Addition of crude fish oil (CFO) in feed toward fat and energy retention of mud crab (*Scylla serrata*)

S Hadijah¹, Agustono*, W P Lokapirnasari²

¹Program Study of Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Kampus C Jalan Mulyorejo, Surabaya 60115 East Java, Indonesia
²Department of Fish Health Management and Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Kampus C Jalan Mulyorejo, Surabaya 60115 East Java, Indonesia
³Faculty of Veterinary Medicine, Universitas Airlangga, Kampus C Jalan Mulyorejo, Surabaya 60115 East Java, Indonesia

*Corresponding author: agustono@fpk.unair.ac.id

Abstract. Mud crab (*Scylla serrata*) is a brackish water organism that has quite big market potential because it has tasty flavour and high nutrition. Natural feed of mud crab is trash fish, one of the example is kuniran fish that has 15.43% of protein, 0.46% of fat, 84.29% of water, and 0.77% of ash. Crab needed 4.8-10.8% fat in feed, but kuniran fish has 0.46% fat, so it needs the additional of fat. Fat is very important to support fish growth rate. Fat is needed as an energy source to maintain the body and tissue function. Therefore it is needed the addition of fish oil as one of fatty acids source that have 55.8791% ether extract, 10.7173% omega-3 fatty acids EPA, and 7.0108% DHA. The aims is to know the addition of Crude Fish Oil (CFO) in feed affects fat and energy retention of mud crab. The methods was experimental methods with randomly complete design which consists of five treatments and four repititions. The treatments used 0%, 2%, 4%, 6% and 8% as the addition of CFO in feed. Data analyzed by statistic and descriptive. Result showed that fat and energy retention for each treatments has no significantly different (p>0.05).

1. Introduction
Aquaculture development is more directed towards high economic fish, while in Indonesian there are still many brackish water biota that can be developed and have high economic value, one of them is mud crab. According to Pramudya *et al.* [1] mud crab (*Scylla serrata*) has a wide enough market potential in the country and abroad, this is because mud crab (*Scylla serrata*) has a delicious taste with highly nutritious.

Aslamyah and Fujaya [2] stated that mud crabs have nutritional content that is 30% of ash, 37.6% of protein, 6.34% of fat, 10.8% of crude fiber, 14.36% of Extraction Material without Nitrogen (BETN), and 11.42 mg / g of glycogen muscle. The natural feed of mud crabs is trash fish, for example is turmeric fish which has a nutritional content of protein is 15.43%, 0.46% of fat, 84.29% of water, and 0.77% of ash [3]. The need for fat in crab feed is 4.8-10.8% [4], but turmeric fish has 0.46% of fat so it requires the additional of fat.
The use of fat in fish feed is very important in supporting the growth rate of fish. Fat retention is a comparison between the amount of fat stored in the form of tissue in the fish body and the amount of fat consumed. Fish need fat as an energy source, and to maintain the shape and functions of the tissue. Energy retention is a comparison between the amount of energy stored in the form of tissue in a fish body and the amount of energy in food consumed [5]. This has led to increased production costs for the supply of feed that requires efficient fat content, therefore, that should be made to add fish oil. Crude Fish Oil (CFO) analysis results showed a crude fat content of 55.8791%, 10.7173% of omega-3 fatty acids EPA, and 7.0108% of DHA [6]. The fat content in fish oil is expected to affect the fat and energy retention of crab meat on the addition of natural crab feed.

2. Materials and methods

2.1 Place and time
The research was carried out at the Educational Laboratory, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya. Proximate analysis of feed raw materials and crabs was carried out at the Feed Laboratory, Faculty of Veterinary Medicine, Universitas Airlangga. This research was conducted in March - July 2016.

2.2 Tools and materials
The tools that used in this research are 60 aquariums, siphons, aerators, aerated hoses, 60 aeration stones, large plastic tubs, measuring cups, digital scales, pH test kits, thermometers, DO test kits and ammonia test kits, reservoirs, spoons, calipers, strainer, chopper, tray, knife, flatbed and measuring pipette. The materials that used in this research are 50-75 gram mud crab, 2.5 liter of brackish water, turmeric trash fish, tapioca flour and Crude Fish Oil (CFO).

2.3 Work procedures
The preparation of this research is by cleaning the equipment that will be used. Brackish water previously carried out by giving aeration in order to increase dissolved oxygen and eliminate chemicals that are not allowed. Equipment used in the form of aquarium maintenance, plastic barrels and wash basins are washed using soap rinsed and dried. Dry aquariums are filled with brackish water in each aquarium. After conditioning the aquarium, water aeration is carried out for 1x24 hours to increase dissolved oxygen and eliminate the unwanted chemicals that are still present in the aquarium. Then, the mud crabs that have been prepared are put into the aquarium and fasted for one day to eliminate the influence of the feed given previously. Mangrove crabs are kept in an aquarium with a size of 25x20x30 cm3 for 1 crab for 35 days.

The food that used in this research is trash fish. The trash fish is a type of turtle which is taken for the purpose of driving and crushed using a chopper. Next, Crude Fish Oil (CFO) and binder with flour were replaced with the same effect as treatment in trash fish. Crated feeds that have been added with Crude Fish Oils and flour are still in the oven at a temperature of 45-50°C for 1 hour before being given to the mud crabs. Giving the maneuver twice a day at 09.00 and 16.00 with a dose of 5% of body weight every day [7]. This is dependent on the results of Hartono [8] research that provides feed intake with a dose of 5% of the body weight will provide the optimal growth. As long as maintenance is carried out on the dishwasher to clean the remaining feed and impurities.

2.4 Research parameters
The main parameters measured were fat and energy retention. Supporting parameters in this study are water quality and heavy growth of mud crabs.

2.5 Data analysis
Research data were analyzed statistically. The analysis used the ANOVA test. Overall statistical analysis was carried out with the SPSS 16 program for windows. ANOVA analysis was used to
determine the effect of using Crude Fish Oil (CFO) on fat and energy retention of mangrove crabs (*Scylla serrata*).

### 3. Result and Discussion

#### 3.1 Fat Retention

The results of the average retention of mud crab fat can be seen in Table 1. The results of statistical tests show that the addition of Crude Fish Oil (CFO) that are not significantly different (p> 0.05) between the treatments of the fat retention value in mud crabs (*Scylla serrata*).

| Treatment | Retention Fat (%) ± SD | Transformation √Y (%) ± SD |
|-----------|------------------------|--------------------------|
| A (Control) | 3.94 ± 2.10            | 1.93 ± 0.52              |
| B (CFO 2%) C | 1.02 ± 0.31            | 0.98 ± 0.27              |
| (CFO 4%) D  | 2.56 ± 1.96            | 1.54 ± 0.63              |
| (CFO 6%) E  | 7.43 ± 8.49            | 2.39 ± 1.52              |
| (CFO 8%)    | 4.06 ± 4.37            | 1.83 ± 1.03              |

Description: Range in the same column showed no significant difference (p> 0.05).

Fat retention describes the ability of fish to store and utilize dietary fat. Calculation of fat retention values showed no significant difference from the results of the addition of Crude Fish Oil (CFO) in experimental treatment feed, but treatment B (CFO 2%) had a low value but did not differ from treatment A (CFO 0%), C (CFO 4%), D (CFO 6%), E (CFO 8%). The value change of fat retention occur in accordance with the increase in feed consumed, growth and addition of the amount of CFO that added to the feed. Lipids contained in food will be digested and absorbed in the digestive organs and transported to cells for storage or use [9]. The result of digestive enzymes is inserted into the posterior part and ends in the tubules of the hepatopancreas to be further digested and absorbed [10].

The low fat content in mangrove crab meat can be concluded that, the feed consumed is the lowest, so that the fat absorbed from the digestive process is used by crabs as an energy source and other metabolic processes. The stored lipids are transported to several organs and tissues for a certain time. Fat from feed is used for energy and maximizes protein for growth [11].

The high fat retention content in treatment D (CFO 6%) is thought to be caused by the lipase enzyme whose task to hydrolyze fat is limited in number, so that fat absorption cannot be carried out maximally which will cause the remaining amount of fat to be retained more. The high fat consumed by fish and which is not used as an energy source is then stored as body fat. This is in accordance with the opinion of Aslamyah [12] which says that one of the functions of fat or lipids is an energy producer, each gram of lipid produces about 9-9.3 calories, excessive energy in the body is stored in adipose tissue as potential energy.

The experimental results show a tendency to decrease the percentage of fat retention in line with the lack of feed consumed, the provision of low feed fat and body weight gain that is not maximal, not in accordance with Riyadhi's statement [10] that the decrease in the percentage of fat retention is in line with the increase in feed fat content in vaname shrimp.

#### 3.2 Energy Retention

The average results of mangrove crab energy retention are shown in Table 2. Statistical test results show that the addition of Crude Fish Oil (CFO) that are not significantly different (p> 0.05) between treatments for the value of energy retention in mud crabs (*Scylla serrata*).

| Treatment | Energy retention (%) ± SD | Transformation √Y (%) ± SD |
|-----------|--------------------------|--------------------------|

Table 2. Average energy retention (%) of mud crab (*Scylla serrata*) in treatment for 32 days.
The low energy content in the mud crab meat (A or CFO 0%) can be concluded that, fat in the feed absorbed from the digestive process is used by crab as an energy source in accordance with Riyadhi [10] that the results of breaking up the feed fat is absorbed by shrimp as an energy process and other metabolic processes.

Subekti [5] stated that normal energy retention is 60-68%, while the results of research are smaller. This happens because the energy produced is expended by the body in the form of heat. According to Ville and Barnes (1988) in Subekti [5] stored energy can be used in the synthesis of cell components and used as fuel for the production of cell energy.

Fat is one of the energy sources in feed, this is in accordance with the opinion of Aslamyah [11] that feed containing fat, protein and carbohydrates as an energy source. Addition of fat and carbohydrate content in feed as an energy source, so that feed protein can be more efficient in metabolism, cell or damaged tissue, reproductive activity, biosynthesis and growth. This is supported by Komariyah and Setiawan [13] the use of fat as an energy source is actually only as a "protein sparing", fat has a function to replace protein as an energy source, so that the use of protein can be saved to maximize growth.

Energy retention is the calculation result of body energy levels with body weight. Calculation of the weight growth showed no significant difference from the results of the addition of Crude Fish Oil (CFO) in the experimental treatment feed, treatment B (CFO 2%) had a low value, but did not differ from treatment A (CFO 0%), D (CFO 6%), E (CFO 8%), C (CFO 4%). Low energy content in mud crab meat (A or CFO 0%) can be concluded that, fat in the food absorbed from the digestive process is used as an energy source in crabs, in accordance with Riyadhi [10] that the results of the breakdown of feed fat is absorbed by shrimp as an energy process and other metabolic processes.

### 3.3 Water quality
Water quality is an important supporting factor in fish farming. Water quality that measured in this research are salinity, pH, temperature, Dissolved oxygen (DO) and ammonia. The average yield of mud crabs energy retention can be seen in Table 3.

#### Table 3. Average range of water quality maintenance in mud crab (*Scylla serrata*) for 32 days

| Treatment | Water Quality Data |
|-----------|--------------------|
|           | Salinity (ppt) | pH | Temperature (oC) | DO (ppm) | Ammonia (ppm) |
| A         | 15-21           | 7.5-8.5 | 28-29       | 4        | 0.09 to 0.27  |
| B         | 16-19           | 7.5 to 8  | 28-29      | 4        | 0.09            |
| C         | 16-21           | 8 to 8.5  | 28-29      | 4        | 0.09 to 0.27  |
| D         | 15-20           | 8 to 8.5  | 28-29      | 4        | 0.09 to 0.27  |
| E         | 16-21           | 8 to 9.0  | 28-29      | 4        | 0.09 to 0.27  |
3.3.1 Salinity
Examination of water salinity levels in this research showed a stable salinity condition between 15-21 ppt according to Anon [14] statement that the optimum salinity for maintenance mud crabs is 10-25 ppt. Maintenance water salinity is adjusted to original salinity to avoid stress on crabs resulting in changes in water salinity.

3.3.2 pH
The pH of water during in this research was in the range of 7.5-9 according to optimal water quality [15]. Water maintenance conditions are stable so that no large pH fluctuations occur. Daily fluctuations in pH values describe the dynamics of water chemical processes involving photosynthesis, decomposition or changes in water composition from external influences [15].

3.3.3 Temperature
The maintenance of water temperature was in the range of 28-29°C, the temperature range did not have much effect on the appetite of crabs. A temperature of 25-35°C can reduce the appetite of crabs and begin to inhibit the crabs growth [15]. Fluctuations in water temperature do not much occur, because when the maintenance is carried out, the environmental condition maintain the stability of the temperature by giving a cover to the aquarium with a black net.

3.3.4 Dissolved oxygen (DO)
Dissolved oxygen (DO) maintenance during this research is 4 ppm, but it is not in accordance with the optimal dissolved oxygen water quality (> 5 ppm) for crabs [14]. Oxygen is needed as food for metabolic and growth processes [16].

3.3.5 Ammonia
Ammonia content was known between 0.09-0.27 mg / L. The toxic nature of ammonia begins to occur at a concentration of 0.6-2 mg / L [15]. Water conditions with high ammonia content will affect the physiology condition of crabs so as to influence the risk of increased ammonia content, a residual feed and feces is siphoned off in the morning.

4. Conclusion
Based on the analysis results and discussion, it can be concluded that the addition of Crude Fish Oil (CFO) to natural feed on mud crabs (Scylla serrata) does not provide a significant difference (p> 0.05) to the content of fat and energy retention. It is recommended to add the Crude Fish Oil (CFO) to mud crab feed (Scylla serrata), that is because fat is underutilized as a substitute for sparing protein for energy sources in feed.

5. References
[1] Pramudya T P, Suryono C A, and Supriyantini E 2013 J Mar Res 2(1), 48-53
[2] Aslamsyah S and Fujaya Y 2010, J Ilmu Kelautan 15(3), 170-178
[3] Novian U 2005 Karakteristik Miofibril Kering Ikan Kuniran (Upeneus sp.) Diekstrak Menggunakan Enzim Papain dengan Metode Press Panas (Jember: Universitas Jember)
[4] Caturcutan M R, Eusebio P S, and Teshina S 2003 J Aqua 216, 253-261
[5] Subekti S, Prawesti M, and Arief M. 2011. J Kelautan 4(1), 90-95
[6] Lokapirnasari W P 2013 Potensi Inokulan Selulolitik Enterobacter cloacae dan Minyak Ikan untuk Meningkatkan Kualitas Pakan serta Implikasinya terhadap Penampilan Produksi dan Kualitas Daging Broiler (Surabaya: Universitas Airlangga)
[7] Caturcutan M R 2002 J Aqua 208, 113-123
[8]  Hartono 2014 Pengaruh Pemberian Kitosan dari Limbah Kepiting pada Pakan Ikan Rucah terhadap Kandungan Kolesterol dan Pertumbuhan Kepiting Bakau (Scylla Serrata) (Surabaya: Universitas Airlangga)

[9]  Plascencia G Y, Albores F V, and Ciaparra I H 2000 J Aqua 191, 171-189

[10]  Riyadhi A 2014 Pengaruh Penambahan Crude Fish Oil (CFO) pada Pakan Udang Vaname (Litopenaeus vannamei) terhadap Kandungan Kolesterol dan Retensi Lemak Daging (Surabaya: Universitas Airlangga)

[11]  Boonyaratpalin M 1996 Nutritional Requirements of Commercially Important Shrimp in the Tropics (Philippines: SEAFDEC Aquaculture Department)

[12]  Aslamyah S 2008 Pembelajaran Berbasis SCL pada Mata Kuliah Biokimia Nutrisi (Makasar: Universitas Hasanudin)

[13]  Komariyah and Setiawan A I 2009 J PENA Akuatik. I(1), 19-29

[14]  Anon 2006 Australia Prawn Farming Manual: Health Management for Profit (The State of Queensland: Department of Primary Industries and Fisheries) p 157

[15]  Widigdo B 2013 Bertambak Udang Dengan Teknologi Biocrete (Jakarta: Kompas)

[16]  Lucas J S and Southgate P C 2003 Aquaculture Farming Aquatic Animal and Plants (UK: Blackwell Publising Company)