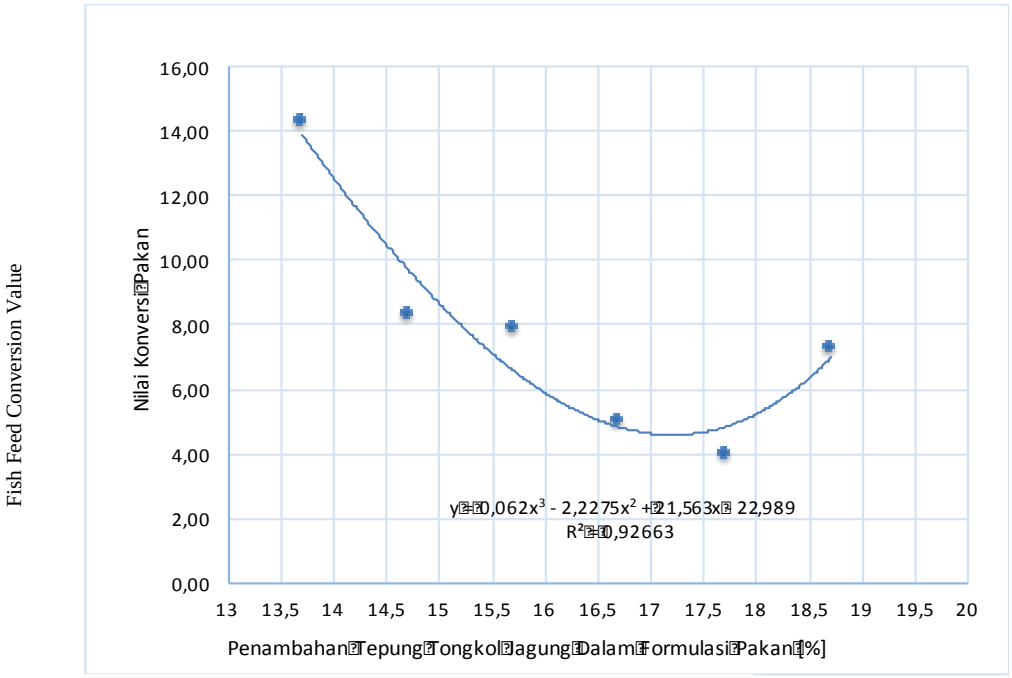

Figure 3. Conversion Value of Nila Fish Feed

4. CONCLUSIONS AND SUGGESTIONS

Conclusions

The addition process of flour corncobs of 17.7% in Nila fish feed formulations provides the best results for weight gain, feed conversion and efficiency of Nila Fish.

Suggestion

Field tests need to be done before the use of feed fish farmers disseminated to farmers.

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REFERENCES

[1] M. Ahmad, M.A. & Tawwab, “The Use of Caraway Seed Meal as a Feed Additive in Fish Diets: Growth Performance, Feed Utilization, and Whole-body Composition of Nile Tilapia, Oreochromis Niloticus (L.) fingerlings. J. Aquaculture, Vol 314, Issue 1–4, Pp 110–114.,” 2010.

[2] D. P. & A. Anggraeny, Y.N., U. Umiyasih, “Potensi bahan pakan inkonvensional asal limbah pertanian dan perkebunan di beberapa kabupaten di Jawa Timur. Pros. Seminar Nasional Teknologi Peternakan dan Veteriner 2006. Bogor, 5 – 6 September 2006. Puslitbang Peternakan, Bogor. pp. 891 – 899.,” 2006.

[3] A. & S. S.-D. Akpapunam, “Jack bean (Canavalia ensiformis): Nutrition related aspects and needed nutrition research. Plant Foods for Human Nutrition. Volume 50, Number 2: 93-99.,” 1997.

[4] J. Fickler, “Fish meal, high protein does not stand for high quality. Feed International, 23 (7):20-22.,” 2002.

[5] H. & Widodo, “Nutrisi Ikan. UMM Press. Malang.,” 2010.

[6] &Garcia B. Hernandez MD, Egea MA, Rueda FM, Aguado F, Martinez FJ, “Effect of commercial diets with P/E ratios on shorpsnout seabream (Diplodus puntazzo) growth and nutrient utilization. Aquaculture 195: 321-329.,” 2001.

[7] U. & M. Kamaruddin, “Pemanfaatan keong mas (Pomacea sp) sebagaisubsitusi tepung ikan dalam dalam pakan ikan. Warta Penelitian Perikanan Indonesia. Badan Riset Kelautan dan Perikanan: 13-15.,” 2005.

[8] &Pahn V. Lemos D, “Energy partitioning into growth, respiration, excretion and exuvia during larval development of the shrimp Farfantepeneaeus paulensis. Aquaculture 199: 131-143.,” 2001.

[9] R. Rahmadika, “Pemberian Tepung Tongkol Jagung Yang Berbeda Untuk Pertumbuhan Ikan Nila [Oreochromis niloticus]. Skripsi, Universitas Prof. Dr. Hazairin, SH Bengkulu.,” 2016.

[10] E. Resita, “Produksi Selo-oligosakarida Dari Fraksi Selulosa Tongkol Jagung oleh Selulase Trichoderma viride. Skripsi. Institut Pertanian Bogor.,” 2006.

[11] &Ray A. Satpathy B, Mukherjee BD, “Effect of dietary protein and lipid levels on growth, fed conversion and body composition in rohu, Labeo rohita (Hamilton), fingerling. Aqua Nutr. 9: 17-24.,” 2003.

[12] I. Setyawati, “Produksi Dan Karakterisasi Xilanase Mikroba Yang Diisolasi Dari Tongkol Jagung. Skripsi. Institut Pertanian Bogor.,” 2006.

[13] J. H. Steel, R.G.D & Torrie, “Prinsip dan Prosedur Statistika. (Terjemahan)) B. Soemantri. PT. Gramedia. Jakarta.,” 1989.

[14] Nose T. Takeuchi, T., Watanabe, T., Ogino, C., Saito, M., Nishimura, K., “Effectsof low protein high calorie and deletion of trace elements from a fish meal diet on reproduction of rainbow

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trout. Bull. Jap. Soc. Sci. Fish. 47 (5) : 645 – 654.," 1981.

[15] E. Tangendjaja, B &Wina, "Limbah Tanaman dan Produk Samping Industri Jagung untuk Pakan. Pros. Seminar Nasional Teknologi Peternakan dan Veteriner 2006. Bogor, 5 – 6 September 2006. Puslitbang Peternakan, Bogor. pp. 427 – 455.," 2007.

[16] N. . Umiyasih, U., Anggraeny, Y.N.,&Krishna, "Strategi Pakan Murah Untuk Pembesaran Sapi Po: Respon Sapi Po Jantan Muda Terhadap Ransum Yang Mengandung Tongkol Jagung Fermentasi. Pros. Seminar Nasional Teknologi Peternakan dan Veteriner 2006. Bogor, 5 – 6 September 2006. Puslitbang Peternakan, Bogor.," 2007.

[17] G. Viola, S., Ariel, Y.,&Zohar, "Animal protein free feeds for hybrid tilapia (Oreochromis niloticus) in intensive culture. Aquaculture, 75:115-125.," 1988.

[18] Yulfiperius, "Domestikasi dan Pengembangbiakan Dalam Upaya Pelestarian Ikan Lalawak (Barbodes sp). Disertasi, Institut Pertanian Bogor.," 2006.

[19] Yulfiperius, "Nutrisi Ikan. PT. Raja Grafindo Persada Jakarta. Cetakan ke-1.," 2014.

[20] J. Zonneveld, N., Huisman, EA., &Boon, "Prinsip-prinsip Budidaya Ikan. PT. Gramedia Pustaka Utama, Jakarta.," 1991.