Engineering Technology Of Fish Farming Floating Nets Cages On Polka Dot Grouper (Cromileptes Altivelis) Used Artificial Feed Enriched Phytase Enzyme

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Abstract. One solution is to utilize engineering technology cultivation floating cage net polka dot grouper (ducker grouper), which is given artificial feed enriched with phytase enzymes. The objectives of this study was to examine the use of technology engineering floating net on ducker grouper on artificial feed that is enriched with different dose phytase enzymes to accelerate growth and survival. The research method used ducker grouper fish size 15,5 ± 0,5 cm in the net cages unit (1 m x 1 m x 1 m), 250 fish per cage, using 12 cages. Each net- cages was made of polyethylens netting, mesh size 12.5 mm. with complete randomized design (CRD) 4 treatment and 3 replication were feed Artificial enriched of phytase enzyme with the doses of A (0 FTU • kg–1 diet), B (200 FTU • kg–1 diet), C (500 FTU • kg–1 diet), and D (800 FTU • kg–1 diet) phytase enzyme. Feed was given 2 times a day in the morning and afternoon with 5% biomass per day. Data includes the growth of absolute weight polka dot grouper, FCR, and survival rate analyzed variety and Test Tukey.The result of the research showed that the difference of artificial feeding enriched phytase enzyme significantly (P <0,05) to growth, food conversion ratio (FCR), survival rete of polka dot grouper. The best treatment at C (500 mg / kg of feed) increase growth of absolute weight of 128.75 g, 1.75 (FCR), and a survival rate of 93.5%.

Keyword: cage, floating net, polka dot grouper, artificial feed, phytase enzyme.

1. Introduction

The Marine waters as maritime waters, especially in Jepara Karimun islands have not been utilized optimally. One solution was using of engineering technology cultivation floating net cage on Polka Dot Grouper fish or Humpback Grouper (*Cromileptes altivelis*) was given artificial feed enriched used phytase enzyme that can accelerate the production of fishery industry maritime.

The general condition of Karimunjawa Islands is included in Jepara Regency of Central Java Province. Located west of the city of Jepara with a distance of 45 nautical miles (83 km). Geographically this area is located at 5º40 '-5º57' L.S and 110º4 '-110º40' BT. Karimunjawa Islands has an area of 107,225 hectares of 100.105 Ha of ocean and 7,120 Ha of land spread over 27 Islands [1][2], Of 7,120 ha of land if 10% opened for aquaculture far from coral reefs then 712 Ha used for ponds, especially fish ponds 5% Tiger Grouper or Humpback Grouper (using 356 Ha pond), then the

result per Ha 12,500 kg with size 250 g / price Rp.50.000,00 - so its value Rp.625.000.000,00 - with production cost Rp. 375,000,000.00, - still profit Rp. 250,000,000, - 3-month cycle of enlargement. It is a miracle that people on small islands whose livelihoods catch fish around the Karimunjawa Marine National Park can turn to Humpback Grouper culture with high economic value and eco-friendly cultivation technology.

Problems of fishmeal is also one of the most expensive and demanded ingredients and has become the main and most critical ingredient in aquafeed production. Because of the increasing cost and demand of fishmeal has encouraged feed manufacture to search for cheaper alternative protein sources using humpback grouper culture source as plant proteins. Fish nutritionists have tried to use less expensive plant protein sources to partially or totally replace fishmeal. Substitution with other ingredients, especially from plant origin, is likely to compromise nutrient balance and sometime fails to match the energy concentration achieved using fishmeal [1][3][4][5]. Plant protein sources contain high lipid and fiber and lack essential amino acids. Considering the increasing cost of fishmeal and doubt concerning its long-term availability much research has been carried out to find alternative protein sources as fishmeal substitutes. [6] reported that for aquaculture to make a net contribution to human supplies, the present use of fishmeal in substitute with addition phytase enzyme for aquaculture diets of humpback grouper especially to cuture in floating net cages must be substantially reduced [2][4][5]. Alternative for addition phytase enzyme to increase growth fish culture in floating net cages reported by [7][8][9].

The best of Humpback Grouper fisheries product used fish culture of floating cage but although still experiencing problems in its cultivation of floating cage. The current condition of grouper cultivation with floating net cage system in Karimunjawa Jepara high mortality 70-80%[2][5]. One of the efforts to overcome the high mortality problem is by improving the technical cultivation and adding good quality feed with phytase enzyme, so the growth and survival of grouper is better [2][10][11][12][13]. The advantages of enzyme phytase in the addition artificial feed given to fish because of phytate of 3.88 g • kg^{-1} diet chelates with mineral such as magnesium (Mg), manganese (Mn), iron (Fe), zinc (Zn), calcium (Ca) and protein which are very beneficial for growth of plant, animal, and human. These elements are also forming poorly soluble complexes which are difficult [14][15][16]. Phytase enzyme has characteristic properties of chelating characteristics. Phytic acid reacts with protein forming phytate-protein complexes and vitamins thus decreasing their bio-availabilty and digestibility [2][17][18][19] showed that protein and phytate compound were barely broken down by proteolysis enzyme, even phytate can hinder pepsin, amylopsin and amylase to work properly. Growth and high survival rate in addition to artificial feed with high protein content is also supported by the maintenance of groupers kept in floating net cages [1][2][4][5]. The purpose of the research is to examine the role of technology using of cultivation floating net cage of Humpback Grouper based on artificial feed used enriched of phytase enzyme with different dosage to accelerate growth and survival of Humpback Grouper fish and to support maritime fishery cultivation industry.

2. Material and methods

2.1 Experimental fish

Humpback Grouper (polka dot grouper) used for the present experiments were seed of Juvenile humpback grouper fish size 15,5 ± 0,5 cm in the net cages unit (1 m x 1 m x 1 m) from Center for Brackish Water Aquaculture, Jepara, Central Java.The examination of growth was done every week.The fingerling used in this study were healthy individuals and had uniform size as suggested modification by [3]. The present experiments were suspended from a floating wooden frame 9 m long by 5.4 m wide. Each net- cages was made of polyethylens netting, mesh size 12.5 mm. at Karimunjawa waters, Jepara. The research method used complete randomized design (CRD) 4 treatment and 3 replication were feed Artificial enriched of phytase enzyme addition.

2.2 Diet preparation

Ingredients and proximate composition of experimental diets are presented in Table 1. Trial feed formulation with addition of phytase enzyme at various doses are presented in table 2.

Table 1. Proximate analysis of compositiont of Feed Composers Materials

Ingredient (g per 100 g diet)	Analysis of materials					
	Moisture	Ash	Crude lipid	Coarse Fiber	Crude Protein	BETN
Fish meal	10,89	22,75	7,98	9,25	45,40	3,73
Soybean meal	11,06	5,65	9,23	5,46	38,71	29,88
Corn meal	13,71	1,77	2,03	0,01	9,38	73,09
Rice meal	12,43	9,25	10,97	18,94	13,62	34,79
Dextrin	10,60	0,20	0,59	0,00	0,10	88,51

The Source: Laboratory of Animal Nutrition and Feed Science, Faculty of Animal Husbandry, Diponegoro University.2017.

Treatment were feed Artificial enriched of phytase enzyme with dosage A (0 FTU • kg^{-1} diet), B (200 FTU • kg^{-1} diet), C (500 FTU • kg^{-1} diet), and D (800 FTU • kg^{-1} diet) based phytase enzyme dosage suggested modification by [3] was optimal dosage used phytase enzyme 500 FTU • kg^{-1} diet. Feed was given 2 times a day in the morning and afternoon with 5% biomass per day. The test feed was prepared with the formulation as follows (Table.2): Table 2. Feed Formulation Test in Research.

Table 2. Feed Formulation Test in Research

Ingredient (g per 100 g diet)	Treatment			
	A (0 FTU · kg–1 diet)	B (200 FTU kg–1 diet)	C (500 FTU kg–1 diet)	D (800 FTU kg–1 diet)
Phytase enzyme	0	0,02	0,05	0,08
Fish meal	34,4	34,5	34,5	34,5
Soybean meal	35	35	35	35
Corn meal	9	8,7	8,5	8,5
Rice meal	8,1	8,1	8,1	8,1
Dextrin	9,8	10	10,21	10,2
Fish oil	1,75	1,75	1,75	1,75
Corn oil	1,75	1,75	1,75	1,75
Vitamine& mineral	1,1	1,1	1,1	1,1
CMC	1,1	1,1	1,1	1,1
Total	102	102	102	102
Energi (kkal)	300,06	300,02	300,02	300,36
Ratio E/P	8,57	8,57	8,57	8,57

A= Experimental feed contained phytase enzyme 0 FTU kg–1 diet, B= 200 FTU kg–1 diet, C= 500 FTU kg–1 diet, and D= 800 FTU kg–1 diet.

2.3. Feeding Trial

The experiments were conducted at Karimunjawa Waters, Jepara, Central Java using Complete Random Design with four treatments and each treatment repeated three times. Phytase enzyme supplemented diet was used in the experiment with the doses of A (0 FTU • kg^{-1} diet), B (200 FTU • kg^{-1} diet), C (500 FTU • kg^{-1} diet), and D (800 FTU • kg^{-1} diet). The enzyme doses used in this study were the modified results from the study by [3][4][5]. The results suggested that the phytase enzyme

as much as 500 to 750 FTU • kg^{-1} diet was the optimum level for the growth of humpback grouper with the average weight of 12.4±0.2 g • $fingerlings^{-1}$.

2.4. Culture Cages

The net cages unit (1 m x 1 m x 1 m) used for the present experiments were suspended from floating wooden frame 9 m long by 5.4 m wide. Each net- cages was made of polyethylens netting, mesh size 12.5 mm. The capacity of the net-cage always submerged in water was calculated to be 3 m3, this capacity was used in calculation of initial stocking density of the fish. The general layout of the cages and their maintenance were as described ealier[1]. Sea cages were suspended from a floating raft in seawater approximately 10 m depth and 0.5 m daily tidal fluctuation. Before the treatment diets, 10 fish were sacrificed for carcass analysis to determine nutritional composition of the initial fish. During the experiment, fish were fed by hand as much related feed as they would consume in 30 min at 07.00 and 16.00. Feeding was carefully monitored to minimize any food wastage. The feeding trial lasted for 12 weeks. Fish were weighed individually at 2-weekly intervals. The individual fish in each cage were weighed using a top loading balance with a precision of 1 g. The experiment finished, four representative fish from each cage were randomly sampled and frozen for determination of the whole body composition according to standard methods[20].

2.5. Parameter of observation

The parameters observed include absolute growth (W), relative growth rate (RGR) and food conversion ratio (FCR), suggested by Tacon [51], ADCP and ADCF according to [28], and Survival Rate (SR) according to NRC [52]. The pH (Jenway 3510), DO (Jenway 970), temperature and Ammonia (HANNA: HI. 8633, proximate analysis of the percentage of crude protein was determined by micro Kjeldahl analysis with distillation into 4% boric acid and titration with sulphuric acid using methyl red indicator for end point determination.Percentage lipid was determined gravimetrically following a chloroform: methanol extraction of the sample, and moisture was determined by drying at 105oC until constant weight.

The research method using complete randomized design were 4 treatment and 3 replication that are given artificial feed enriched of phytase enzime with different of dosage as follow as are the doses of A (0 FTU • kg^{-1} diet), B (200 FTU • kg^{-1} diet), C (500 FTU • kg^{-1} diet), and D (800 FTU • kg^{-1} diet).. Feed was given 2 times a day in the morning and afternoon with 5% biomass per day.

2.6. Data collection

2.6.1. Absolute Growth. The absolute growth formula is calculated by the formula Tacon [51] , with the following formula:

W = Weight end test animal research – Weight of animal initial test of

$$RGR : \frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight xTime experiment}} \times 100\%$$

$$FCR : \frac{\text{The amount of feed consumed}}{(\text{Final weight} + \text{Total weight fish deat}) - \text{Initial weight})} \times 100\ \%$$

$$SR\ (\text{Survival}): \frac{\text{(Final count)}}{\text{Initial count}} \times 100\%$$

2.7. Statistical Analysis

The experimental design used Completely Randomized Design (CRD) with four dosages of phytase enzyme content as a treatment and each treatment repeated three times. The effect of the treatments was tested using an analysis of variance (ANOVA)[49], which was then used to analyze the data. Before analyzing, the normality, additivity, and homogeneity of the data were first tested. If the

analysis of variance was significant ($p<0.05$) or highly significant ($p<0.01$), Tukey test was conducted to find out the mean of the treatment[49]. To determine optimal dose of phytase enzyme, was conducted using Minitab 16 and Maple12. Water quality data were descriptively analyzed.

3. Results and discusson

The results showed that the difference of artificial feeding enriched with different enzyme phytase enzyme showed highly significant (P <0,01) to growth, food conversion ratio (FCR), survival of Humpback Grouper fish, and also to improve the aquaculture industry. The best treatment was at C (500 FTU kg^{-1} diet) with an absolute weight of 128.81 ± 0.85^{a} g, 1.74c (FCR), and a survival rate of 94.03 ± 1.06^{a} %. The quality of water during the maintenance of groupers in floating net cages is relatively good and feasible (Table.3).

Table.3. Absolute growth rate, Relative Growth Rate (RGR), Food Conversion Ratio, Survival of Humpback grouper fish kept in floating net cages in Kep.Karimunjawa waters, Jepara.

	Treatments			
	A (0 FTU · kg–1 diet)	B (200 FTU kg–1 diet)	C (500 FTU kg–1 diet)	D (800 FTU kg–1 diet)
1. Absolute weight growth (g)	123.35 ± 0.38^{b}	$127.24\pm1.00.37^{a}$	128.81 ± 0.85^{a}	126.31 ± 0.99^{a}
2. Relative growth rate (% day)	0.95 ± 0.01^{c}	1.48 ± 0.01^{b}	1.63 ± 9.01^{a}	1.45 ± 0.01^{b}
3. Feed conversion ratio (FCR)	4.11^{a}	3.41^{b}	1.74^{c}	3.05^{b}
4. Survival rate (%)	63.57 ± 0.50^{b}	73.78 ± 1.3^{b}	94.03 ± 1.06^{a}	86.19 ± 0.81^{a}

Information :

Treatmens are given artificial feed enriched of phytase enzime with the doses of A (0 FTU • kg^{-1} diet), B (200 FTU • kg^{-1} diet), C (500 FTU • kg^{-1} diet), and D (800 FTU • kg^{-1} diet).

The same supercrip marks showed no significantly (P> 0.05) difference (Tukey's Test) Based on the Tukey'S test indicating that the mean value of C-A, C-B treatment is very different, but not significantly different from C-D.

3.1. The absolute growth of the Humpback grouper

The results showed that the difference of artificial feeding enriched with different phytase enzyme significantly (P <0.01) on the growth of absolute weight of humpback grouper fish. The addition of phytase enzyme on the diet significantly ($p<0.01$) increased the relative growth rate of milkfish fingerlings as shown in the Table 2. The results gave evidence that supplemented diet with the phytase enzyme could hydrolyze protein that was bind by phytate into amino acid. This amino acid was readily digested and could provide energy to grow [3][4][5][41][42].In addition [3] result of research that the addition of phytase enzyme 500 FTU kg- diet could increase relative growth rate of humpback grouper initial growth weight 26.7 to 31.7 g and specific growth rate 1.4 % to 1.7%, [37]) reported crucian carp *Carassius carassius* by 25 percent better higth compare [2][42]was average weight lower was 9.95%. But compare with reported by Diana & Samidjan [42]. [42] showed (RGR) weight of milkfish 1.95 ± 0.04c %,was given of artificial feed and 2.9 ± 0.29^{b} was given of artificial feed addition of 500 FTU kg- diet phytase enzyme. The same results were also found in carp, African catfish, striped bass rainbow trout, Atlantic salmon Korean Sebastes schlegeli, nile tilapia, tiger prawn, rainbow trout, sea bass, snakehead (*Channa striata & Channa micropeltes*), grass carp [3][4][29][42][53][54][55][56], The results of orthogonal polynomial test on the relationship of phytase enzyme in the diet and the relative growth rate (Figure 1) had cubical pattern with the equation Y = - 19.36 X2 + 19.61 X + 123.0, R2=0.919. The optimum dose of the phytase enzyme in the diet on the relative growth rate was 506 FTU kg- diet with the maximum absolute growth of 128.015 g.

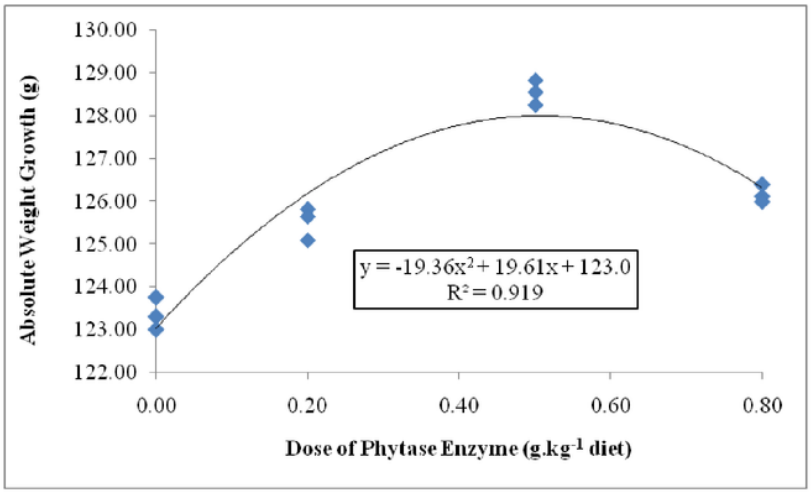

Figure 1. Graph of orthogonal polynomial absolute weight of Humpback grouper (C. altivelis). Information : 506 FTU kg- diet with the maximum absolute growth of 128.015 g.

Furthermore, based on the results of analysis of variance showed that the presence of artificial feeding enriched phytase enzyme different dosage highly significant (P <0.01) on the average growth rate of humpback grouper

It is assumed that there is a real influence due to grouper fish that can utilize artificial feed enriched fitase enzyme different dose independently and supported by good water quality condition, so as to increase tiger grouper fish growth. This is consistent with the opinion of Shapawi et al [4][5] reported that maintaining good water quality along with suitable and nutritious feeding can increase the growth and survival of humpback grouper. Based on the Tukey'S test indicating that the average value of C-A, C-B treatment is very different, but not significantly different from C-D. Based on Table 3, in the presence of different doses of enzyme phytase there is a very significant (P<0.0) effected on growth. It is found that the absolute growth very high were treatment C was 128.55 ± 0.29a g and the lowest A (123.35 ± 0.38^{b}) .The growth of humpback grouper shows the high of this is the same opinion by Shapawi et al. [4][5], [27] showed final weight 26.7 g to 31.7 g lower with result experiment.

3.2. Relative Growth (RGR)

Relative growth rate shows that the highest at C (1.63±9.01%) (Table 3). The analysis of variance showed that the presence of the addition of phytase enzyme on the diet highly significant (p<0.01) increased the relative growth rate of humpback grouper as shown in the Table 3. The results gave evidence that supplemented diet with the phytase enzyme could hydrolyze protein that was bind by phytate into amino acid. This amino acid was readily digested and could provide energy to grow [2][3][4][5], [41][42]. The result showed elative growth rate of humpback grouper that the highest at C (1.63±0.01%) but compare with humpback grouper 1.4 %[4][5], Specific growth rate (SGR) of tiger grouper 0.96 to 1.06 %[3][4][5], SGR of tiger grouper 1.12 to 1.38 %[3][4], and milkfish lower RGR 2.95 ± 0.29b % [41][42]. The results of orthogonal polynomial test on the relationship of phytase enzyme in the diet and the relative growth rateof humpback grouper (Figure 2) had quadratical pattern with the equation , Y = -2.6857 X2+2.617 X +0.8495, R2=0.88, The optimum dose of the phytase enzyme in the diet on the relative growth rate was 487 FTU kg- diet with the maximum relative growth rate of 1.49 % per day.

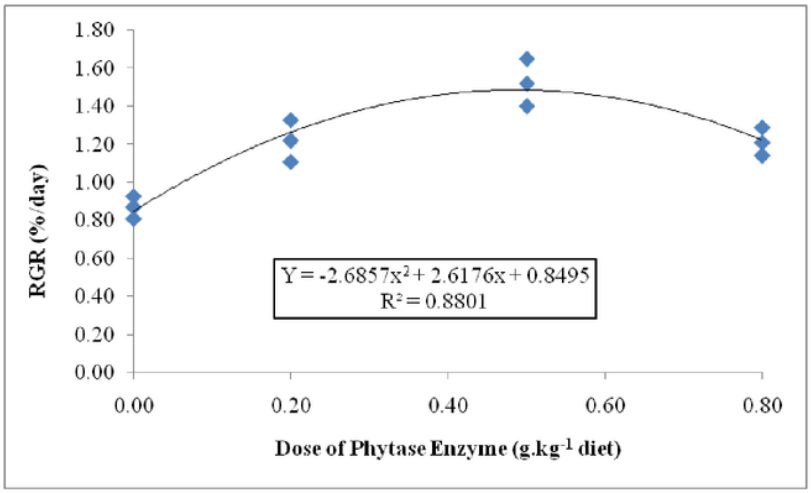

Figure 2. Graph of orthogonal polynomial RGR of Humphback grouper (*C. altivelis*).

The optimum dose of the phytase enzyme of RGR 487 FTU kg- diet with the maximum relative growth rate of 1.49 % per day.
[3] also reported of phytase enzyme 500 to 750 FTU kg- diet could increase average weight of humpback grouper final weight 26.7 g to 31.7 g and SGR 1.4% to 1.7 %. In addition by Yu & Wang (2000) that showed crucian carp Carassius carassius by 25 percent. The same results were also found in tiger grouper [2][3][4][5], African catfish [53][54], striped bass [55]. Based on the Tukey'S test indicating that the average value of C-A, C-B treatment was very different, but not significantly different from C-D. This shows that relatively good growth of C (1.63±9.01%) dose of phytase enzyme (500 FTU • kg–1 diet) compared with [3][4][5] that the daily growth rate of hump grouper SGR 1.4 to 1.7 %, during maintenance 60 days fed "pellet enrichment of phytase enzyme" with a protein content of final weight 26.7 to 31.7 g[3][4]. Furthermore ,[4] stated that the daily growth rate of humpback grouper and tiger grouper is different of SGR , because tiger grouper better growth rate and better feeding rate.The cultivation of humpback grouper must be used by feed in protein content of 41.20 to 41.55%, indicating that daily growth rate observations were still good [3][50].
The addition of phytase enzyme on the feed 500 FTU kg- diet significantly increased the growth of humback grouper fingerlings compared to the addition of 200 and 800 FTU phytase enzyme per kg-diet. It can be concluded that the addition of 800 FTU phytase enzyme on the every kg feed could reduce antinutrients or phytate on soybean meal. [3] also reported that the addition of phytase enzyme 750 FTU kg- diet could increase average weight of humpback grouper.

3.3. Food conversion Ratio

The lowest humpback grouper feed conversion showed that the feed was very efficient, this was found in treatment C(500 FTU kg–1 diet) of feed with FCR (1.74c) (Table 3).
The addition of phytase enzyme significantly (P<0.01) affected on the feed conversion ratio of humpback grouper. conversion ratio better. The same result was also found for absolute growth and relative growth rate. Based on the Tukey'S test indicating that the mean value of middle treatment of CA, CB is very different, but not significantly different from the CD. The low feed ratio C ratio with FCR (1.45 ± 0.3) is more efficient feed utilized by Humpback Grouper (C. altivelis) [3][4][50] was suggested that phytase enzyme can break down phytate, losing the binding between phytate acid and protein and minerals compound. It would positively increase activity to convert trypsinogen into trypsine enzyme which broke down protein into amino acids. In addition by Abrehouch, et al.[47], It

can increase feed utilization and reduce feed conversion ratio. Wang et al. [6][35] also reported that the addition of phytase enzyme the soybean diet for rainbow trout also made feed conversion ratio better. The same result was also found for *L. rohita*[13][21]. C treatment (500 FTU kg- diet) resulted in the lowest feed conversion ratio among other treatments, B (200 FTU kg- diet), D (800 FTU kg- diet), and A (0 FTU kg- diet). Therefore to improve the feed efficiency is required addition of phytase enzyme in diet utilization and make feed conversion ratio low. [3][4][51][52] reported using in addition of 250 units or more microbial phytase enzyme in the diet showed increase feed the consumption to increase growth but lower of food conversion ratio. The results show[15][16][21][22][23][24] [29][30] that there were higher feed consumption, higher weight gain, and lower feed conversion ratio than those without addition [21][22] [23] [24][25] [26][27] [28][31] [32][33][59]. The relationship between phytase enzyme in diet and the survival based on the orthogonal polynomial test, as shown in the Figure 3, was quadratical. The equation was Y= 11.24 X2- 11.022 X +4.5152 and R2 =0.6322. The optimum dose of the phytase enzyme in the diet on the convension ratio was 490 FTU kg- diet with the maximum of FCR 1.81 (Figure .3).

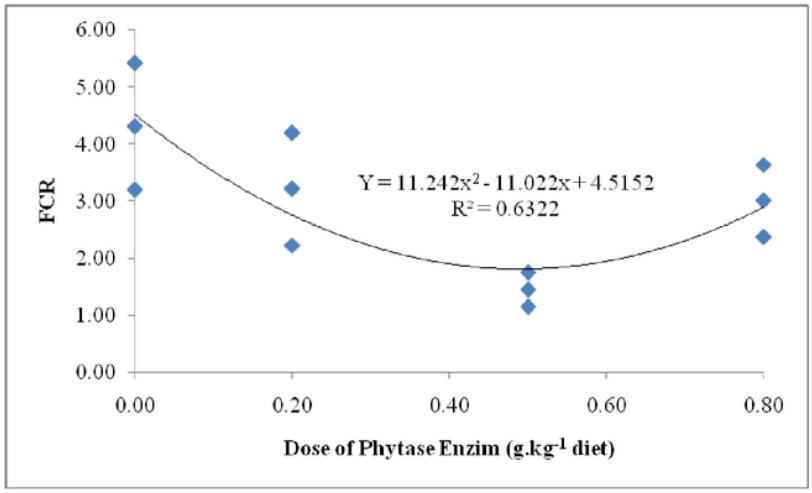

Figure 3. Graph of orthogonal polynomial FCR of Humphback grouper (*C. altivelis*).

3.4. Survival Rate of Humpback Groupers

The highest Humpback grouper life was found in treatment C (93.33%) (Table 3).The existence of feeding and good cultivation environment gave a highly significant effect on the survival of Humpback grouper fish (P <0.01), as shown in the Table 3. The result was in line with the [3][4][5][51] showed finding that survival rate was highly significant affected by addition of phytase enzyme in the diet. gender, heredity, age, reproduction, disease resistance and external factors such as water quality, density, number. The same result was also found [2][38][39][40][41][42], showed the survival rate was affected by internal factors such as using technology of floating net cages is very good and supporting of environment Karimunjawa waters in live of Humpback grouper [34][35][36][37] showed can increase the same of survival rate was highly significant affected by addition of phytase enzyme.

The relationship between phytase enzyme in diet and the survival based on the orthogonal polynomial test, as shown in the Figure 4, was quadratical. The equation was

Y= -81.03 X2+97.49 X +61.38 and R2 =0.917. The optimum dose of the phytase enzyme in the diet on the survival was 602 FTU kg- diet with the maximum value of survival 90.71% (Figure .4).

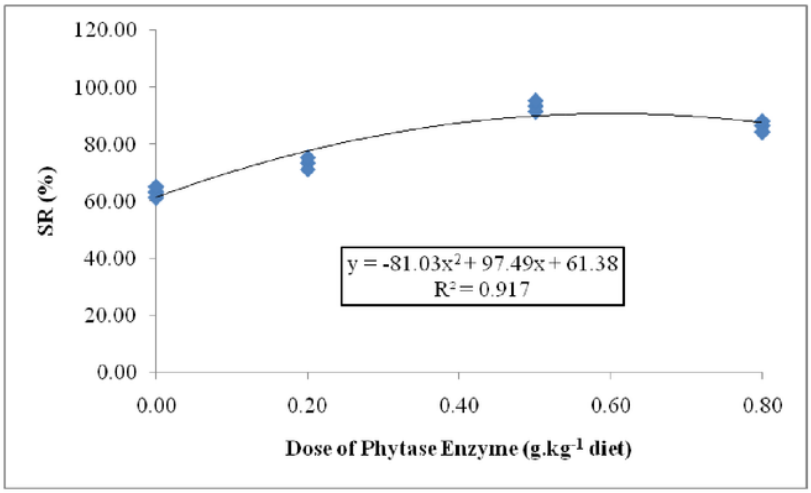

Figure 4. Graph of orthogonal polynomial survival of Humphback grouper (*C. altivelis*).

Information :

The same superkrip marks show no significant difference (Tukey's Test) P> 0.05

The optimum dose of the phytase enzyme in the diet on the survival was 602 FTU kg- diet with the maximum value of survival 90.71%

Shapawi et al [3][4][5] reported that high survival rate 90±10% to 96.67±5.77%, in addition by Moreover, [52] reported that the phytate content 0.5% in the diet could decrease the growth and feed efficiency for rainbow trout (*O. misskis*). [17][49][51][52] also suggested that 2.58% phytate in the diet could decrease growth, feed efficiency, protein efficiency, and also cause mortality and composition of amino acid in the diet [3][40][51]. The water quality during the research was suitable for cultivating the humpback grouper. The measurement of the observed parameters of water during cultivation of humpback grouper can be seen (Table.3). Result of treatment C showed better survival was 94.03±1.06a than B (200 FTU • kg–1 diet) was 73.78±1.3b %, D (800 FTU • kg–1 diet) 86.19±0.81a %and lowest was A (0 FTU • kg–1 diet) of survival 63.57±0.50b %

The existence of feeding and good cultivation environment gave a very real effect on the survival of humpback grouper fish showed highly significant (P <0.01). Based on the Tukey'S test indicating that the average value of C-A, C-B treatment was very different, but not significantly different from C-D.The result of our reserch different reported by Rachmawati & Samidjan [42] the addition of phytase enzyme in the diet insignificantly affected on survival rate of milkfish fingerlings. Moreover, [3][51][52] reported shows in line [4], finding that survival rate was insignificantly affected by addition of phytase enzyme in the diet. [3][4] the addition of phytase that survival rate was insignificantly affected. This is in accordance with the opinion of [3], with good feeding and cultivation environment gave a very real effect on the survival of Humpback grouper. Addition by Shapawi et al. [4][5] that by maintaining tiger grouper better SGR higher with humpback grouper whose maintenance media using biofilter combination of biology and chemistry as well as water intermediary of grouper fish maintenance can improve water quality and increase the life of Humpback Grouper [2][27] results showed that the survival of Humpback Grouper grouper fish kept in floating net cages in Karimunjawa waters of Jepara regency, Central Java province showed a relatively higher survival compared with those reported by Shapawi et al.[3][4], reported that the survival of tiger grouper fish kept in floating net cages ranged from 55 to 60%. In addition of opinion [34] reported to increase of survival rate to improve enviroment waters in floating cages, in the same reported by Shapawi et al [3][4] used addition of phytse enzyme 500 FTU increase survival rate of

humpback grouper. In the same opinion by Chateau et al. [14] reported environment good support to increase survival rate fish culture in float net cages in the same to increase in floating cages of fish [45][49] [57].

3.5. Water quality

Water quality during the experiment of humpback grouper fish kept in floating cages showed its feasibility at the end of the study is still alive well (Table 4).

Table 4. The Water quality during the maintenance of humpback grouper in floating net cages

Parameter	unit	Range to (Research)	Reference	
Temperature	o C	27.5-30.5	26-33	Shapawi et al.(2007)
pH		7.2-8.1	7-8.2	Shapawi et al.(2007)
Salinity	ppt	25-30.5	25-32	Shapawi et al.(2007)
Dissolved Oxygen	mg/l	5.27-6.62	7-May	Shapawi et al.(2013[b,c])
NH_3	mg/l	0.011-0.017	0.02	Shapawi et al.(2007)
NO_2	mg/l	0.01-0.05	0-Jan	Shapawi et al.(2013[b,c])

Based on Table 3, it shows that the temperature range is 27-30 oC, pH 7.1-8.1, salinity 24.5-28.0 ppt, dissolved oxygen 5.25-6.50 mg / l, NH3 0.012-0.018 mg / l and nitrite 0.03-0.08 mg / l. It shows the proper water quality for tiger grouper cultivation[2][3][4][5][6] [32][33][41][42[43][44][45][46] added also that the role of aquatic environments and habitat of sediments elements of sand and gravel with 85% composition and calcareous algae from Halimeda sp can improve the survival of groupers and improve water quality for grouper life [2][12][13][20] [58].

3.6.*Aquaculture Industry Humphback grouper fishery with floating net cages system*

The development of tiger grouper fish breeding in Karimunjawa waters of Jepara with floating net cages, the floating nets cages ware very fast and can improve the welfare of the community around Karimunjawa, Jepara districts. The results shows that Grouper duck (*Cromileptis altivelis*) at the producer level costs about Rp 140,000, - to Rp 300.000, - kg^{-1} diet. Tiger grouper fish belongs to the type of euryhalyne, which has a relatively wide range of salinity tolerance, so that tiger grouper other than can be cultivated in the sea, can also be cultivated in ponds. While the price of grouper sunu (*Plectropomus leopardus* and *P. maculatus*) at the producer level cost around Rp 180.000, - to Rp 300.000, - . kg^{-1} diet Grouper sunu can be cultivated in floating net cages and easy on the sea. Muddy grouper '; This is in line with opinion. In adition by Shapawi et al. [3][4] there are several important types of coral reef fish in Indonesia, including *Serranidae, Lutjanidae, Kyphosidae, Lethrinidae, Acanthuridae, Mulidae, Siganidae, Labridae* and *Haemulida*e [3][4][10] [11][12].

Humpback grouper fish as one of the commodities studied in this study included the *Serranida*e family. The characteristics of *Serranidae* according to Shapawi et al [3][4][21] showed have characteristics such as solitary, usually hiding in caves or under corals, up to 2 meters long, weighing up to 200 kg, and belonging to carnivores, eating fish, shrimp and crustaceans. According to Suhartono & Samidjan [60] showed humpback grouper (*Cromileptes altive*lis) has the highest price, between Rp 350.000, - to Rp 400,000, - kg^{-1} diet at the producer level (fishermen and fish farmers).

As for the seeds of 4-5 cm, the price per tail reached Rp 5,000, - to Rp 7,000, -. Humpback Grouper (*C. altivelis*) at the producer level costs about Rp 140,000, - to Rp 300.000, - kg^{-1} diet. Tiger grouper fish belongs to the type of euryhalyne, which has a relatively wide range of salinity tolerance, so that tiger grouper other than can be cultivated in the sea, can also be cultivated in ponds. While the price of grouper sunu (*Plectropomus leopardus* and *P. maculatus*) at the producer level cost around Rp 180.000, - to Rp 300.000, - kg^{-1} diet. Grouper sunu can be cultivated in floating net cages and easy on the sea of Mud groupers. Business Feasibility Study of Coral Reef Fishery, Grouper and Seaweed Cultivation 2-3 (*Epinephelus suillus / E. tauvina* and *E. coioides*) cost around Rp 100.000, - to Rp 200.000, - per kg. Mud grouper fish can be cultivated in floating net cages, easy and ponds. While malabar grouper (*Epinephelus malabaricus*) is often also called as grouper. Added by Afero et al [10] examines the feasibility analysis of tiger grouper size 400 grams Indicator Value Conclusion NPV (Rp) 85,790,261 Deserves IRR (%) 52% Worth Payback Periods 1 Year 5 months 11 days Eligible BC Ratio (PV) 1.14 Eligible, but different Economic analysis of tiger grouper *E. fuscoguttatus* and Humpback Grouper *C. altivelis* commercial stage culture in Indonesia [10] showed analysis of the financial performance of humpback grouper that all production scales can be regarded as marginally viable with a projected cumulative cash flow for 5 years for small-scale (IDR 133,344,826.52), medium-scale (IDR 446,749,192.00) and large-scale (IDR 1,692,212,500.00) farms. Application of the 15% discount rate produced a NPV for small-scale (IDR 85,009,002.45), medium-scale (IDR 286,822,375.91) and large-scale (IDR 1,088,181,355.75) farms over a 5-year period. Further analysis of financial performance highlighted a benefit cost ratio over 2, an internal rate of return greater than 300% for all production scales and a payback period of\1 year.

4. Conclusions and recommendations.

4.1.*Conclusion*

The results showed that the difference of artificial feeding enriched with different phytase enzyme showed highly significant (P <0,01) to growth, food conversion ratio (FCR), survival of humpback grouper fish, and also to increase cultivation of fishery industry. The best treatment at C treatment (500 FTU kg- diet) were absolute growth (128.81±0.85^{a}g), relative growth rate (1.63±9.01^a %), Feed conversion ratio (FCR) (1.74c) and survival rate (94.03±1.06^a %).

The optimal doses of phytase enzyme on growth performance, Feed conversion ratio (FCR) and survival rate were in humpback grouwer range 490 FTU kg- diet to 602 FTU kg- diet.

4.2.*Recommendation*

It is necessary to have a follow-up on artificial feeding in addition phytase enzyme using of the optimal doses of phytase enzyme on growth performance, Feed conversion ratio (FCR) and survival rate were in humpback growth range 490 FTU kg- diet to 602 FTU kg- diet.

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References

[1] Abrehouch A, A A Ali, K Chebbaki, H Akharbach, M Idaomar 2010 *J. Agriculture and Biology Journal of North America.* **1**(3): 175-184.
[2] BTN Karimunjawa 2002 *Statistics and Monographs of Karimunjawa Islands, Jepara Regency. Sea Park National Park, Karimunjawa Islands.*
[3] Shapawi R, W N Keong, S Mustofa 2007 *J. Aquaculture* **273** (118-126)
[4] Shapawi R, Ebi I, Yong A, Chong M, Chee L K, Sade A 2013 *J.Agricultural Sciences*

4(6A):19–24
[5] Shapawi R, I Ebi, A Yong 2013 *J. Agricultural Science* Vol **4**(7) 317-323
[6] Wang, M S, Yan Y. Wang Z R. Lun, and T B Yang 2013 *J. Aquaculture Research* 1-5
[7] Fox J M, Addison L L, Anthony J S, Allen D, Denis RM, Elizabeth CD, and Tzachi M S 2006 Phytase supplementation in aquaculture diets improves fish, shrimp growth performance.
[8] Gondwe M J S, S J Guildford, R E Hecky 2011 *J.of Great Lake Reaserch **37**,* 93-101.
[9] Garcia F, O J Sabbag, JM Kimpara, D M Romera, N S Sousa, E M Onaka, L P Ramos 2017 *J. Aquaculture* 479, 838-844.
[10] Afero F, Miao S, Arlenie A Perez A A 2010 *J. Aquacult Int* **18**:725–739.
[11] Baliao D D, M A D Santos, N M Francos, N R S Jamon 2000 Grouper culture in floating net cages (Aquaculture Extension Manual No.29)
[12] Barcellos L, J G, L C Kreutz, R M Quevedo, I Fioreze, L Cericato, A B Sos, M Fagundes, J Conrad, R K Baldissera, A Bruschi and F Ritter 2004 *Journal Aquaculture* 232, 383-394.
[13] Baruah K, Sahu N P, Pal A K, Debnath D, Mukherjee S C 2007 *J.Aquaculture Research* 38(2):109–120.
[14] Chateau, P A,Y C A Huang.,C A Chen,Y Chang.,2015. *J.Ecological Modelling* 299,140-146.
[15] Chen C P, Hsien, H L and Chang K H 1980 *Some aspect of the sex chance and reproductive biology of the Grouper, Epinephelus diacanttus* (*Cuvier valenciencis*).
[16] Chor W K, L S Lim, M Chong, K C Lu, A Sade, R Shapawi 2015 *Malaysian J. of Science*. **34** (1): 58-68.
[17] Liu B, Rafig A, Tzeng Y M, and Rob A. 1998 *Enzyme Microbial Technology.j.* 22:415–424.
[18] Li M H, Robinson E H. 1997. J World Aquacult Soc **28**:402–406.
[19] [NRC] National Research Council 1993. *Nutrient requirements of fish*. [Washington DC: National Academy Press]. 124p.
[20] AOAC[Association of Official Analytical Chemists] 1990 *Official Methods of Analysis*. [15th ed. Washington DC: Association of Official Analytical Chemists)]. 1298p.
[21] Baruah K, Sahu NP, Pal AK, Debnath D 2004. J.*World Fish Center Quarterly* **27**:15–19.
[22] Chua T E and Teng S K 1974 *in* Chua and Teng, 1982. Effects of food ration on growth condition factor, food conversion efficiency, and net yield of estuary Grouper, *Epinephelus salmoides*. [Maxwell, culture in Floating net cages].
[23] Chua T E and Teng S K 1978 *Reared in floating net cages aguaculture,J.* **16**:219-232.
[24] Chua T E and Wong S K 1978. *Aquaculture,J.* **16**:219.
[25] Coleman F C, C C Koenig, K M Scanlon, S Heppell, S Heppell and M W Miller 2010 The Open Fish Science J, 2010, 3, 1-15.
[26] Huang Y, X Huang, Y Yan, J Cai, Z Ouyang, H Cui, P Wang and Q Qin 2011 *BMC Genomic J.* **12**(556), 1-12.
[27] Hussain N A and M Higuchi. 1980. *Aquaculture J.* 19. 339-350.
[28] Fenucci J L 1981 *Studies on the nutrition of marine shrimp of the Penaeus*. [Ph.D. Dissertation]. Houston, Texas, USA: Faculty of Department of Biology, University of Houston. 185p.
[29] Rachmawati D and I Samidjan 2017 *Philippine J. of Science* **146** (3):237-245.
[30] Forster I, Higgs D A, Dosanjh B S, and Rowshandeli M 1999. *Aquaculture J. 179(1):109–125*.
[31] Randall and B Tuvia. 1983. *Bull of Marine Sciences* J.:33(2):373-426.
[32] Ransangan J, B O Manin, A Abdullah, Z Roli., E F Sharudin 2011 *J. Aquaculture* 315, 327-334
[33] Sedgwick, R W 1979. *J. Aquaculture,* **16** : 7 - 30.
[34] Turja R, N Hoher, P Snoeijs, J Barsiene, L Butrimaviciene, T Kuznetsova, S V, Kholodkevich., M H Devier, H Budzinski, K K Lehtonen 2 014 *J. Aquacultre* 473-474, 398-409.
[35] Wang X, Choi S, Han K, Kang J C, and Bai S C 2005 *J. Aquaculture* 243: 315–322.
[36] Watanabe T, C Kitajima,S Fujita 1983. *Nutritional Values of Live Organisme Usea in Japan for Mass Propagational Fish. A Review Aquaculture 34 Elsever Science*. Publisher B-V

Amsterdam, Netherlandns.
[37] Yu F N, Wang D Z 2000. *J Fish Sci Chin* 7(2):106–109.
[38] Hassan MS, Soltan MA, H M Agouz, A M Badr 2013 *Egyptian J. of Aquatic Research 39(3):205–213.*
[39] Hassan S, Altaff K, and Satyanarayana T 2009 *Pakistan Journal of Nutrition J.* 8(4):341–344.
[40] Hepher 1988. *Nutrition on pond fisheries*. [Cambridge, USA: Cambridge University Press]. 388p.
[41] Rachmawati, D, I Samidjan, M, and Mel. 2016 *J. Teknologi* 78(2–4):39–43.
[42] Rachmawati D, I Samidjan, and M Mel 2017 *Philippine J. of Science*. 146 (3):237-245.
[43] Paquotte P L, Chim, J L M, Martin, E Lemos, M Stren, G Tosta. 1998 *J. Aquaculture 168*, 151-166.
[44] Pescod M B 1973 *Investigation Of Rational Effluent And Stream Standart for Tropical* [Countries. San Fransisco].
[45] Degefu, F S, Mengistu, M Schagerl 2011 *Aquaculture J.* 316, 129-135.
[46] Demetrio J A, L C Gomes, J D Latini 2012 *J. Aquaculture* 330-333, 172-178.
[47] Gatlin III D M, D M Barrows, F T Brown, P Dabrowski, P Gaylord, T G Hardy, R W Herman, E Hu, G Krogdad, S Nelson. 2007. *Aquaculture Research J.* 38:551-579.
[48] Gopakumar G 2009. *Cultured in floating net cages J.*
[49] Stell R G D, Torrie J H and Dickey D A 1996. *Principles and procedures of statistics*, [3rd ed. New York: McGraw Hill International Book Company, Inc]. 672p.
[50] Suloma.A and H.Y. Ogata 2011 *J Aquac Res Development 2011, 2:2*
[51] Taco 1987 *Nutrition and Farmed Fish and Shrimp*. [Training Manual]. Brazil: The Essential Nutrients Food anf Agricultural Organization of the United Nations].
[52] [NRC] National Research Council 1993. *Nutrient requirements of fish.* [Washington DC: National Academy Press]. 124p
[53] Papatryphon E, Howell R A and Soares J H 1999 *J World Aquacult Soc* 30:161–173.
[54] Sajjadi M, Carter C G. 2004 *J Aquacult Nutr 10(2):135–142.*
[55] Sajidan A, Farouk A, Greiner R, Jungblut P, Mueller E C, Borriss R. 2004 *Applied Microbiology and Biotechnology J.* **65**(1):110–118.
[56] Schaefer A, Koppe W M, Meyer-Burgdorff K H, Guenther D. 1995 *Water Science and Technology J.*; 31:149–155.
[57] Chua T E and S K Ten 1979 *Marine Biology J* **54**, 363-372.
[58] Madin, J, V C. Chong., B Basri 2009 *J. Aquaculture* 83, 19-29.
[59] Korsoen O J, T Dempster, P G Fjelldal, F Oppedal T S Kristianse 200 *Aquaculture J.* 296, 373-381.
[60] Suhartono and I Samidjan 2014 J.*Applied Mathematical Sciences*, Vol. **8**, 2014, no. 179, 8921 – 8928.

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