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Effects of Different Dietary Protein Levels for Maximum Growth of Rabbitfish (*Siganus guttatus* Bloch) Reared in Floating Netcages

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ABSTRACT

A 60-day feeding trial was conducted in 12 units of cages measuring 1.0 x 1.0 x 1.5 m installed at South Sea AquaVenture Fishcage Project, Tiniguiban Cove, Puerto Princesa City, Palawan to determine the growth and survival rates of wild rabbitfish (*Siganus guttatus* Bloch) fed with formulated diets with protein levels ranging from 20% to 30% with 5% interval. "Lumut" (*Chaetomorpha* spp.) was also used as feed to serve as the control. Rabbitfish with a mean initial body weight ranging from 5.73±0.30g to 6.05+0.14g and mean total length from 8.11±0.18cm to 8.58±0.34cm., were randomly distributed at a stocking density of 20pcs/m^3. The stocks were fed at 10% body weight thrice daily.

The fish fed with 20 and 30% crude protein showed significantly higher FCR, final weight, and biomass than those fed with "lumut". Moreover, the FCE of rabbitfish fed with formulated diets was highly significant than those fed with "lumut". There were no significant differences in terms of K, weight gain, SGR and survival among treatments.

The better biomass, FCR and FCE obtained from treatments with formulated feeds suggest improved growth response of rabbitfish with high protein diet. It is recommended that a longer culture period and higher protein level be used on further study for optimum fish growth.

Keywords: *Siganus guttatus, rabbitfish, aquaculture, feeds and* feeding, cage culture

INTRODUCTION

Aquaculture became a growing industry in both local and global scale. Researches on fish nutrition aim to help support the aquaculture development in the production of high quality and healthy fish.

Protein is indispensable in fish nutrition. It comprises about 70% of the dry weight of fish muscle (Robinson and Li 2003). Protein is digested and broken down to its component amino acids basically for the body maintenance and growth of the

fish. The excess however can be converted to energy to fuel fish activity. It is very important therefore that the protein requirement of the cultured fish be determined accurately to attain fish optimal growth.

Rabbitfish (*Siganus guttatus* Bloch) belonging to family Siganidae, is one of the potential species for aquaculture in the Philippines. This species can be distinguished from other species of the same genus largely by its color pattern. Orange spots cover the entire body of the fish.

Duray (1998) cited that some rabbitfishes are traditionally farmed either monoculture or polyculture with milkfish in ponds in the Philippines. It can also be reared in floating cages and fed with commercial diets. Although siganids are primarily herbivores, some species are capable of omnivory (Lam 1974) as cited by Duray (1998).

The market value of rabbitfish is generally high. It can be a promising alternative to milkfish culture considering that milkfish fry from the wild is now declining. To encourage fish farmers to venture into culturing this species, a quality and well-balanced feed and cost effective diet must be developed.

The present study aimed to determine the growth and survival of rabbitfish (*Siganus guttatus* Bloch) fed at different protein levels and to calculate its feed utilization.

METHODOLOGY

Experimental diets

Diets with protein levels ranging from 20% to 30% with 5% interval were formulated at the Western Philippines University (WPU) freshwater hatchery in Puerto Princesa City.

The composition of the experimental diets is shown in Table 1. The formulated feeds were stored in an individual plastic bag and stored inside the

Table 1. Ingredients of the Experimental Diets.

Ingredients	Protein Level (%)			
(g/100 wet matter)	Control	20	25	30
Fish meal	0	1.6	14.1	26.6
Copra meal	0	93.4	80.9	68.4
Corn Meal	0	2.0	2.0	2.0
Rice bran	0	1.0	1.0	1.0
Bread flour	0	1.0	1.0	1.0
Vitamin-mineral mix	0	1.0	1.0	1.0

freezer (0°C). The natural food known as "lumut" (*Chaetomorpha* spp.) that serves as the control was collected from the water near the experimental site.

Experimental fish and treatments

Juvenile rabbitfish collected within Puerto Princesa Bay and conditioned at South Sea Aqua Venture fish cage project (Figure 1) were used in this study. Fish were subjected to feeding trial from August 19-October 19, 2004.

The 60-day feeding trial followed a Completely Randomized Design with three replicates per treatment. Fish were fed with natural food ("lumut") for Treatment I and with formulated diet at 20%, 25% and 30% protein levels for Treatments II, III and IV, respectively.

Fish stocking, rearing, and sampling

The 240 pieces of rabbitfish were randomly distributed into 12 units of cages measuring 1.0 x 1.0 x 1.5m installed at Tiniguiban Cove, Puerto Princesa City with a stocking density of 20pcs/m^3, mean initial body weight ranged from 5.73±0.30g to 6.05±0.14g and the mean total length from 8.11±0.18cm to 8.58±0.34cm.

One week prior to experiment, the fish were fed with a mixture of natural food and commercial feeds at 10% body weight thrice daily. Then the fish were given the experimental feed at the same feeding rate and frequency for 60 days.

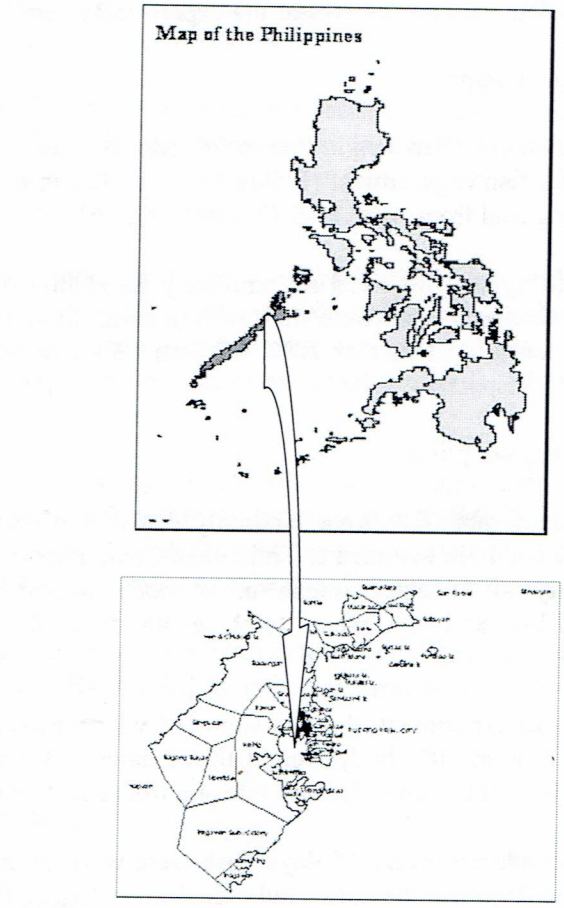
Sampling was conducted every 15 days. Fish were weighed in bulk during early samplings (1st and 2nd) but thereafter individual sampling of fish was done using Yamato weighing scale (100g capacity) and a measuring board for body weight and total body length measurement, respectively.

Water parameters

Water parameters such as dissolved oxygen, pH, temperature and salinity were determined using the portable dissolved oxygen analyzer, portable pH meter, laboratory thermometer and refractometer, respectively.

Statistical analysis

Weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR), condition factor (K), biomass, survival rate, and feed conversion efficiency (FCE) were calculated following Saitoh *et al.* (2003), Serrano and Apines (1996), and Bai *et al.* (1999). Comparison of treatment means for each trial was carried out



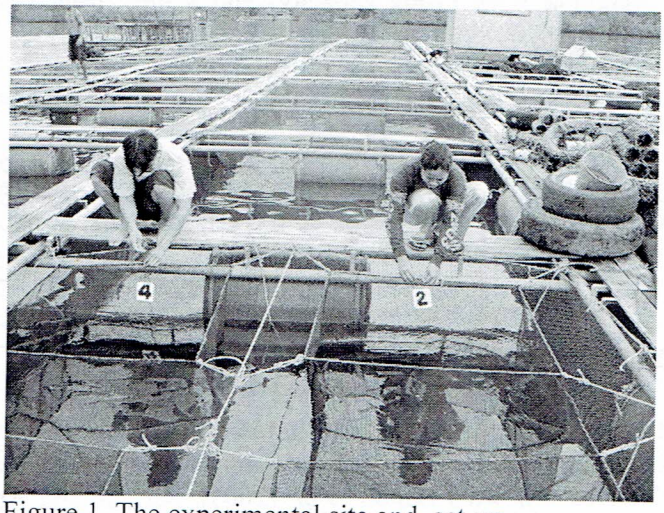


Figure 1. The experimental site and set-up.

using one-way Analysis of Variance. Duncan Multiple Range Test was used to determine differences between treatment means.

RESULTS AND DISCUSSION

Growth Performance and Survival

The performance of rabbitfish fed with various experimental diets for 60 days is shown in Table 2. The trend in growth as seen in average body weight of the species during entire culture period is in general increasing, however, a slight decrease is noticed for Treatment III (25% crude protein) as shown in Figure 2. This decreased can be attributed to the presence of a competitor inside the cage and the fish survival (88.33±7.64). No significant difference was recorded in terms of the fish total length (Tab. 2; Fig. 2).

Table 2. Growth performance of *Siganus guttatus* cultured in floating netcages.

	Treatments			
Indicator	I	II	III	IV
Feed Conversion Efficiency**	5.50±2.08^{c}	12.18±0.37^{a}	9.08±0.52^{b}	14.41±1.37^{a}
Feed Conversion Ratio*	0.34± 8.67^{a}	8.21±0.25^{b}	11.04±0.63^{b}	6.99±0.70^{b}
Initial Weight^{ns}	5.97± 0.39	6.05± 0.14	5.73±0.30	5.78±0.01
Final Weight*	9 630.40^{b}	10 530.46^{ab}	9 830.55^{b}	11 781.77^{a}
Final Total Length^{ns}	8.11± 0.18	8.38±0.12	8.17±0.07	8.58±0.34
K^{ns}	1.81± 0.07	1.79±0.01	1.80±0.09	1.85±0.08
Weight Gain^{ns}	3.67±0.74	4.47±0.28	4.10±0.85	5.99±1.82
SGR^{ns}	0.80±0.19	0.92±0.07	0.90±0.21	1.17±0.28
Biomass*	157.46±11.51^{c}	200.00±8.66^{a}	173.33±12.58^{bc}	192.78±24.29^{ab}
Survival^{ns}	81.67±2.89	95.00±00	88.33±7.64	88.33±5.77

ns – not significant; *-significant at .05; **- significant at .01
values within the same row not sharing common superscript letters are significantly different

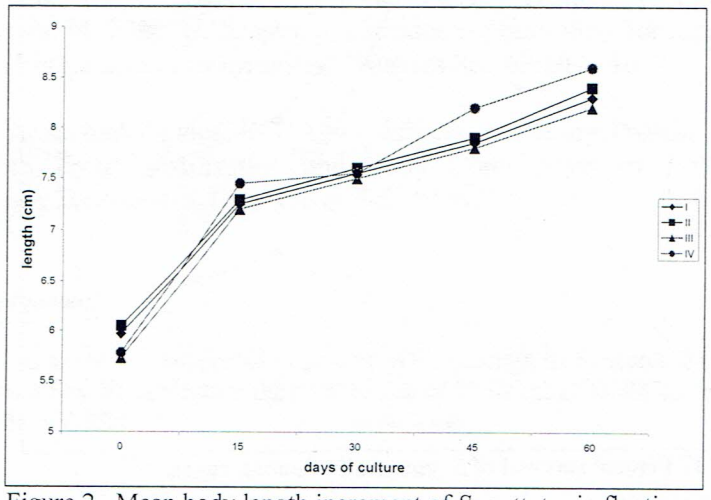


Figure 2. Mean body length increment of *S. guttatus* in floating cages.

Within 60-day culture period, the fish fed with 20 and 30% crude protein showed significantly higher ($p<0.05$) final weight, and biomass than those fed with "lumut". Moreover the FCE of fish fed with formulated feeds was significantly ($p<0.01$) better than those fed with "lumut". However no significant differences were observed in terms of K, weight gain, SGR, and survival among treatments.

Among the formulated diets, although not significantly different from the rest, the best growth performance was exhibited by the fish fed with highest level of protein (30%). This finding is in accordance with the observation of Perazo (1989) that the specific growth rate of juvenile *S. guttatus* increases with protein and energy levels. *Siganus guttatus* fed with "lumut" supplemented with 30% protein obtained highest weight gain in the pond (Ganzon-Naret 1991 as cited by Duray 1998).

From the results, the low biomass, FCR and FCE attained by fish fed with "lumut" can be explained by the observation of Tobias (1976) and Tsuda and Bryan (1973) as cited by Duray (1998) that the algal species consumed by the adult fish were rejected by the juveniles. Further, that "lumut" has a low protein digestion coefficient especially when fresh (Duray 1998) as the one used to feed the rabbitfish in this study. Further, Duray (1998) cited the observation of Westernhagen (1973b, 1974) that natural food is preferred by juvenile *S. guttatus* in the laboratory condition but take this only in small amount in nature.

Survival of fish ranged from 81.67±2.89 to 95.00±00 but not significantly different among treatments. Figure 3 indicated an almost similar trend among treatments wherein mortality started to occur only after 45 days of culture.

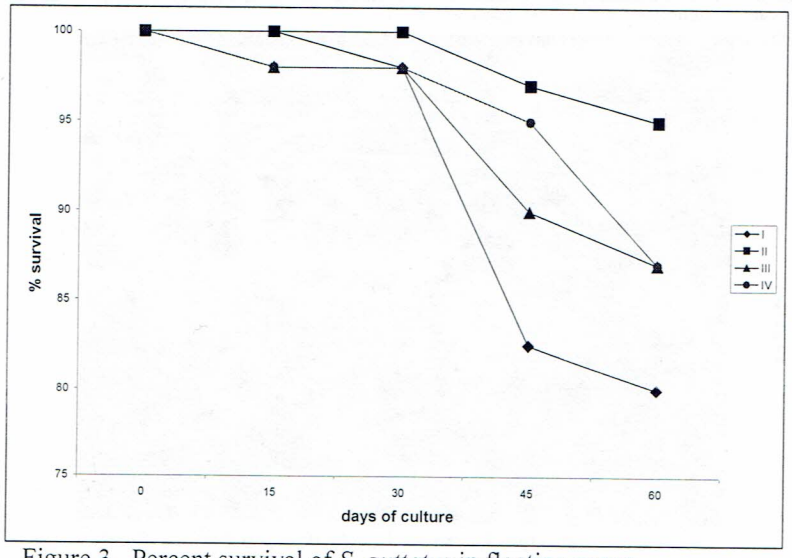


Figure 3. Percent survival of *S. guttatus* in floating cages.

According to Duray (1998) for cage culture of rabbitfish, the water temperature should be 28 to 32°C and salinity of 15 to 27ppt. For this study, water temperature range from 29 to 30°C. The salinity however is higher at 33 to 35ppt. The dissolved oxygen and pH of water in the study site are within the normal range for fish growth and survival, 6.4 to 7.5 and 7.4 to 8.6, respectively.

Results of this study indicated that juvenile rabbitfish growth performance is influenced by the level of crude protein in the diet. This study established better response of fish with 30% protein level. Compared with the other formulated diets used in this study, no significant differences were recorded in general, however, it is recommended that a longer culture period and higher protein level be used for further study to be able to determine the protein level for the optimum growth of rabbitfish.

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