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Shell Weight and Length Accretion of *Conus* sp., in Cage Captivity at Intertidal Zone of Kailolo Village, Central Maluccas District

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Abstract
Conus sp., lives in intertidal zones that has ecological, biological and economical functions of alternative protein food for local villagers of Kailolo village, Central Maluca District, Maluca Province. The increased exploitation of *Conus* sp. by local villagers without any consideration of its size, decreses its population in the natural habitat. Seafarming efforts to sustain the organism population and the organism as a animal seafood is needed, hence it has to be conducted a cultivation or culture. Lane (1998) stated that *Conus* sp., was hategorized into Phylum Mollusca that is existence and life in intertidal zone with highly total population because of the availability of its feed and supported environment. This process can be carried out by marine culture in intertidal zone. How does the accretions weight and length of the *Conus* sp., after feeding by additional feeds in cage cultivation in intertidal zone of Kailolo village, Haruku Sub-District? Is there any effect of additional feed to the organism density based on length and weight of body in the cage process of the area? This research is a field experiment used ecological approachment that culture organism by giving additional feed by using planted cage in the intertidal zone of Kailolo village, Haruku Sub-district. Physical and chemical sea water quality parameters of environment considerably support the growth process of *Conus miles* and *Conus ermeneus* in each cage, such as temperature is in ranged of 28^0C - 28.1^0C in sunny day and 26.3^0C - 26.4^0C in the night; pH is about 7.8 in sunny day and 7.6 in the night; Dissolved Oxigen (DO) is in ranged of 6.62-6.63 and 6.78 – 7.41 in the night; and water current is about 0.36 m/s – 0.4 m/s. Growing length and weight of *Conus miles* shell after feeding by fish flesh shows differences. In first cage, the growth shell of both species, *C. miles* and *C. ermeneus,* are in ranged of 4.15 mm – 4.72 mm and 4.25 mm – 5.78 mm, respectively. Moreover, the weight of *C. miles* in this cage is in ranged of 13.2 – 18.5 grams. On the second captivity, growing weigth of *C. ermineus* is about 16.5 grams – 37.7 grams. However, 15 individus of C. miles and C. ermineus at the third captivity grew at weight about 14.0 grams – 28.4 grams. There is an influence of additional feed by fish flesh and worms towards *C.miles* and *C. ermineus* in the captivity process. This influence varians significantly at rate 0.000<0.05.
Keywords: growth, feeding, *Conus* sp.

1. Introduction

Usage of *Conus sp.,* when low tide by villagers of Kailolo Village, Pulau Haruku Sub-district, as seafood. High exploitation of this organism by local villagers without any consideration such as size or age of the organisme inflicts to be decreasing its population. Rumahlatu et al., (2011) explained that the usage without any balancing suitainable efforts of sea resources will bring a bad effect to sea ecosystem, and it also can be degraded the seawater quality resources. One of the bad usage of sea resources is the habitual of local villagers that collect some sea organisms continuously without consider those organisms age and size that they collected.

Villager's activity that use *Conus* sp., continuously will decrease its population and however information which related to growth, distribution pattern and density of the organism in the coastal area of Kailolo Village, Pulau Haruku sub-district are necessarily collected. This is paralelly with Rejeki and Susilowati (2011) point of view that it is needed an augmentation effort of gastropods which have small sizes that have to be raised in a cage (culture). It is being one of ways for controlling gastropods population that tends to be decreased by exploitation.

In movement to look for foods, *Conus* sp., is seen moves together with its shell. This movement is carried out by its strong dorsal leg on its both side which can produce glue gland that has function as gumming its body on substrat in intertidal zone (Dorit, 1991). The body *Conus* sp., can be hiden in its shell, and its dorsal leg can restrain its shell when there is any pressure from coastal water environment.

The high growth of *Conus* sp., is very supported by surrounding environmental nutrient compounds that can give space and opportunity for local people in coastal areas to consume this organism that distributes at a variety substrates in intertidal zone. Its growth is related to environmental parameters that are factors in determining the organism growth in cage situation in the intertidal zone. Hegner (1989) stated that gastropods included *Conus* sp., on specific species according to their different size and length are affected by the availability food resources

surrounding of their habitats. Therefore, usage of *Conus* sp., as an alternative seafood of local villagers is necessary to maintain its population balance that one of this effort is by giving additional feed as based on its natural feed.

Giving feed to the *Conus* sp., can be delivered in its natural habitat by a bottom cage. This way is conducted in order to observe the effect of additional feed to the individual growth of the organism naturally. Marking individu *Conus* sp., in a cage by giving numbers of its shell in order to indetify the organism growth. Nurdin et al., (2006) stated that more and more additional feed in the specific habitat, the growth and density of an organism can be observed. Accordingly, the feed availability as a result of additional feed to *Conus* sp., on a captivity condition provides a chance for growing to be happened.

This research is conducted by treathment effort of additional specific feed in order to know the growth based on size and weight body of *Conus* sp., in a captivity condition in intertidal zone of Kailolo Village and to know whether any effect of additional feed to its growth and density and also to know the environmental parameters that affect to the organism life. This matter is enforced clearly by Hawkes, (1978); Nugroho et al., (2012) that environmental factors are taken part of affecting distribution and abundance of gastropods, such as water condition, habitat, and compounded nutrients availability. When if there is less nutrient availability in the environment, the gastropod population will be disturbed. This research aimed (1) to know environmental factors that affect to *Conus* sp., growth; (2) to observe the growth of length and weight shell of the organism after adminstring additional feed in a captivity condition in the intertidal zone of Kailolo Village, Pulau Haruku sub-district; (3) to identify effects of additional feed for growing length and weight of the organism in a captivity condition in the intertidal zone of Kailolo Village, Pulau Haruku sub-district.

2. Research Method

Field experiment conducted through ecological approachment that was conducted by administering additional feed to *Conus* sp., in a captivity cage in intertidal zone of Kailolo Village, Pulau Haruku sub-district as shown on the figure below.

Fig 3.2. *Conus* sp., Cage in Research Location

Chemical and physical water quality parameter measurement was carried out by using a significant tools, especially for temperature, pH, salinity, dissolved oxygen, and water current. The collected data therefore were calculated for specific growth of *Conus* sp., based on deviation between initial and final weight that was divided with time of looking after. Analysis of additional feed to growth weight and shell length of the organism used inferencial statistic SPSS 20. Specific growth rate (%/day) used the formula by Tucon, 1987; Rejeki et al., 2011 as written below.

$$SGR = \frac{Ln\ Wt - Ln\ W0}{t} \times 100\%$$

3. **Research Results**

Measuring chemical and physical water quality parameter in the research location was taken every week along with administering additional feed to *Conus* sp., in a captivity at the intertidal zone of Kailolo Village, Pulau Haruku sub-district. Those measurements are described in the Table 3.1 below.

Table 3.1. Measuring Result of Environmental Paramaters in the Research Location of *Conus* sp.

Weeks	Temperature	pH	Salinity	DO	Water Current
I	26.8 ^{0}C	6.87	23.4 $^0/_{00}$	6.56 mg/l	0.36 m/s
II	27.2^{0}C	7.07	21.6 $^0/_{00}$	6.92 mg/l	0.40 m/s
III	26.8^{0}C	6.62	26.4 $^0/_{00}$	6.86 mg/l	0.35 m/s
IV	27.9^{0}C	7.34	21.4 $^0/_{00}$	6.95 mg/l	0.32 m/s
V	27.7^{0}C	7.08	22.5$^0/_{00}$	6.76 mg/l	0.38 m/s
VI	27.9^{0}C	6.62	27.8$^0/_{00}$	6.77 mg/l	0.36 m/s
VII	28.2^{0}C	6.81	26.5$^0/_{00}$	6.58 mg/l	0.39 m/s
VIII	27.5^{0}C	7.05	25,6 $^0/_{00}$	6.47mg/l	0.33 m/s
IX	27.4^{0}C	6.85	23.6$^0/_{00}$	6.4 mg/l	0.38 m/s
X	26.4^{0}C	6.95	24.9$^0/_{00}$	6.21 mg/l	0.4 m/s
XI	27.8^{0}C	7.05	26.8$^0/_{00}$	6.61 mg/l	0.35 m/s

Calculating daily wight of *Conus* sp., is taken based on initial and final weights divided with looking after time for 15 individus of *Conus* sp., in the cage is written in the Table 3.2 as follows.

Table 3.2. Measuring Result of Daily Weight of 15 Individus of *Conus* sp., in Captivity Cage.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Ln Wt	2.94	2.78	2.87	2.76	2.94	2.8	3.14	3.32	3.22	3.23	3.41	3.05	3.23	3.28	3.27
Ln Wo	2.68	2.51	2.6	2.42	2.53	2.5	2.86	3.16	3.03	3.02	3.25	2.8	2.93	3.01	3.06
	0.26	0.27	0.27	0.34	0.41	0.3	0.28	0.17	0.19	0.22	0.16	0.25	0.3	0.27	0.21
t (78)	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0.02
SGR	0.34	0.35	0.35	0.44	0.52	0.4	0.36	0.22	0.24	0.28	0.21	0.32	0.39	0.35	0.27

Counting of added length of *Conus* sp., shell along with the observing process can be seen in the Table 3.3 as follows.

Table 3.3. Counting Result of daily Added Length of *Conus* sp., Shell of Observing Location

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Ln Wt	1.686	1.686	1.649	1.686	1.66	1.71	1.609	1.792	1.81	1.79	1.81	1.81	1.79	1.81	1.84
Ln Wo	1.3083	1.361	1.253	1.361	1.31	1.39	1.224	1.459	1.482	1.46	1.44	1.41	1.41	1.41	1.504
	0.378	0.325	0.396	0.325	0.36	0.32	0.386	0.333	0.33	0.33	0.37	0.34	0.38	0.34	0.337
t (78)	0.005	0.004	0.005	0.004	0.01	0.004	0.0049	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.0043
SGR	0.4847	0.4172	0.508	0.417	0.461	0.408	0.4944	0.4271	0.419	0.427	0.478	0.509	0.488	0.509	0.4314

Table 3.4. Result of Varians Analysis of Administring Additional Feed on Shell Length and Weight of *Conus* sp.

Source	Type Sum of Squares	Df	Mean Square	F	Sig	Partial Eta Squared
Corrected Model	133815.663[a]	2	66907.831	70.316	.000	.946
Intercept	7086.385	1	7086.385	7.447	.026	.482
Weight	2763.368	1	2763.368	2.904	.127	.266
Lenght	793.652	1	793.652	.834	.388	.094
Error	7612.246	8	951.531			
Total	1432481.750	11				
Corrected Total	141427.909	10				

a. R Squared =.946 (Adjusted R Squared =.933)

According to the Table 3.3 above shows that F_{count} value for weight 2.904 is signicantly on 0,127 > 0,05 . This means that the null hipothesis (H0) is rejected and research hiphotesis (H1) is accepted which stating that " there is an effect of administring additional feed on weight growth of *Conus* sp.". Result analysis of the same table above also gives an explaination that F_{count} value of the shell lenght at 0,834 is significantly on 0,388 > 0,05. This number means that null hipothesis (H0) is rejected and accepted research hipothesis (H1) statting that " there is an effect of administring additional feed on shell lenght of *Conus* sp., in the captivity condition".

Both species, *C. miles* and *C. ermineus* in absorbing natural food is not only as deposit feeder, but also as feeding feeders, however total of absorbed food for growing depends on metabolism of specific mantels cells. Tuaputty (2015) explained that either shells growth or body growth of gastropods verily depends on compounds of absorbing body cells especially specific mantel cells of gastropods in both deposit feeders and suspension feeders. The same thing also is enforced by explaination of Noor et al., (1998) stating that spreading feed to gastropod especially Giant Top Shell (*Trochus niloticus*) for culturing and its added weight is very dependently on kinds of feeding food and absorbing body of the organism. Therefore, additional feed giving to *Conus* sp., can increase body weight and shell length.

Conus sp., growth naturally depends on feed availability. By feeding the organisms in its cage with suitable amount will help the growth process. Desai et al., (2009) in their report stating that feeding treatment in more amounts of feed enhances growth process than feeding less amout of feed. In natural condition of Gastropods (*Conus* sp.) foraging foods through movement to other place, depend on the body size and species. Petersenf et al., (1997) explained that the gastropods can move to feed in the intertidal areas, especially micro plankton and microzobenthos. In foraging foods at intertidal areas, the organism body is adapted towards the low tide by slacking into its shell to protect its body from dry.

Existance of both organisms, *C. miles* and *C. ermineus*, in the cage on the pebble sandy substrate where its growth verily depends on absorbing feed, and feeding habits. Aralaha et al., (2015) explained dues to availability of feed naturally and environmental factors in various substrates of rich organic particles can be sufficient for gastropods needs. Explaining by Norma et al., (2007) that marine invertebrates that including suspension feeders has much more foods on the hard substrates than the deposit feeders, especially the abundance of natural feeds on the substrates. Hence, by feeding the *Conus* sp., in the cages gives a chance for its growth either suspension feeders or deposit feeders.

Analysis result shows the effect of additional feeding towards the *Conus* sp., growth in the cages is presumed there are enough food, and suitable chemical and physical parameters for its life. Jabang et al., (2006) stated that growth rate of weight and shell length of mollusk is very determined by feed availability, and supporting chemical, physical and physiology factors of sea water, substrates, and moving spaces. Jabang furthermore explained that the more gastropods size, the lowest its shell growth and adversely the bigger its shell size diameter in the growth process of shell diameter. According to Wijayanti (2007) stating that the gastropod's feed compounding of calcium carbonat and pigment enters to the blood plasm and it is distributed to around of the body. Those compounds furthermore are absorbed by mantle, and then the mantle excretes cells that can form structure and colour of the shell. This mantle of gastropods is an architecture in the formation of structure and colours of gastropods shells.

5. Conclusion

Chemical and physical parameters of water are very supportive the growth process of *Conus* sp. Those parameters such as temperature, pH, salinity, dissolved oxygen, and water current, are in ranged of 26.4 ^{0}C – 27.9 ^{0}C, 6.62 – 7.9 , 21.4 $^0/_{00}$ - 27.9 $^0/_{00}$, 6.21 mg/l - 6.95 mg/l and 0.32 m/s - 0.40 m/s, respectively. Growing weight and shell length of *Conus* sp., after administering additional feed for 15 individus of the organism shows a significant growth. According to the statistical test reveals there is an effect of additional feed for the organism significantly by 0.000 < 0.05.

4. Discussion

Measuring water temperature in intertidal zone of both specices *Conus* sp ., cages shows that the temperature is in ranged of 26,8^{0}C – 28,04 ^{0}C. The water temperature condition as that is very suitable to support living activity of *Conus* sp., in the cages. This is sterenghtened by Sitorus (2008) explained that temperature in ranged of 26^{0}C – 31^{0}C is very suitable for molluscs living activities. Water quality parameter can be determined by pH or sea water acidity, pH under 7 means that the water is acid and ph above 7 means that water is alkali. Water measurement of acidity (pH) in the research location is in ranged of 6.83 – 7.83. This pH is still support the growth of *C. miles* and *C. ermineus*. Ruberu Pskilas (2002) revealed that if there happened a change of sea water pH resulted by infiltrating minerals or decreasing sea water minerals ecologically will influence organism physiology, but some of sea creatures can be survived by regulating their body metabolism. However, both *C. miles* and *C. ermineus* in each cage of research location can be adaptated physiologically with sea water pH that have been changing.

Sea water salinity in the research location is about 21.4 ‰ – 28.6‰. This ranged salinity is good for *Conus* sp., growth. This ranged salinity is caused by entering fresh water from land because of rainy season. This salt concentration undergoes chemical reaction process as resulted by infiltrating minerals into sea water so that NaCl undergoes down, however NaCl itself is higher than other minerals in each permil of sea water. Gatot Sudiono (2008) stated that commonly salinity in coastal areas near by to islands ranged from 18‰ – 34 ‰ that indicating the the standard life for marine biotas. The salinity of research location is frequently happened because of entering fresh water from main land as resulted by raining.

Activities of both *C. miles* and *C. ermineus* in the cages necessarily need dissolved oxygen. Result of measuring dissolved oxygen in a liter of seawater yields the average is in ranged of 6.2 mg/l – 6.9 mg/l. This dissolved oxygen compound is very supportive those organisms growth. Brower et al., (1990); Sitorus (2008) explained that dissolved oxygen in sea water more than 5 mg/l shows the water quality is very good for gastropods activities.

The water current in the research location displays that its average about 0.32 m/s – 0.40 m/s. This such current is given a chance for *Conus* sp., activities much better. Nontji (2005) explained that marine biotas growth in the areas that have current are much better than in the static water. Marine biotas commonly breed in the areas that have current because it can provide supply of oxygen, and even it can flow food particle that is needed by marine organisms. Muzahar (2012) revealed that result of marine snail research in the coastal areas of Bintang island at the low tide showing temperature, pH, and dissolved oxygen were 28.6 ^{0}C, 7.7 - 7.8, 5.5 mg/l – 9.7 mg/l, respectively. This water quality parameter was suitable for culturing Dog Conch (*Strombus* sp.). Noor et al., (1988) explained that water environmental parameters such as at ranged of 26.3 ^{0}C – 29.3 ^{0}C for temperature, pH 7 – 7.5, and dissolved oxygen for 8.0 mg/l – 8.5 mg/l are normal for gastropods life.

Analysis of feeding additional fish flesh towards body weight and shell length of both organisms *Conus* sp., shows there is a significant effect. This is resulted by availability of food resource and there is no competiting in consume the food. It is inferred that the given food is well obsorbed by the organisms to produce energy and metabolism for growing body weight and shell length. Rahmawati et al., (2010) stated that given feed to marine bioatas firstly will be used for metabolism process, look after the body and the compound of feed also is utilize for growth, whenever the compound of feed is less to fulfill the body needs, the growth of gastropods disturbed.

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