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DIET DEVELOPMENT FOR MUD CRAB (*Scylla serrata*) AQUACULTURE USING LOCAL MATERIAL AVAILABLE IN CENTRAL JAVA

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ABSTRACT

Phase I study (1996/1997) indicated that the local protein materials at relatively low cost were found abundance in Central Java throught the year. Their nutritional levels i.e. protein content, amino acids profile and availability are suitable to be used for mud-crab feed development. It is therefore the selected protein materials such as : soybean, mysidaceae, trash fish and saga, are then subjected to the formulation of experimental diet for mud crab on-growing culture (Phase II study 1997/1998).

The aims of study are to determine the nutritional performance of experimental diets (novel diets) for mud-crab scylla *growth, food utilization and protein efficiency during the feeding trial. The study has been conducted in a 12 bamboo-cages of 1.0 x 0.5 x 0.70 m immersed in BW ponds at CZEL "Prof.Gatot Rahardjo JS - UNDIP", Jepara and the stocking density of wild mud-crab (50 - 60 gram) was 1 pieces/box (0.2 x 0.2 m). Experimental diet (pellet formed) consists of four treatments i.e. diet A (25% dietary protein level), diet B (30%), diet C (35%) and diet D (40%).*

The growth and nutritional parameters observed as response to the experimental diets tested are : Individual growth and growth increment, Specific Growth Rate (SGR), FCR, NPU and PER. The completely Randomize Design was adopted in this study and then followed by Duncan's New Multiple Range Test in order to determine the difference among the treatments.

The results derived from this study indicated that Diet C (dietary protein level of 35%) appeared to be the best diet wheather for the growth (W and SGR) or nutritional performance (FCR, PER and NPU) and followed by diet B, D and A. Meanwhile, during the course of feeding trial water quality of experimental media remain in good condition to support mud-crab growth.

Key wards : local protein materials, experimental diet, growth, food utilization and protein efficiency.

I. INTRODUCTION

Mud crab *(Scylla serrata)* is one of the important fisheries commodity which has recently been decided by Central Java Government that their cultured production level should be improved in the near future, since the demand either for domestic market or as an export commodity tends to increase from year to year. In spite of the big potential for mud crab aquaculture development in Central Java, there were some constrains faced by farmers such as the availability of a good quality feed in regular supply.

So far, the commercial mud-crab culture i.e. on-growing culture and fattening are mainly depending on the supply of trash fish as main food sources which is unefficient, less accurate and viable to water quality deterioration. It is, therefore, study on the mud crab feed development should be encouraged in the near future.

The results derived from Phase I (1996/1997) indicated that local protein sources (plant and animals origin) virtually found abundant in Central Java, contained high protein level (41.50% - 80.55%), available in several agriculture and fisheries production centre at low price. They are suitable to be used in making compound balance diet for on-growing mud-crab culture. It is, therefore, the experimental diet had been formulated using those local materials with approached on varying dietary protein level and different plant : animal protein ratio.

In this periode of study (Phase II 1997/1998), the experimental diets were fed to the mud crabs (feeding trial) which stocked in the bamboo-cage immersed in the brackishwater ponds. The expected outcome of this periode of study (1997/1998) are the best feed formulation using local protein materials (low cost input) and a good quality diets suitable for on-growing culture at low proce (cost effective diets). Ultimately, the production of mud-crab culture in Central Java will be improved accordingly. The aims of Phase II study (1997/1998) are to determine the nutritional performance of experimental diets formulated in Phase I study and their effects to the growth and survival rate of mud-crab *(Scylla serrata)*.

II. METHODOLOGY

Four experimental diets with varying dietary protein level (25%, 30%, 35% and 40%) at plant and animal protein ratio of 20% : 80% are adopted as treatments. They are : A (dietary protein level of 25%), B (30%), C (35%) and D (40%), where each treatment was replicated three times.

The experimental diets was formulated by using : trash fish meal, mysid meal, soybean meal, saga meal, squid oil, rice bran, lecithin, top mix and CMC. Composition of experimental diets and the nutrient contents in each diets (proximate analysis) can be seen in Appendix 1 and 2. Experimental animals used are mud crab *Scylla* obtained from the wild nature (mangrove forest) with the initial weight ranging from 50.0 to 60.0 gram. The experimental systems used for feeding trial was a 12 compartments of bamboo cage with size of 1.0 x 0.5 x 0.7 m. Each compartment containts a box of 0.20 x 0.20 x 0.20 m and it was stocked by one individual crab/box. The bamboo-cage had been immersed in

the brackishwater ponds at Coastal Zone Ecodevelopment Laboratory-Diponegoro University, Jepara.

The parameters observed as function to the treatments adopted are : W (absolute and growth increament), Specific Growth Rate (SGR%/day), FCR, NPU, PER and water quality parameters. The experimental design adopted was Completely Randomized Design (CRD) and analysed by ANACOVA and followed by the Duncan's New Multiple Range Test, in order to determine the difference among the treatments during the periode of feeding trial.

III. RESULTS AND DISCUSSIONS

The growth curve of individual mud-crab as function to the treatments adopted is presented in Fig. 1, meanwhile the Growth Increment of individual crab and its Specific Growth Rate (SGR%/day) are shown in Table 1 and 3; Fig. 2 and 3 as follows:

Table 1.

Growth increment data (gram) of individual mud crab as function to the experimental diets adopted during the feeding trial

Exp. Feeds	Growth			Total	Mean ± SD
	1	2	3		
A	21.50	22.11	16.33	59.94	$19.98^{a} \pm 2.59$
B	24.81	23.27	24.64	71.72	$23.91^{b} \pm 0.56$
C	31.98	29.45	30.43	91.86	$30.62^{c} \pm 1.04$
D	23.73	24.56	23.45	71.74	$24.01^{d} \pm 0.47$

Note : A : Dietary Protein Level of 25%
B : Dietary Protein Level of 30%
C : Dietary Protein Level of 35%
D : Dietary Protein Level of 40%

Table 2.

Analysis of Covariance of Growth Increment

Source	d.f	SS	MS	F cal.	F tabel	
					0.05	0.01
Error	7	21.3502	3.0500			
Treatment (adjusted)	3	146.2908	48.7636	15.9881**	4.35	8.45

Note : ** = highly significantly difference (P<0.01)

Table 3.

Specific Growth Rate (SGR%/day) of individual mud crab *Scylla* as function to the treatments adopted during the feeding trial

Exp. Feeds	SGR %/day			Total	Mean ± SD
	1	2	3		
A	0.61	0.62	0.49	1.71	$0.57^{a} \pm 0.060$
B	0.65	0.60	0.64	1.97	$0.66^{a} \pm 0.017$
C	0.84	0.78	0.83	2.45	$0.82^{b} \pm 0.026$
D	0.65	0.65	0.66	1.95	$0.65^{a} \pm 0.006$

Note : A : Dietary Protein Level of 25%
B : Dietary Protein Level of 30%
C : Dietary Protein Level of 35%
D : Dietary Protein Level of 40%

Table 4.

Analysis of Covariance of Specific Growth Rate

Source	d.f	SS	MS	F cal.	F tabel	
					0.05	0.01
Error	7	0.0123	0.0017			
Treatment (adjusted)	3	0.0759	0.0253	14.8823**	4.35	8.45

Note : ** = highly significantly difference (P<0.01)

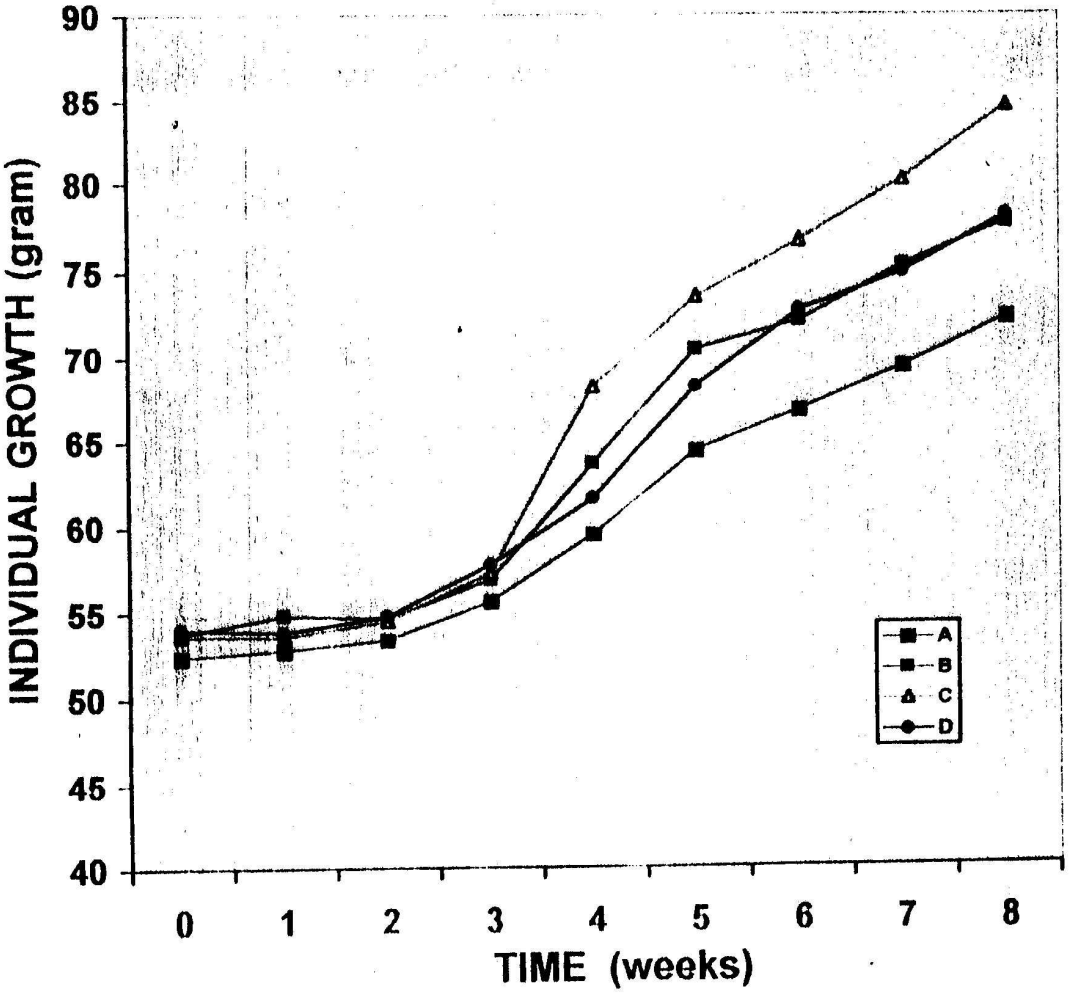

Fig. 1.

Individual Growth Curve (gram) of Mud-crab *Scylla* as Function of the Treatments during the Feeding trial

Note : A : Dietary Protein Level of 25%
B : Dietary Protein Level of 30%
C : Dietary Protein Level of 35%
D : Dietary Protein Level of 40%

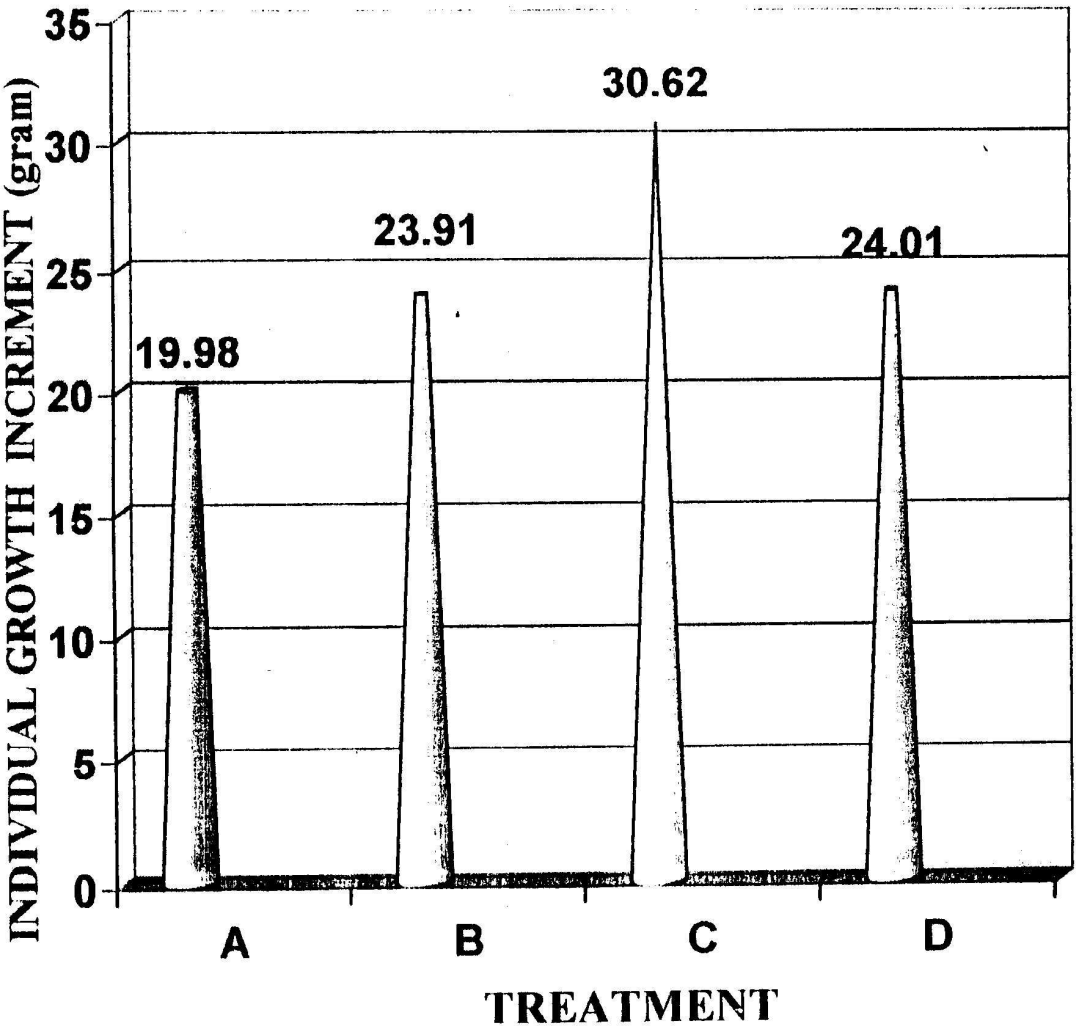

Fig. 2.

Growth Increment (gram) of the Individual Mud-crab as Function of the Treatment during the Feeding trial

Note : A : Dietary Protein Level of 25%
B : Dietary Protein Level of 30%
C : Dietary Protein Level of 35%
D : Dietary Protein Level of 40%

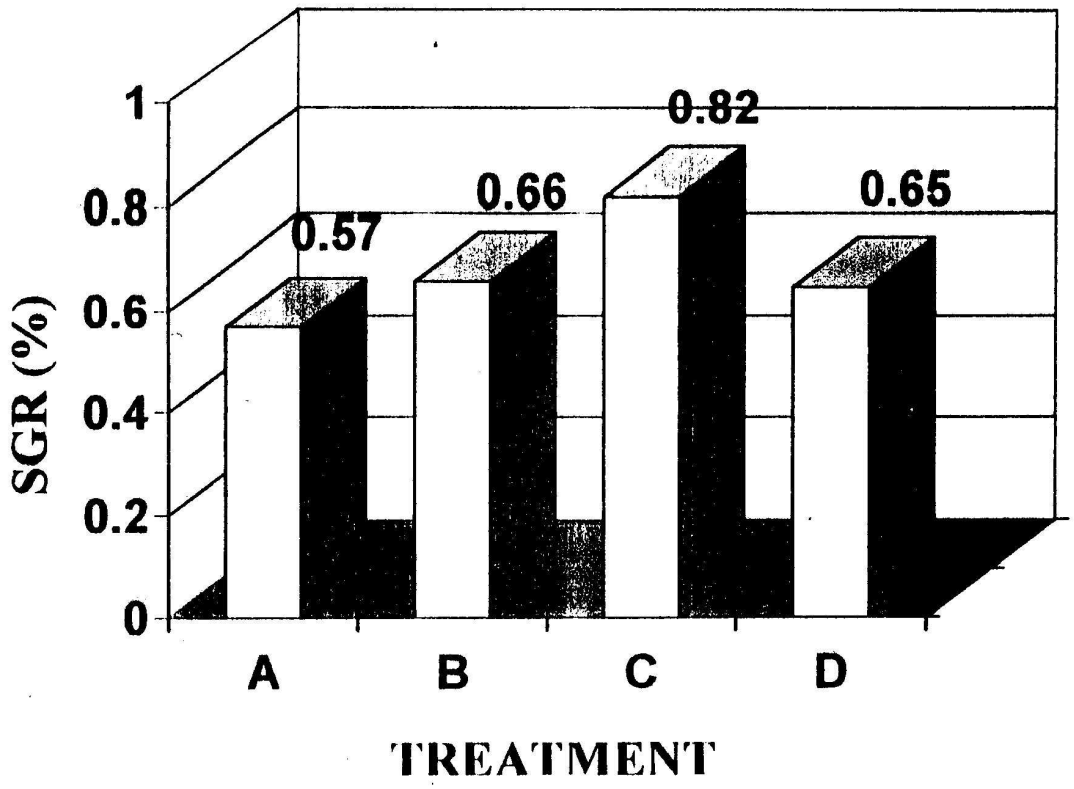

Fig. 3.

Specific Growth Rate (SGR %) of Individual Mud-crab as Function of the Treatments during the Feeding trial

Note : A : Dietary Protein Level of 25%
B : Dietary Protein Level of 30%
C : Dietary Protein Level of 35%
D : Dietary Protein Level of 40%

The data of Food Conversion Ratio (FCR), PER and NPU (%) are presented in Table 5 and Fig. 4 to 6.

Table 5.

Data of FCR, PER and NPU(%) as function to the treatments adopted during the feeding trial

Exp. Feed	FCR	PER	NPU (%)
A	3.44	0.44	13.82
B	2.41	0.41	16.12
C	1.91	0.46	20.16
D	2.30	0.32	18.14

Note : A : Dietary Protein Level of 25%
B : Dietary Protein Level of 30%
C : Dietary Protein Level of 35%
D : Dietary Protein Level of 40%

Table 6.

Data of water quality parameters

Parameter	Range	Reference
Temperature (°C)	26 - 30	26 - 32
Salinity (°/oo)	35 - 37	15 - 30
pH	7.5 - 8.3	7.5 - 8.5
Dissolved Oxygen (ppm)	5.4 - 5.9	6.0
Total Ammonia (ppm)	0.037 - 0.045	< 0.1
Nitrite (ppm)	0.18 - 0.20	< 0.5

*) Manual for Cultivation Technology of Mud crab *(Scylla serrata* Forskal) in Bracksihwater pond (BADC-dit.Gen. Fisheries-Jepara).

Water quality levels of media during the periode of study (feeding trial) are: Temperature (°C): 26 - 30; Salinity (°/oo): 35 - 37; pH: 7.5 - 8.3; DO (mg/L): 5.4 - 5.9; Ammonia (mg/L): 0.037 - 0.045; Nitrite (mg/L): 0.18 - 0.20.

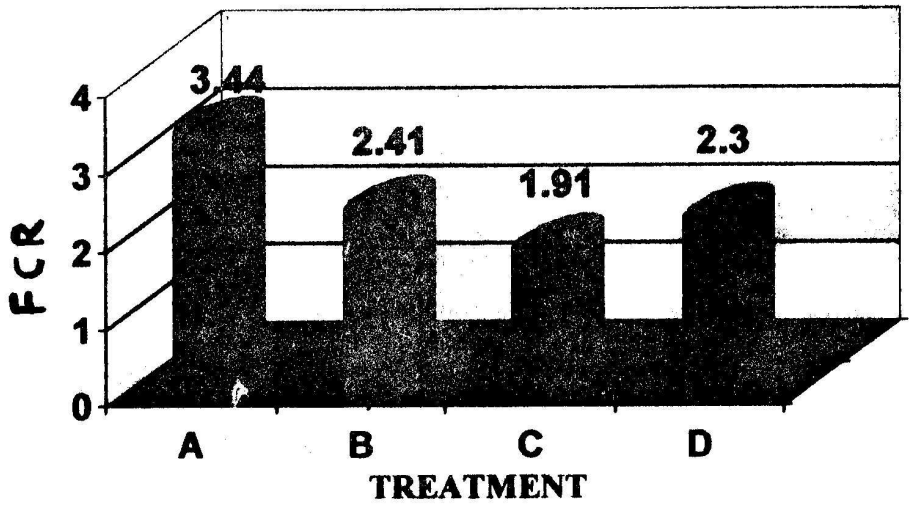

Fig. 4.

Food Conversion Ratio (FCR) as Function of the Treatments during the Feeding trial

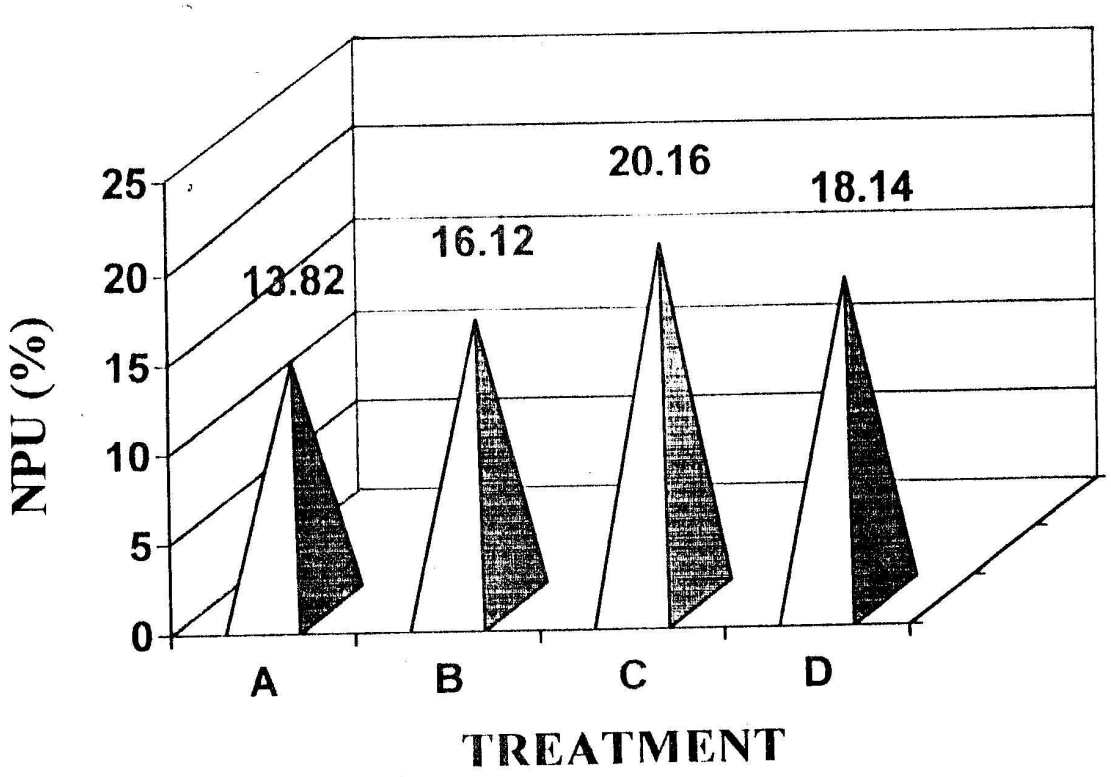

Fig. 5.

Net Protein Utilization (NPU %) as a Function of Treatment During the Feeding Trial

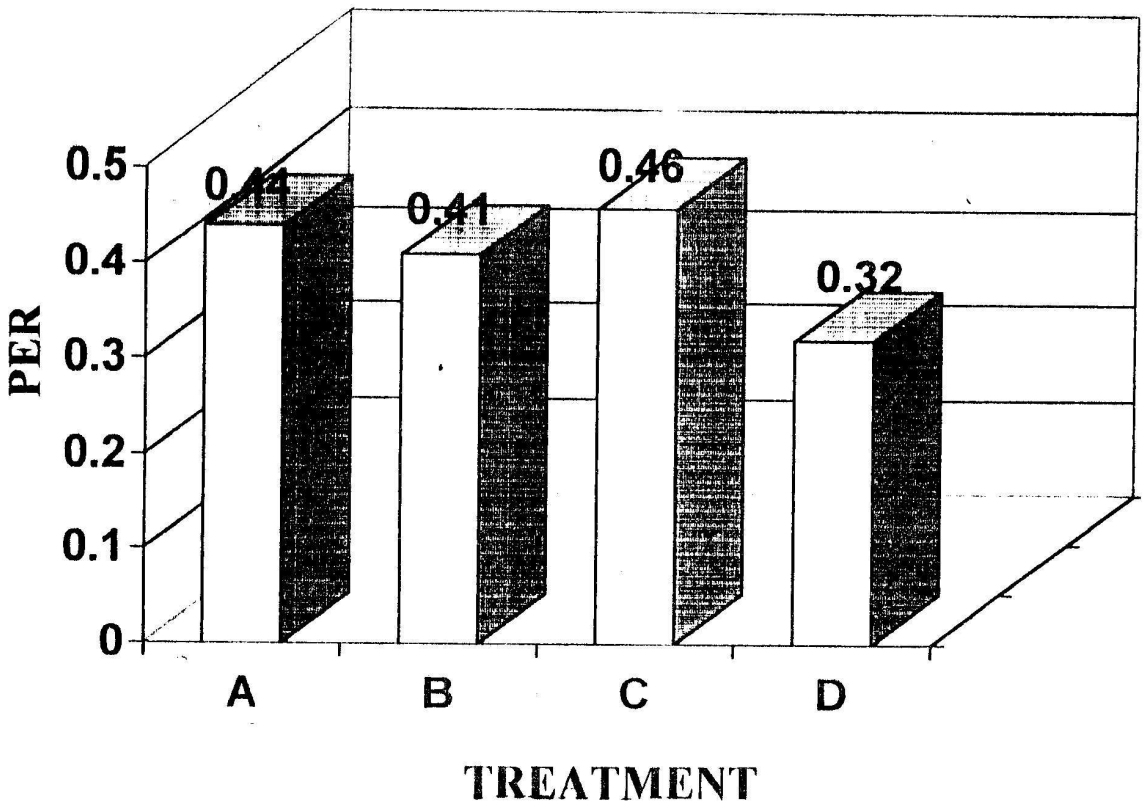

Fig. 6.

Protein Efficiency Ratio (PER) as a Function of Treatments During the Feeding Trial

The results of this study indicated that the feed formulation C (dietary protein level of 35%) appeared to be the best diet for mud-crab growth (W and SGR) and the best feed utilization and protein efficiency (FCR, PER, NPU) for on-growing culture. This is in agreement with Kasry et al (1991) and Djuwito et al (1992) which were stated that the level of dietary protein requirement for on-growing mud-crab culture should be ranging from 30% to 35%. Although the best growth of mud-crab during feeding trial was achieved by diet C (30.62 grams; 0.82 %/day), but, in general, it can be noticed that the growth rate of mud crab was still under expectation for mud crab on-growing culture. According to Gunarto et al (1987) he found that mud crab fed on fresh trash fish during fattening culture, the minimum growth rate was more than 0,82% per day.

This might due to the case that the mud crabs were not ready to consume the pelleted feed. Based on the intense observation during the course of study, it found that the mud crab requires two or three weeks for

feed adaption, before they really begin to consume the experimental diets given. It reflected to the FCR values (1.91 - 3.44) during feeding trial. The lowest FCR value (1.91) was performing by diet C, it might be due to the fact that the moisture content has been found in feed C (6.76%), so that the feed efficiency tend to increase. HutaBarat (1984) stated that the lowest moisture content in the feed, the more efficient feed consumed by the cultivan would be, since the feed will easily concentrated and hardly to break down.

In addition, the salinity level of culture media during the course of study was slightly higher (ranging from 35-37°/$_{oo}$) compared to the optimal salinity level required for mud crab growth as stated in reference (15-13 °/$_{oo}$). It is, therefore the growth rate of individual mud crab was lower due to hyperosmotic pressure coming from culture media. Meanwhile, the other water quality parameters (temperature, pH, DO, total ammonia and nitrite) are remain in the optimal range for mud crab growth as stated in reference (see Table 6).

PER and NPU values of each experimental diet were ranging from 0.32-0.46 and 13.86-20.16%, respectively. Protein efficiency by mud crab depends entirely on the essensial amino acids profile and availability in the feed. If the essensial amino acids requirements has been sufficiently supplied by feeds, the protein available in the feed will be more efficiently utilized by mud crab (indicated by increasing PER and NPU values) (Mazid et al, 1976; Oberst, 1984; Hutabarat, 1984). This phenomenon might be the case for diet C, that is mhy it was appeared to be the best feed during the course of feeding trial.

It is, therefore, suggested that the dietary protein level in the diet for on-growing mud crab culture should be about 35%. The study will be continued in the near future by using different local protein sources at different plant: animal protein ratio and varying initial weight of mud crab.

IV. CONCLUSIONS

The use of local protein sources : trash fish, mysid, soybean, saga, rice bran combined with squid oil, lecithin, top mix and CMC in the experimental diets had significantly affected to the growth, food utilization and protein efficiency of mud crab *Scylla serrata*.

Feed formulation of Diet C (dietary protein level of 35%) appeared to be the best diet for on-growing culture.

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Appendix 1. Composition of Ingredients in Experimental Diets (in 100 gram)

Ingredients	Exeperimental Diets (%)			
	A	B	C	D
Trashfish meal	14.50	17.41	20.31	23.21
Mysid meal	16.32	19.58	22.84	26.11
Soybean meal	6.39	7.67	8.94	10.22
Saga meal	9.33	11.20	13.06	14.93
Rice bran	47.46	38.25	28.84	19.53
Squid oil	2.00	2.00	2.00	2.00
Lechitin	1.00	1.00	1.00	1.00
Top mix	2.00	2.00	2.00	2.00
CMC	1.00	1.00	1.00	1.00

Appendix 2. Proximate Analysis of Experimental Diets

Diet	Nutrient Composition (%)						Total Energie (Kcal/gr)	P : E Ratio mg.prot/Kcal
	Moist.	C. Prot	C.Lp	NFE	C.Fibre	Ash		
A	7.52	25.36	7.90	43.85	7.31	8.06	3977.24	145.03
B	7.90	30.12	8.76	38.79	6.74	7.69	4120.00	125.98
C	6.78	34.23	7.92	37.18	6.02	7.87	4206.81	114.59
D	7.30	39.58	6.84	37.70	3.14	5.17	4428.35	103.72