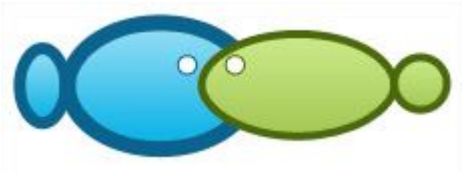

Growth performance and survival rate of climbing perch (*Anabas testudineus*) fed *Daphnia* sp. enriched with manure, coconut dregs flour and soybean meal

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Abstract. The objective of the present study was to determine the best material for enhancing nutritional value of *Daphnia* fed to climbing perch (*Anabas testudineus*) larvae. The study was conducted at Laboratory of Marine and Fishery Faculty, Syiah Kuala University, Indonesia in July 2015. The completely randomized design was used, this study was conducted with three enhancer materials; chicken manure, coconut dregs and soybean meals. The Annova test showed that the treatment gave a significant effect on specific growth rate, weight and length gains ($p < 0.05$), but did not give a significant effect on survival rate of climbing perch larvae ($p > 0.05$). The highest growth performance was found at fish fed with *Daphnia* enhanced by soybean meals. Hence, it is concluded that the best enrichment material of *Daphnia* for climbing perch larvae is soybean meal.
Key Words: Kruep, betok, specific growth rate, weight gain, *Daphnia*.

Introduction. Climbing perch (*Anabas testudineus*) or locally known as kruep fish are living in freshwater, they can live in waters with low oxygen levels because they have an additional respiratory organ called labyrinth (Hughes et al 1986). This species commonly occurres in Aceh waters, Indonesia (Muchlisin & Siti-Azizah 2009; Muchlisin et al 2015). The climbing perch has thick flesh, delicate and tastes savory so favored by the local people, and therefore this fish has potency as a fish target for aquaculture (Muchlisin 2013). Presently, the kruep fish supply are mostly from wild, this is because culture system has not well developed. Intensive fishing on climbing perch gave a negative impact in decreasing of wild population of this species (Personal communication with fisheries local authority). Therefore, the catching climbing perch from wild population has to be stopped and the fisher has to switch their business to aquaculture, and therefore the hatchery technology of climbing perch has to be initiated to support the fish farming of this favorite fish in the future. Larval rearing is an important aspect in relation to producing the high quality and quantity of fish larvae.

Daphnia is one of common live feeds for fish larvae. This live feed contains 20-27% lipid and up to 70% protein (Pangkey 2009). The nutrient content of *Daphnia* is possible to be improved by feeding it the high nutritional materials. This technique is commonly known as enrichment method with the objective to increase the nutritious value of live feed and would give a positive effect on growth performance and survival of the fish larvae (Mufidah et al 2009). Several materials have been used as enrichment materials for *Daphnia* such as canola oil (Fereidouni et al 2013), n-3 HUFA (Gholomi 2010), potassium (Civitello et al 2014). Other promising materials are soybean meal and coconut dregs meal. The coconut dreg has 14.54% protein, while the soybean meal has approximately 53.44% protein (Aprilian 2014). These materials have not been used as enrichment in daphnia for climbing perch larvae live feed. Hence, the objective of the

present study was to find the best materials for enhancing the nutrient content of *Daphnia* to boost the growth performance of climbing perch larvae.

Material and Method. The study was conducted at Integrated Laboratory of Faculty of Marine and Fisheries, Syiah Kuala University, Indonesia in July 2015. The completely randomized design with three treatment levels were used in this study, and every treatment has three replicates. The tested treatments were: (A) *Daphnia* enriched with manure, (B) *Daphnia* enriched with coconut dregs flour, (C) *Daphnia* enriched with soybean meals.

Daphnia culture. The daphnia were collected from Brackishwater Aquaculture Station of Ujung Batee (BBAP Ujung Batee) in Aceh Besar District. The *Daphnia* were cultured with coconut dregs flour, manure, and soybean meal at doses of 3.5 g L^{-1} in three different plastic tanks. A total of 500 mature *Daphnia* were stocked into the culture basins. The supplementary enrichment was applied two days interval at the same doses. The *Daphnia* were initially harvested seven days after cultured and subsequent harvesting was done every day of feeding.

Experimental fish and feeding trial. The climbing perch larvae were purchased from Freshwater Hatchery in Jantho, Aceh Besar District with average weight and length of 0.06 g and 4.06 cm, respectively. The fish were reared in plastic tanks (40 cm x 25 cm x 20 cm) at stocking density of 15 fish each tank. The experimental fish were fed with *Daphnia* ad libitum three times a day on 08.00 AM, 02.00 AM and 06.00 AM for 15 days. The feces were siphoned two hours after feeding and water level was maintained about 20 cm in the tank.

Proximate analysis. The harvested daphnia were subjected to proximate analysis (protein, lipid and ash contents) prior to feed for the experimental fish. The proximate analysis were performed using standard procedure proposed by AOAC (1991), this analysis were conducted in Bio Chemistry Laboratory, Faculty of Agriculture, Syiah Kuala University.

Measured parameters. The weight and total length gains were calculated as follow: L = Lt – Lo, where L is length gain (mm), Lo is the average length of fish at start of experiment (mm), Lt is the average of fish at the end of experiment (mm).

The weight gain was calculated as follow: W = Wt – Wo, while W is weight gain (g), Wo is the average weight of fish at start of experiment (g), Wt is the average weight of fish at the end of experiment (g). While the specific growth rate was calculated based on De Silva & Anderson (1995) as follows:

$$\mathbf{SGR} = \frac{[\mathrm{Ln}(\mathbf{W}]_t) - \mathrm{Ln}[(\mathbf{W}]_o)}{(\mathbf{t})}$$

Where, SGR = specific growth rate (% day^{-1}), Wo is the average weight of fish at start of experiment (g), Wt is the average weight of fish at the end of experiment (g), t is feeding duration (day).

Survival rate was calculated based on Muchlisin et al (2016) as follow: SR = $(N_o - N_t)/N_0$ x 100, where SR is survival rate (%), N_t is total number of death during the experiment, N_o is total number of fish at start of experiment.

The water quality (dissolved oxygen, pH and temperature) were measured one week interval at morning (09.00 AM) and afternoon (06.00 PM).

Data analysis. The growth performance and survival rate data were subjected to one way analysis of varian (One-way ANOVA) following with a Duncan's multirange test at 5% errors level using SPSS version 16 (Sofyan & Werwatz 2001).

Results and Dicussion. The study revealed that the average weight gain ranged from 0.044 g to 0.083 g, length gain ranged from 3.01 mm to 3.25 mm and specific growth rate ranged between 3.87% day^{-1} to 5.86% day^{-1}, while the survival rate reached 100%

at every treatment (Table 1). The Anova test showed that the feeding treatment gave a significant effect on weight gain and specific growth rate ($p < 0.05$), but did not give a significant effect on length gain and survival rate ($p > 0.05$). The Duncan's test showed that the higher weight gain and specific growth rate were recorded at treatment C (fish fed with daphnia enriched with soybean meals), these values were significantly different with other treatments, the total length gain was also recorded at treatment C, but this value was not significantly different with other treatments. Therefore, the results showed that the fish fed daphnia enriched with soybean meals gave the better results compared to other treatments.

The dissolved oxygen ranged between 4.5-5.0 mg L^{-1}, water temperature was 26-28^{o}C, and pH was 6-7. These values are suitable for fish in general (Boyd 1998). The proximate analysis of cultured *Daphnia* showed that the higher protein content was found in *Daphnia* enriched with soybean meal, while the higher lipid and fiber contents were recorded in coconut dregs flour (Table 2).

Table 1

The weight gain, length gain, specific growth rate and survival rate of climbing perch (*Anabas testudineus*) fed *Daphnia* enriched with coconout dregs flours, soybean meals and manure for 15 days of feeding trial. Mean±SD with different superscript at same column are significantly different ($p < 0.05$)

Treatment	*Weight gain (g)*	*Total length gain (mm)*	*Specific growth rate (% day^{-1})*	*Survival rate (%)*
A	0.044 ± 0.01^{a}	3.01 ± 0.07^{a}	3.87 ± 0.46^{a}	100^{a}
B	0.048 ± 0.01^{a}	3.07 ± 0.02^{a}	4.01 ± 0.82^{a}	100^{a}
C	0.083 ± 0.01^{b}	3.09 ± 0.07^{a}	5.58 ± 0.82^{b}	100^{a}

Note: A = *Daphnia* enriched with manure, B = *Daphnia* enriched with coconut dregs flour, C = *Daphnia* enriched with soybean meals.

Table 2

The protein, lipid and fiber contents of daphnia enriched with several materials

Treatment	*Crude protein (%)*	*Crude lipid (%)*	*Fiber (%)*
A	11.2	18.41	6.24
B	17.4	29.61	13.77
C	68.4	17.44	12.33

Note: A = *Daphnia* enriched with manure, B = *Daphnia* enriched with coconut dregs flour, C = *Daphnia* enriched with soybean meals.

The study revealed that the better growth performance was recorded at fish fed *Daphnia* enriched with soybean meal. In general, the growth performance and survival rate of climbing perch in this study were higher compared to climbing perch fed an artificial feed containing pineapple stems extract (Masniar et al 2016). In addition, the growth performance of climbing perch in this experiment was also higher compared to African catfish (*Clarias gariepinus*) fed *Daphnia* enriched with viterna (Mufidah et al 2009). The higher growth performance in fish fed *Daphnia* enriched with soybean meal is probably due to the higher protein content in *Daphnia* cultured with this material, where the crude protein content was reached, 68.4%. Moreover, the higher protein content in *Daphnia* at this experiment is probably related to protein content in the enrichment material where the soybean meal has higher protein content compared to coconut dregs flour. According to Aprilian (2014) the soybean meal has 53.44% protein and 18% lipid, while the coconut dregs flour has 14.54% protein and 23.36% lipid.

The study showed that the higher growth performance was recorded at fish fed with higher protein content, this is an indication that the growth performance of climbing perch was much affected by protein content of the diet, and not much affected by lipid content, for example the *Daphnia* enriched with coconut dregs flour has higher crude lipid content (29.61%), but the growth performance of fish in this treatment was lower compared to fish fed *Daphnia* enriched with soybean meal which had 17.44% crude lipid.

Climbing perch is a carnivorous fish and according to Palinggi et al (2002) the carnivorous fish requires higher protein content compared to herbivorous fish, this fish has ability to digest feed with higher protein contents effectively. Besides, the nutritious requirement of fish varied from species to species, this is strong related to the ability of fish to digest the feed materials (Melianawati & Imanto 2004). This study indicates that the climbing perch is not much effective to digest feed with higher lipid and fiber contents. In addition, the survival rate at all treatments reached 100%, these values were higher compared to seurukan fish (*Osteochillus vittatus*) fed a similar feed (Khairul 2015).

Beside nutritious factor, the growth performance and survival rate of fish are affected by environmental factors such water quality. The results showed that main water quality parameters (dissolved oxygen, pH and temperature) are at the optimum level for fish (De Silva & Anderson 1995).

Conclusions. The enrichment materials of *Daphnia* gave the significant effect on growth performance of climbing perch, but did not give a significant effect on survival rate. The highest growth performance was recorded in fish fed *Daphnia* enriched with soybean meal. It is concluded that the best *Daphnia* enrichment material for climbing perch larvae was soybean meal.

Acknowledgements. Authors are grateful to Department of Aquaculture Syiah Kuala University and all people who does not mention in this paper.

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Received: 22 August 2016. Accepted: 09 September 2016. Published online: 17 September 2016.
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How to cite this article:
Putra D. F., Fanni M., Muchlisin Z. A., Muhammadar A. A., 2016 Growth performance and survival rate of climbing perch (*Anabas testudineus*) fed *Daphnia* sp. enriched with manure, coconut dregs flour and soybean meal. AACL Bioflux 9(5):944-948.