GSJ: Volume 7, Issue 4, April 2019, Online: ISSN 2320-9186

www.globalscientificjournal.com

EFFECT OF ADDITIONAL NATURAL BINDER SEAWEED GRASS (Kappaphycus alvarazii) ON GROWTH PERFORMANCE OF SIAMESE CATFISH SEEDS (Pangasius hypophthalamus)

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ABSTRACT

This study aims to determine the effect of the addition of natural seaweed binder (*Kappaphycus alvarazii*) to the physical characteristics of feed and growth of Siamese catfish seeds. The research method was carried out experimentally using a Completely Randomized Design (CRD). This study used five treatments with three replications. The treatments used were treatment A (addition of 5% CMC binders) as a control, treatment B (addition of 5% *Kappaphycus alvarazii* seaweed binder), treatment C (addition of *Kappaphycus alvarazii* seaweed binder 7.5%), treatment D (addition of binders *Kappaphycus alvarazii* seaweed 10%), treatment E (addition of 12.5% *Kappaphycus alvarazii* seaweed binder). The parameters measured were daily growth rate, absolute weight, and survival rate. The effect of each treatment on parameters was analyzed using Analysis of Variance (ANOVA) and continued with Duncan's Multiple Distance Test if there were differences between treatments. The results of the research on the addition of seaweed binders gave a significantly different effect on the daily growth rate, but did not give a significant effect on absolute weight, and survival rate. The addition of 10% seaweed produces the highest growth rate of 1.25%, absolute weight and survival rate on the addition of seaweed 0% -12.5%, each ranging from 50.33 - 88.67 grams and 99 - 100%.

Keywords*:* Binder, *Kappaphycus alvarazii*, growth rate, Siamese catfish seeds

INTRODUCTION

Aquaculture has a strategic role in meeting national food needs, as population growth continues to increase significantly every year. One of the commodities of freshwater fish that has a very good prospect is catfish. Catfish cultivation is not difficult because it is a fish that is tolerant of low oxygen and is omnivorous and is an export commodity in several countries such as the European Union, Russia, Ukraine and for the Asian region namely China, Hong Kong and Egypt (Ministry of Maritime Affairs and Fisheries 2013). The Central Bureau of Statistics noted that the export value of catfish in 2017 was 5,321 tons and the value of national catfish production was 437,111 tons, up 28.91% from the previous year and in 2018 the target of catfish production was 28.31% or 604,587 tons (Ministry of Maritime Affairs and Fisheries 2018).

One important factor in aquaculture is feed. Feed consists of two types, namely natural food and artificial feed. Natural feed is food that is available in nature and artificial feed is a food made

based on certain formulations so that it can be adapted to the nutritional needs of fish. The quality and quantity of feed needs to be considered in supporting aquaculture. Feeds in catfish cultivation have chemical qualities, namely the nutrient content in feed that can meet the needs. One form of artificial feed is pellets. Pellets are feed made by compacting, compacted through a mechanical process. Pellets can be made in the form of clumps and small cylinders of different diameters, lengths, and levels of strength (Enshminger *et al.*, 1990 *in* Wikantiasi 2001). Therefore in the feed mixture there is a need for additional feed ingredients in the form of binders or adhesives.

Binders or adhesives are ingredients that are added to feed formulas which function to unite all raw materials to make feed. the use of adhesives will affect the quality of feed physically. Adhesive can be divided into two types, namely natural adhesive and artificial adhesive. An artificial adhesive that is often used is CMC (*Carboxy Methyl Cellulose*). But when viewed in terms of CMC prices it is considered less economical when used as an adhesive for fish feed because it is an imported raw material, therefore the use of natural adhesives is needed including tapioca flour (Syamsu, 2007) and seaweed flour (Saade & Aslamyah, 2009) with good adhesive potential. On the other hand natural adhesives use local raw materials so that they are easily available and affordable prices.

Seaweed group of red algae that can be used as an adhesive is one of them is *Kappaphycus alvarazii*. The gel properties possessed by seaweed have the potential as an adhesive material containing nutrients in the manufacture of pellet type dry feed (Saade *et al.*,2013). To determine the effect of additional feed ingredients for nutritive seaweed binders, it is necessary to examine the biological value of the growth of Siamese catfish seeds.

METHODOLOGY

Place and Time

This research was conducted at the Aquaculture Laboratory and the Ciparanje Land Fisheries Laboratory of the Faculty of Fisheries and Marine Sciences of the University of Padjadjaran which began in September 2018 to February 2019.

Materials and Research Methods

Fish used in this study were Siamese catfish with a length of 5 - 8 cm as many as 600 tails and each aquarium is filled with heads and 30 fish per aquarium.

The feed used is artificial feed with seaweed binders *Kappaphycus alvarazii* different, namely 5%, 7.5%, 10% and 12.5%.

The research method was carried out experimentally using a Completely Randomized Design (CRD). This study used five treatments with three replications in each treatment. The treatments given are as follows:

Treatment A : feed with CMC binders as much as 5% (Control)
Treatment B : feed with seaweed flour binders as much as 5%
Treatment C : feed with a binder of seaweed flour as much as 7.5%
Treatment D : feed with seaweed flour binders as much as 10%
Treatment E : feed with seaweed flour binders as much as 12.5%

Research Procedure for

Preparation of Tools and Materials

Preparation of research tools begins with cleaning the acurium and checking the pellet making equipment. Aquarium preparation is rinsed using water, then dried. Dry aquariums are labeled according to treatment and arranged at a designated location. Preparation of tools for making pellets is cleaned from the remains - dirt and checked the function of each part of the tool.

Preparation of research materials is by providing raw materials for natural seaweed binders which are dried seaweed and then transformed into flour by grinding until smooth. Preparation of other raw materials, namely bran, fish oil, premix and CMC is obtained commercially. Then made into artificial feed according to the prescribed formulation. Procurement of catfish seeds is then acclimatized for 2 days so that the fish adapt to the new environment.

Feed Making The test for

making the test feed was done by preparing feed formulations according to protein requirements of 30% (Ghufran 2004) and using binders according to CMC 5% treatment, Seaweed Flour 5%, 7.5%, 10%, and 20.5 %. Treatment feed composition can be seen in Table 3. The composition of the treated feed.

Table 1 Composition of Feed Treatment

Raw material for	Treatment				
	A (CMC 5%)	**B (Seaweed Flour 5%)**	**C (Seaweed Flour 7.5%)**	**D (Seaweed Flour 10%)**	**E (Seaweed Flour 12.5%)**
Fish Meal	20.54	20.67	19.30	19.85	16.67
Flour soybean meal	20.54	20.67	19.30	19.85	16.67
Wheat bran refined	50.92	50.66	50.90	47, 30	51.16
Premix	2	2	2	2	2
Fish Oil	1	1	1	1	1
Seaweed Flour	0	5	7.5	10	12.5
CMC	5	0	0	0	0
Total	**100**	**100**	**100**	**100**	**100**

Implementation of Research

Making feed is carried out through several processes, namely refining, mixing raw materials, printing, and drying. Smoothing aims to obtain a relatively finer and uniform size so that it will produce feed that is easy to digest and compact. Mixing raw materials starts from the least amount to the most amount, then stirs until homogeneous. Materials that have been mixed are given as much as 6% water stirring until it becomes a mixture. The dough is printed with a pellet forming machine and adjusted in size to the catfish mouth openings. The pellets that have been printed are then dried by drying or by using an oven.

Catfish seeds are kept for 30 days in an aquarium with a density of 30 fish / aquarium. The weight of catfish is weighed before stocking into the aquarium. Feeding is done 3 times a day The amount of feed given is 3%. Measuring the weight of catfish is done every 6 days to determine the development of daily weight of catfish. On the last day the maintenance was carried out observing the survival rate, daily growth rate, and absolute weight growth.

Research Parameters of Water Quality

The measured water quality parameters include oxygen solubility in water (DO), temperature and acidity (pH). Water quality measurement data is used as supporting data.

Survival

Survival (*survival rate*) is the number of biota that live at the end of a certain time (Effendie 1997). Calculation of the viability of using the formula:

$$\text{Survival} = \frac{Nt}{No.} \text{ x } 100\%$$

Description:

N_t: The number of larvae at the end of the study periodto-i

N_o: The number of larvae at baseline

Growth

a. Daily Growth

Daily growth rate calculations using formulas Effendi (1997):

$$\text{LPH} = \frac{LnWt - LnWo}{t} \text{ x } 100\%$$

Description:

LPH : Daily growth rate (%)

Wt : Fish weight at the end of the study (g)

Wo : Fish weight at the beginning of the study (g)

T : Research time (days)

b. Absolute Weight

Absolute weight growth is calculated using the formula Zonneveld *et al* (1991) as follows:

$$BM = Wt - Wo$$

Description:

BM : Absolute Weight (g)

Wt : Fish biomass at the end of the study (g)

Wo : Fish biomass at the beginning of the study (g)

Data Analysis The data obtained is then tabulated and analyzed using variance analysis (ANOVA) to determine the effect of each treatment. If there are differences between treatments then Duncan's multiple distance test is carried out with a confidence level of 95% (Gasperz 1991).

RESULTS AND DISCUSSION

Daily Growth Rate

Analysis of variance showed that the daily growth rate of Siamese catfish seeds fed with the addition of 5% CMC Binder (Control), seaweed 5%, 7.5%, 10% and 12.5% gave effect which is significantly different from the treatment.

Table 2. Average Daily Growth Rate

Treatment	Averageof LPH (%)
A (CMC Control 5%)	0.77 ± 0.0018 [a]
B (5% Seaweed Flour)	0.94 ± 0.0020 [ab]

C (Seaweed Flour 7.5%)	0.96 ± 0.0017 [ab]
D (10% Seaweed Flour)	1.25 ± 0,0003 [b]
E (Seaweed Flour 12.5%)	0.79 ± 0,0008 [a]

Description: Value followed by lowercase letters, the same shows no significant difference at the 95% confidence level.

The results showed the highest daily growth rate of catfish seeds produced by treatment D with a 10% seaweed natural binder of 1.25%, meaning that in one day the weight increase increased by 1.25%. The growth rate of Siamese catfish seeds fed with the addition of 10% natural seaweed binders resulted in significantly different growth (P> 0.05) higher than the control treatment (5% CMC binder) and treatment of natural binder addition 12.5 %. The treatment of feed with the addition of seaweed natural binders of 5% and 7.5%, each did not show a significant difference either by the treatment of the addition of 10% binders or by the control treatment (CMC 5%). The growth rate of Siamese catfish seeds with the addition of natural seaweed binders is 7.5% and 5% respectively 0.96% and 0.94%. While treatment E with the content of seaweed natural binder 12.5% by 0.79% and the lowest growth rate that tends to be treatment A (control) with a 5% CMC binder content of 0.77%.

The high value of the daily fish growth rate in treatment D is because the feed given has an optimal seaweed natural binder of 10%. This is because feed with the addition of seaweed binders has a texture that is not too hard so that it can be digested by fish and but can last quite a long time in water. The level of use of binders as an adhesive will affect the level of hardness in feed and if the fish feed is too hard it will inhibit the process of digestion of food which results in a decrease in the rate of fish growth. This is in line with the statement of Andriani *et al*. (2016) which states that food that is easily absorbed is food that has gone through a process of simplifying food both physically and chemically by the digestive system which is then circulated throughout the body through the circulatory system.

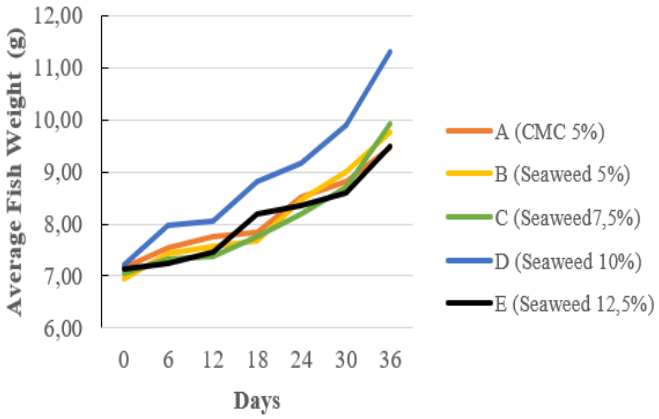

Figure 1. Graph for average Siamese catfish Weigth

Gainquality feed can be easily digested and produce good energy for fish. Treatment B and C have a lower daily growth rate than treatment D which has the highest daily growth rate. This is because in treatment B and C the level of adhesiveness between feed ingredients is not good so that when the feeding process in the cultivation media there are some foods that are easily dissolved in water. Dissolved feed on cultivation media cannot be used by catfish seeds, especially for the process of converting feed into energy for fish growth. The value of fish growth rate in treatment E was higher than treatment A (control) and lower than treatment B, D and D. This is because the feed in treatment E had a

higher level of violence among all treatments. The higher addition of natural seaweed binders is thought to increase pellet hardness (durability) and can result in food difficult to digest by the digestive tract in Siamese catfish stadia. According to NRC (2011) the energy contained in feed is first used by fish for basic metabolism, production of sexual organs, movements, replacement of damaged cells, and the rest is used for growth of the body. Siamese catfish seeds, the digestive tract is relatively simple so that the content of food substances and energy contained in the treatment of E feed (12.5% natural binder), cannot be utilized maximally for its growth.

Absolute Weight Absolute

growth is an increase in both the length and weight of fish at a certain age. According to Effendi (2004), absolute weight growth is the difference between the total body weight of the fish at the end of maintenance and the beginning of maintenance. The results showed that the absolute range of fish weight by giving natural seaweed flour feed was *Kappaphycus alvarazii* 48.00-88.67 grams.

Table 3. Absolute Weight Of Siamese Catfish Seeds

Treatment	Absolute Weight (g)
A (Control CMC 5%)	50.33 ± 16.15 [a]
B (Flour Seaweed 5%)	51.67 ± 15.95 [a]
C (Wheat Grass Sea 7.5%)	51.00 ± 26.21 [a]
D (10% Seaweed Flour)	88.67 ± 31.18 [a]
E (Seaweed Flour 12.5%)	48.00 ± 22.87 [a]

Description: Values followed by lowercase letters that show the same are not significantly different at the 95% confidence level.

The observations during the study of the addition of natural seaweed binders *Kappaphycus alvarazii* to feed Siamese catfish seeds during maintenance for 36 days gave an influence on the absolute weight of catfish seeds which showed that the feed with the addition of natural seaweed and CMC binders could be eaten and utilized by Siamese catfish seeds. Based on absolute weight observation data analyzed using variance analysis method states that between treatments of feeding with the addition of natural seaweed binders and CMC is not significantly different. this is because the feed given can be digested and utilized properly by the catfish seeds. Feed that can be properly digested by fish is food that has good quality. The level of resilience in the water and the optimal hardness of feed can maximize the utilization of feed by fish during feeding and can be well digested in the digestive system of fish. According to Detrik (2018) the feed given to fish must have high quality where the growth rate of fish will be hampered if the feed given is not suitable or has low quality.

Survival Rate

Survival rate is a calculation that is expressed as a percentage of live fish from the fish reared for certain maintenance in a container maintenance. Factors that affect the survival of fish include water quality, ability to adapt, availability of feed that is suitable for the needs of optimal fish and solids.

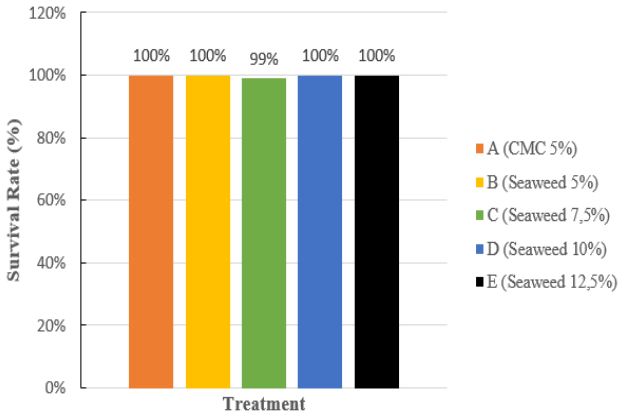

Figure 2. Graph of Siamese catfish Seed Survival

Based on Figure 2 the highest survival rate of catfish seeds is in treatment A, B, D and E of 100% and the lowest is found in treatment C of 99%. The results of the analysis of the variability of the survival of catfish seeds showed that feeding with natural seaweed binders in each treatment did not have a significant effect on the survival of catfish seeds.

Table 4. Survival Rate of Siamese Catfish Seeds

Treatment	Survival Rate (%)
A (CMC Control 5%)	100 ± 0,000 [a]
B (5% Seaweed Flour)	100 ± 0,000 [a]
C (7.5% Seaweed Flour)	99 ± 0 , 0192 [a]
D (10% Seaweed Flour)	100 ± 0,000 [a]
E (Seaweed Flour 12.5%)	100 ± 0,000 [a]

Description: Values followed by lowercase letters that are the same show no significant difference at the 95% confidence level.

The treatment of feeding with the addition of natural seaweed binders *Kappaphycus alvarazii* and CMC to the Siamese catfish seeds can be digested and does not provide an effect that can lead to death in fish. The survival rate of Siamese catfish seeds in this study can be said to be very good, ranging from 99% - 100%. A very high survival rate indicates a good response to the feed given and maintenance conditions that are still in good condition.

There was a death of fish in treatment C as many as 1 fish during the first week of maintenance. This death is allegedly due to fish still in the process of environmental adaptation and feed provided. The existence of environmental differences in this case external factors can put pressure on fish and cause fish stress. According to Effendi (2006) states that the impact of fish experiencing stress results in decreased fish immunity and even death in fish.

The treatment of feeding with the addition of natural seaweed binders *Kappaphycus alvarazii* and feeding with the addition of CMC binders on catfish seeds gave a good response to the survival rate. This proves that the feed treated with the addition of natural seaweed binders and CMC can meet the energy requirements for Siamese catfish seeds to survive. In line with the statement of Djunaidah (2004) which states that survival can be influenced by two factors namely abiotic factors which include food availability and quality of maintenance media, then biotic factors which include the age and ability of fish to adapt to the environment.

Water Quality Water

Quality is one of the important factors in fish farming activities. Water quality is measured to determine the

condition of the waters in fish culture media both physically and chemically. According to Effendi (2006) water quality is a physical and chemical factor of water that can affect the environment of fish culture media and indirectly can affect fish metabolism. Water quality measured during the study took place including temperature, dissolved oxygen (DO), and degree of acidity (pH).

Table 5. Water Quality Media of Siamese Catfish Seed Maintenance

Treatment	Parameter		
	Temperature(ºC)	DO (mg / L)	pH
A (CMC 5%)	28,1-30,2	6,3-6,7	6,71- 7,18
B (R. Sea 5%)	28.3-30.5	5.7-, 6.8	6.70- 7.10
C (R. Sea 7.5%)	28.4-30.3	6.1 -6.7	6.71 to 7.14
D (R. Sea 10%)	28.1-30.7	6.2-7.0	6.72 to 7.17
E (R. Sea 12.5%)	28.0-30.6	6.0-6.7	6.71 - 7.14
Tolerance limits	**27-30 ***	**> 3 ***	**6.50-8.50 ***

* National Standardization Agency SNI 7551: 2009

One of the parameters important in cultivation is temperature. Temperature is included in the water physics factors that need to be considered because it is closely related to the metabolic processes of fish. The temperature during fish maintenance for 36 days is in the range of values 28 - 30.7^{0}C. The temperature is still in a good category for the maintenance of catfish seeds based on the National Standardization Agency (2009). This is in line with the statement of Minggawati (2012) which states that good water temperature for cultivation ranges from 25 - 32^{0}C. Aliyah (2017) states that the optimal temperature of tropical waters for fish is 28 - 32^{0}C. The temperature will have an effect on fish growth and related metabolism. When there is a change in temperature in a waters will cause changes in the metabolic rate and the rate of consumption of feed, then affect the rate of growth of fish. At low temperatures fish metabolism will decrease so that appetite decreases and at high temperatures the metabolism of fish will increase. Based on Phuc (2015) at a low temperature of approximately 24^{0}C catfish will only consume half of the amount of feed given. This will have an impact on the rate of fish growth and the efficiency of feed utilization.

Based on the results of observations during the maintenance period the pH values obtained ranged from 6.70 - 7.18 (Table 7). This value is in the good category for the maintenance of catfish seeds. Based on the Indonesian National Standardization (2009), a good pH for the cultivation of Siamese catfish ranges from 6.5 to 8.5. according to Mahyudin (2010) pH conditions for the maintenance of Siamese catfish seeds range from 6 - 9. Sarimanah (2017) states that most freshwater fish will live well in a slightly acidic to neutral pH range. PH conditions are related to temperature conditions where when the temperature is high the fish will be more sensitive to changes in pH. In addition according to

Kordi (2010) pH conditions are closely related to the level of solubility of oxygen in water where if the pH is low or acidity is high then the dissolved oxygen content will decrease and when the pH is high or in an alkaline state the dissolved oxygen content will tend to be constant.

Dissolved oxygen (DO) or dissolved oxygen is a parameter that plays a very important role in a culture to support fish survival, metabolism and fish growth. Water movement in cultivation media will affect the level of oxygen solubility in the waters. On the other hand dissolved oxygen is a limiting factor for Scratch animals. The results of the observations during maintenance of DO values obtained ranged from 5.7 to 7.0 mg / L. The DO value is within the tolerance limit of catfish seeds and can be said to be very good based on the National Standardization Agency (2009). this is in line with Wahyudin (2010) which states that the oxygen range that supports fish farming activities is 3 - 7 mg / L. Good dissolved oxygen ranges from 3 - 7 mg / L, and optimally ranges from 5-6 mg / L (Ghufran 2005). This is in line with the Indonesian National Standardization (2009) which states that the DO value that is suitable for Siamese catfish cultivation is ≥ 3 mg / L. A good DO value indicates that the use of seaweed binders can help maintain water quality. Strong gel characteristics cause feed to have good stability in water so it is not easily soluble in water. in the study of Wulansari et al (2016) stated that the stability of feed with seaweed binders was 82.08% - 86.75%.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the research, the addition of *Kappaphycus alvarazii seaweed* to Siamese catfish feed can be concluded:

1. The addition of seaweed natural binders is 5%, 7.5% and 10% in the maintenance of Siamese catfish seeds, resulting in water quality namely temperature ranging from 28.0-30.7^0 C, DO 5.7-7.0 and pH 6.7-7.17, and according to the living conditions of Siamese catfish seeds, the
2. addition of 10% seaweed produces the highest growth rate of 1.25%. Absolute weight and survival of Siamese catfish seeds in the addition of 0% -12.5% seaweed ranged from 50.33 - 88.67 grams and 99-100% respectively.

Suggestion:

Giving additional feed ingredients for seaweed binder *Kappaphycus alvarazii* on feed catfish seed no more than 10% to obtain good growth performance.

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