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Study of Trochus Niloticus Growth Population as Determination Base of Number and Harvest Time Distance in Rhun Island Waters

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Abstract: *The increasing occurrence of Trochusniloticus asking every year has caused explotation being more and more intensive. It caused the more decreasing of production including extinction. This study aims: 1) to determine population growth and potential of T.niloticus in the explotation area (zone edge reef) and 2) to determine the use level and distance of harvest time for continuity of population. Monitoring of groth population was done monthly for 16 months. The area wide of observation was 2400 m^2 or17.14% of the area wide of study with 2 m width, 400 m length and 6 units transect line. Citing was done by divers using snorkel and scuba with transect line.Every observation was put 6 units transect line using parallel line with coastal line. The monitoring on maximum population density was carried out by using quadran with the size of 5m x 5m to determine the use level for the continuity population. The result showed that the maximum density of T.niloticus population in the exploitation zone during 16 month was 0.08 ind m^{-2} whilst, the population density average was 0.0254 ind m^{-2} with the potential of 356 ind (14000 m^2) or 254 ind ha^{-1}. The use level namely 243 ind (68.25%) of potency and around 113 ind (31%) was prepared as plasma nutfa. In addition, The distance of harvest time to recoverT.niloticus resource is 15 months.*

Key Words: *Trochus.niloticus, population growth, explotation area, harvest number, and harvest time*

I. Introduction

Mollucs has an opportunity to be developed in the future to increase society prosperity, wholives in the small Islands. Commonly, they have a low prosperity level in which almost 90% of their life need is depended on fisheries resources of intertidal zone in which the fisheries resources has been traditionally used. Mollusc has several advantages to be developed because it can be used as food source, jewelry and raw material. It also has the high protein content causing it has the high economic value. In addition, the sale price of mullucs can be increased through sentuhan seni without need expensive tool and it also has the big size causing it has been easy to be explotated. Furthermore, it has an opportunity to be cultured particularly, species having export value such as, *Haliotis*spp., *S.gigas*, *T.niloticus*, and*T.marmoratu*[1, 2].

In recent years, shellof *Trochus niloticus* has been one of export commodities in several countries such as Indonesia, Philipina, Papua New Guinea, Palau, Fiji, Australia, and Vanuatu. Commonly, *T.niloticus*has been exported Japan, Singapure, Hongkong, Taiwan, and Italia[3] with the big asking has been come from Eropa, Amerika and Japan [4, 5].

*Trochus niloticus*is one of mollucs which has commonly been used by coastal society in Moluccas [6]. *Trochus niloticus* Lennieus 1767 is included in the big *lola* snail with the cone shellhaving 10-12 units of suture and whorl has a clear spiral form[7]. The teeth of columella contai nacreous with the shine white side surround umbilicus [8]. *T.niloticus* lives in depth of 0 -10m and has the age of 12-13 years[9].

T.niloticus resource is limited by the various activity of society using it for everyday need. The increasing of society number will support the high use of *T.niloticus* which influence on fisheries resource. Commonly, the coastal society,who live in small Islands often do the searching of mollusc, Sea urchin and fish at low tide. The presence of continuous without paying attention on bioecological aspects will results in the decreasing of resource potency and habitat degradation including *T.niloticus*. Therefore, it is need the existence of conservation efforts to protect the continuity of marine resource and their environment.

In Moluccas, *T.niloticus* harvest has been commonly used through *sasi* system arranging collection time of 1-3 years and minimal shell diameter which may be collected has a size of 4 fingers or $\pm$ 70 mm.The presence of this system still also showed that *T.niloticus* number collected decreased from time to time [10]. *T.niloticus* harvest in Saparua Island at one year period time started from 1979 to 1992 showed the decreasing of 4 ton dried shell to 0.25 ton in 1992 [11]. The similar condition was also showed by harvesting of *T.niloticus* in Aitutaki Islands in which harvesting was occurred every 1, 2 and 3 years. In 1981, *T.niloticus* harvest was $\pm$200 ton whilst, in 2001 *T.niloticus* harvest was only 31 ton. Furthermore, in 2011, *T.niloticus* harvest was only 18.9 ton[12].

All *T.noliticus* producer countries such as Palau, Cook Islands, Solomon Islands, Fiji, Papua New Guinea, French Polenesia, and Federation States of Micronesia have been found to have the decreasing of production and size. Several producer countries had applied production moratorium orproduction limitation and stock size. *T.noliticus* Production in several producer countries had decreased 10-500 kg since1973 to 1990. In 1979, *T.noliticus* Production was only 10 ton and continued to decrease and only 500 kg production was obtained in 1991 [11], and 447 kg in 2011 (Conservation Department Report of Central Moluku, 2012).

The *T.niloticus* asking has increased every year causing the mass exploration in Indonesia Waters. Production increasing which is not based on the information on the resource can decrease production and cause the extinction.

*T.niloticus*in Banda Archipelago has suffered a pressure ecologically and over exploitation in its use parallel to the society increasing and the high life need. As the initial step to protect over capture, it has been done the potential identification of each mangement area through the supplying of data and information about the availability *T.niloticus*for management. Knowledge and technology are needed to be able to manage nature resource and can only function effectively if there is the availability of data base for potential count and opportunity to be developed [4].

Therefore, this study aims: 1) to determine population growth and potential of *T.niloticus*in the explotation area and 2) to determine the use level and harvest time distance for the continuity of population in Rhun Island Waters. Meanwhile, the benefit of this study is to know the growth rate of population to be used as data base to identify the use level and distance of harvest time in the future for the continuity of resource.

II. Method

Time and Place

Study was conducted on March 2012 to May 2013. Study location was in Rhun Island Waters, Banda Naira subdistrict, Central Moluccas at04° 32″ 55.4' South latitude and129°41′41.9″Easth longitudinal. The observation of population growth was done monthly for 17 months in the exploitation area sizing 14.000m^{2}with width of 35m and length of 400m. The observation area had a wide of 2400 m^{2}or 17.14% with the width of 2m, length of 400mand 6 units of transectstrip.

Sample Collection Method

Citing was done by divers in the night using snorkel and scuba. Sample determination used a transect strip method and every transect strip sized the length of 400m and the width of 2m. Every observation was put 6 units of transect strip which had been parallel to coastal line using rope. The number of transect were adjusted with the wide of study location in which the wide of observation area must be 15 % than research area. Citing was done by counting of number and measuring of width and hight of *T.niloticus* appeared in transect area. Sampling was carried out monthly and finished after population growth reached maximum level. To determine the use level for the continuity of population, there was done the monitoring on the maximum population density by using quadran with the size of 5m x 5m.

Data Analysis

a. Density

Density is individue number of particular wide or volume and counted by equation as followed:

$$K = \frac{\sum x_i}{n}$$

Note :

K = Density of *T.niloticus*

x_i = Number of *T.niloticus*in sample unit at the time

n = Number of sample unit wideat the time

b. Potency, formula used to calculate potential :

Potency is determined by equation as followe:

$$P = \bar{X}.A$$

Note :

P = Potency

$\bar{X}$ = Density (ind/m^2)

A = Study area wide

c. Use level

Use level is determined by equation's Schaefer [13] as followed:

$$Y = rN\left(1 - \frac{N}{N\infty}\right)$$

Note:

Y = Use level permitted

r	=	1
N	=	Density average
N ∞	=	The high density

III. Result And Discussion

1. Study Location Description

Study on *T.niloticus*was done in Swour coastal, North Rhun Island with study area wide of 14000 m^2 .Whilst, observation area wide was 2400 m^2(Figure 1).

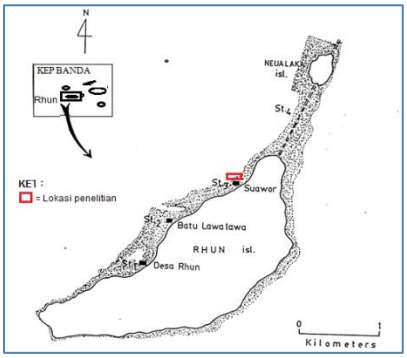

Figure 1: Research Location Site

Figure 1 showed that study location distance was ± 1.5 km of settlement. This near distance caused society activity influenced organism habitat which live in intertidal zone being the place of mollusc, echinoderm and fish development. People who lives in this area have been used organisms of intertidal zone for their need. Related to *T.niloticus* population growth is if ecosystem condition of logoon zone with seagrass structure, sand and small coral breacking and flat reef zone with died reef hunk structure have a good condition, population density in explotation zone (*edge reef*) will increase. Ecosystem has an important function in the juvenile growth out, food and seeding of *T.niloticus*[14]. Therefore, information about ecosystem conservation in lagoon zone, flat reef zone and edge reefzone need to be known by the society to be able to help in the conservation of *T.niloticu* secosystem and finally increase population density.

Study location was devided in three zones namely; lagoon zone, flat reef zone and edge reef zone.

a. Lagoon Zone

Lagoon zone condition at lowest tide, where the whole flat reefzone was obtained its dried water whilst, atlagoon zone in particular part was still filled by water of ± 0.2 m– 0.35 m. It caused microorganisms sticking at sea grass leaves and small reef breaking did not suffer driness. Clearly, profile of lagoon zonais shown in Figure 2.

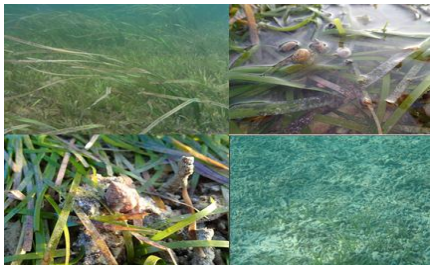

Figure 2. Lagoon zone Profile (study result)

T.noluticus obtained in lagoon zone had the size range from1.21 cm-2.21 cmandstick at sea grass leaves as its food habit. It was due to the availability of gastropoda epifits as foodat the leaves. In lagoon zone, species of *Trochus* found was *T.niloticus,T.pyramis, T.maculatus,* and *T.Radiatus*with the most dominant species was *T.pyramis*.

b. Flat Reef Zone

Flat Reef Zonehas habit structure of small reef breaking, sandy and has the structure habitat small rubble, slightly sandy and died reef hunkingas well as several species of microalgae and macroalgae sticking at died reef hunking. Flat reef zone profile is clearly shown by Figure 3.

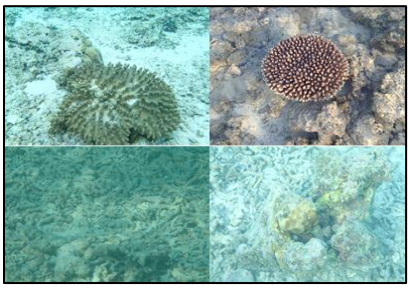

Figure 3.Flat ReefZone (study result)

Structure of flat reef zone was dominated by died reef hunking and a little of small reef breaking as shown by lagoon zone. The most number of Gastropoda species obtainedwas*T.pyramis*, followed by *T.maculatus*, *T.radiatus*, and *T.niloticus.* Commonly, Gastropoda was found in hunking hole of died reef in the day time and in the night time, the Gastropoda would go out to search food. The number of macro algae obtained in this zone was less than in lagoon zone.*T.niloticus* found had the size of 2.34 cm-4.20cm

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b. Edge Reef Zona

Edge reef zone is also called exploitation zone because in this area was occurred harvest process of *T.niloticus.* Habitat structure of exploitation zone is life reef, soft coral and several species of macroalgae and microalgae sticking at life reef hunking which is clearly seen in Figure 4. In exploitation zone, *Trochus* pecies was dominated by *T.niloticus*and*T.pyramis* whilst, two other species, *T.maculatus*and *T.radiatus*did not obtained in thiszone.It was caused by these two species had the small size causing they were difficult to adapt with habitat condition of this exploitation zone at the depth of > 5 m. *T.niloticus* obtained in this zone commonly had the size of 5.23cm-12.33cm. There was also found the presence of *T.niloticus* with the diameter average of 40.2mm, 61.3mm ,100.4mm, and 117.8mm at the depth of 0.1-3m, >3 – 5m, >5 - 8m, and >8-11m, respectively.

Figure 4. Edge Reef Zone (study result)

This study showed that distribution of *T. niloticus*based on the depth followed by the increasing of shell diameter size. *T.niloticus* which lives at the deep ocean has the bigger relative shell diameter size than at the shallow ocean.This study can not explain detailly about the dept structure in which at the dept of 5 m, the ocean has a slope direct waters base of 90°. Due to this condition, *T.niloticus*has rarely been found at the depth >7 m. Clearly, the ocean base profile is exhibited in Figure 5.

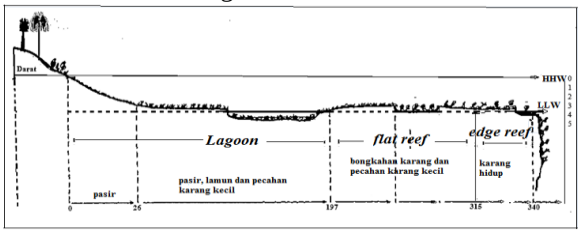

Figure 5: Profile ofStudy Area Waters Base

Figure 5displayed that study area at the lowest tide was found a dried part and a water filled part particularly, in lagoon zone, flat reef zone and edge reef zone. Area ofedge reefzone is habitat of *T. niloticus*

which has a bigger size than 50 mm at the lowest tide time. Condition of steep ocean slope being *T.niloticus* was only found at the depth < 7m. The similar condition was also obtained in all *T.niloticus* locations in Rhun Island.

2. *T. niloticus* growth

The size of *T.niloticus* durind 15 months period time range from March 2012 to May 2013 in explotation area (edge reef zone)at the depth of 5m-7min Rhun Island waters, Central Moluccas Regency, is shown by Figure 6.

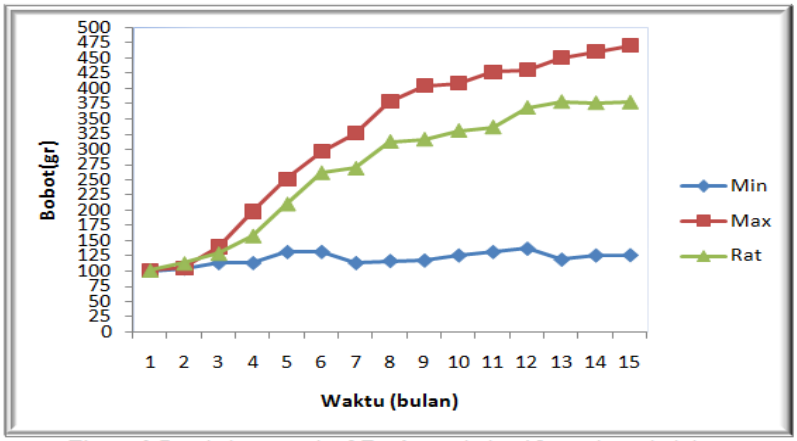

Figure 6. Population growth of *T. niloticus*during 15 months period time

Figure 6 exhibited that there was the increasing of *T. niloticus* size started on the second month (March 2012) to the fifteenth month (May 2013) with the maximum weight of 469 g and basal diameter of 122.6 mm. The highest weight increasing average of *T. niloticus* found on the fourth, fifth and sixth month was 51g. Mean while, in the end of study (the fifteent month) the weight average of *T. niloticus* was 376g. On the fifth, sixth, tenth, eleventh, and twelveth month there was the absence of recruitment indicated by the absence of the new size of *T. niloticus*. It showed that on the particular months there was no seeding or occurred seeding but waters condition did not support the juvenile development.

3.Population density in exploitation zone

The initial transect was done on February 10, 2012 to determine the population density after *T. niloticus* harvest (*sasi* open) and the result showed no any density (0 indm^{-2}) of study area wide of 14.000 m^2. Mean while, the *T. niloticu s*density of 1 or 0.00028 ind/m^{-2}was obtained on the second month namely March 10, 2012. Furthermore, population growth of *T.niloticus* during 17 months (February 10, 2012-June 10, 2013) of study period time is shown in Table 1.

Table 1.Population growth of *T. niloticus*in Rhun Island Waters

No	Date	Individue Number(ind)	Density (ind m^{-2})	No	Date	Individue Number (ind)	Density (in m^{-2}
1	10/2/2012	0	0.00000	10	10/11/2012	42	0.0175
2	10/3/2012	1	0.0004	11	10/12/2012	46	0.0192
3	10/4/2012	2	0.0008	12	10/1/2013	51	0.0213
4	10/5/2012	7	0.0029	13	10/2/2013	56	0.0233
5	10/6/2012	13	0.0054	14	10/3/2013	59	0.0246
6	10/7/2012	19	0.0079	15	10/4/2013	61	0.0254
7	10/8/2012	27	0.0113	16	10/5/2013	63	0.0263
8	10/9/2012	33	0.0138	17	10/6/2013	61	0.0254
9	10/10/2012	38	0.0158				
	Observation area wide =2400 m^2						

Table 1 showed that the density level of *T.niloticus* was 0.0254 ind m^{-2} or 254indha^{-1}during 15 months period time. The similar density was also found in Cook Island namelyin Tautau and Omoka State on 10 titik of sample collection area showing 554 individue with the density of 0.001-0.075 $\pm$ 0.027 ind m^{-2}[15] and in Palawan [18] with the population density of 0.00-0.002 ind m^{-2} [16] [17]. Mean while, in Saparua and Queens

land (Australia)[19], the population density of *T.niloticus* was different namely 0.062 and 0.115 indm^{-2}, respectively.

T.niloticus population in several producer locations such as Saparua, Kei Besar, Banda, and Tayando Islands exhibited the higher density than the above locations namely 3 ind m^{-2}[11]. In the last 10 years production of *T.niloticus*had significantly decreased in producer countries. The producer countries have tried to perpetuate *T.niloticu s*resource. Since 2006, Solomon Island had done a moratorium exportfor5 years.The moratorium export said that after 5 years would be done evaluation by doing 2 times research and if the result reached the population density of 200-300 indha^{-1},the moratorium would be reopen in the next year and 30%-40% results with the basal diameter of 80 mm was permitted to harvest [20]

4. Use Level in Exploitation Zone

Potential and use level of *T.niloticus* resource in explotation zone was determined based on study result during 17 months period time and the results are shown in Table 2.

Table 2. Potential and use level of *T.niloticus*in Rhun Island

No	Date	Density (ind m^{-2})	Potency (ind)	Ind ha^{-2}
1	10/02/2012	0.0000	0	0
2	10/03/2012	0.0004	6	4
3	10/04/2012	0.0008	11	8
4	10/05/2012	0.0029	41	29
5	10/06/2012	0.0054	76	54
6	10/07/2012	0.0079	111	79
7	10/08/2012	0.0113	158	113
8	10/09/2012	0.0138	193	138
9	10/10/2012	0.0158	221	158
10	10/11/2012	0.0175	245	175
11	10/12/2012	0.0192	269	192
12	10/01/2013	0.0213	298	213
13	10/02/2013	0.0233	326	233
14	10/03/2013	0.0246	344	246
15	10/04/2013	0.0254	356	254
16	10/05/2013	0.0263	368	263
17	10/06/2013	0.0254	356	254
	Study area wide	14.000 m^2		
	Max. density	0.08 ind m^{-2}		
	Use		243	173

Table 2 showed that the highest relative growth increasing was obtained on the third month and continued to decrease until the lowest level on the fifth month with the population density of 0,0254 ind m^{-2}. On the fifteenth month it was estimated as the maximum population growth and population density and maximum population density average of this time were used as the base data in the determination of number of use level and harvest time distance.

The maximum population density obtained was 0.08 ind m^{-2}. According to Schaefer,if a resource used, bimassa change in time unit similar to the use level [13]. In balance condition, resource use rate will the same as biomassa recovery rate. It was indicator in the measurement of use level. Analysis on population density showed that population density average of *T.nilotius*was 0.0254 in dm^{-2}and maximum population density was 0.08 in dm^{-2}. Meanwhile, the use level obtained was 243 ind or 68.25% of its potency namely 356 indor 254 ind ha^{-1} and the rest (113 ind or 31,75%) was used as plasma nutfafor the continuity of resource.

Population growth is a complex biological process and influenced by several biological factors. The population growth has a concept called as autocatalytic growth in which individues will increase continueously along supported by biotic and abiotic environment. Nevertheless, in the particular time the population growth will reach the balance level causing the growth is obtained to be low and finally stoped. Time need of *T.nilotius* population to reach this level can be used as the base in determination of harvest time distance. To reach the highest density namely 0.0254 ind m^{-2} in exploitation arealoita, *T.nilotius*need 15 months of rearing. Harvest time distance (*sasi* open) suggested for the continuity of *T.nilotius* population in Rhun Island, Banda Subdistrict, Central Moluccas, was 15 months.

In 2011 harvest of *T.nilotius* was 447 kg (Conservation Department of Central Moluccas Regency report, 2012). Estimation result of the use level, weight average, explotation area length and width in exploitation zone was 243 indor 68.25% of potency reaching354 indor 254 ind ha^{-1}, 375 g ind^{-1}, 1.550m, and 35m, respectively. Mean while, the wide of explotation area in Rhun Island was 5.423 with production reaching132 kg production. Compared to production in 2011 (447 kg), estimation production decreased 314 kg. The similar production level was also observed for Saparua Island. According to Tuhumury, *T.niloticus*is

organism which has been threatened with extinctiondue to over exploitation. Eksploitation offishes and human activity residue has also been reported to be the cause of population decreasing[21].

IV. Conclussions And Suggestions

Conclusions

From these study explanation, it can be concluded as followed:

a. Distribution of *T.niloticus* size was influenced by the depth of Ocean, wherethe deeper of ocean will the bigger of basal diameter.
b. Population density average of *T.niloticus*in exploitation zone was 0.0254 in $dm^{-2}$and maximum population density was 0.08 in dm^{-2}.
c. Potential of *T.niloticus*in exploitation zone was 356 indor 254 ind ha^{-1}. For the continuity of *T.niloticus* potential, the use level suggested was 243 ind (68.25%) and the rest (113 ind or 31.75 %) was used as plasma nutfa.
d. For recovery of *T.niloticus* in Rhun Island, Banda Subdistrict, Central Moluccas, harvest time distance permitted was 15 months.

Suggestions

It is suggested to study number, use level number and harvest time distance of *T.niloticus*in the producer locations to be used as the data base in management of resource for the continuity of *T.niloticus* which can increase human prosperity.

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