The differences of depth on the species composition of Spiny Lobster Puerulus on South Pacitan Regency, East Java

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Abstract. Lobster resources is the one of renewable resources but if catches are increasing without any control will cause a depleted resource. Catching lobsters is not only for adult phase but for all phases are captured. The purpose of this study to determine composition of lobster seeds between depths which has a high value of lobster seeds collection so that it can be used as a reference for lobster protection in nature. This research was conducted in January – February 2019, located in Wawaran beach waters, Pacitan. The statistical method used in this research are Chi-Square and Kruskall-Wallis analysis. Based on the results of atractror puerulus lobster in two different depths (14 and 20 meter) in Wawaran beach waters found that there are 4 species puerulus, i.e. *Panulirus homarus*, *Panulirus penicillatus*, *Panulirus ornatus* and *Panulirus versicolor*. It was found that different depths did not affect the composition of the collected puerulus species. Then the Kruskal-Wallis test at 14 meters and 20 meters depth found a significant difference in the value of each type of lobster. The type of puerulus from *Panulirus homarus* has the dominant results compared than the other three species.

1 Introduction

Asia Region have a high potential of fisheries sector. Around 70 percent of Asia's fisheries production comes from the South East Asia countries[1]. The most valuable fisheries group is lobsters. Lobsters have high economic value in local and international market. Most of them inhabits coral reef, sometime on muddy substrat, sandy bottom, or sandy and muddy along shallow waters. Indonesia oceans located in a tropical territory made the diversity and organism variability is high. Lobster is nocturnal which have more activity in night than day and prefer be hidden at substrat layer[3].

Spawning zone of lobster is spread along the South Java Sea. One of them found in district of Gunung Kidul and Pacitan. Nowaday, catch activity and utilization of lobster including lobsters seeds from those places involves fisherman, collector, distributor, and exporter. There is an argument that population of lobster had been decreased along the South Java[4]. It is believed that lobster are used to be caught and sold under maturity size.

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Over-exploitation on resource could be a threat in sustainable. Therefore, it needs lots of management options to control the utilization of lobsters[5, 6].

High intensity of lobster catch activity would threat the sustainability of lobster resource, particulary at size that not reached yet from catch regulation. Baby lobster collecting which did by fisherman due to many request from exporter that promise with more high price velue. Economic factor is the trigger why fisherman dare to abandon the regulation (PERMEN-KP No. 56 tahun 2016) that contain regulation of lobster catch size[6, 7]. Managing lobster through all its life phase is necessarily important to ensure a better management of the lobster resources.

2 Method and material

The survey was conducted from January to February 2019 in Wawaran beach, Kebonagung, Pacitan of East Java, Indonesia. The method that used in this research is experimental. Based on Nazir [6] that method are identifiying the presence of caused-effect relationship and how this relationship give certain treatments and provide a control for comparison. In this case be used to find out the effect of depth difference by collecting primary data.

2.1 Research Material

Material used was a sample such as lobster larvae in puerulus phase. Larvae as research prime object, alchohol / ethanol to preserve specimen and specimen bottle used as puerulus placement. Then, tools which took in this research were writing tools, camera, identification book of lobster larvae, Ms. Excel, and SPSS. The specimens were preserved in 96% alcohol, transported to the laboratory for assessment of morphological characters and identification.

2.2 Identification Key

The researcher would survey catch result directly in fish landing place with fisherman in location. From catch interview would be checked with field condition. Lobsters were indentifiying as reference to determine kind of spceies that sorted from special characteristic of family, genus, and species each lobster. Then would checked with identification reference based on keybook "*Identification of tropical palinurid lobster puerulus and juveniles*", so we gained suppositions of lobster species.

2.3 Composition Analysis of Species Catch Analysis

This research used for knowing influence of location attractor depth differences to puerulus catch composition in Pacitan south coast with descriptive which used modified percentage analytic [8]:

$$Ks = ni/N \text{ x } 100 \text{ \%} \qquad (1)$$

2.4 Chi – Square Data Analysis

Chi-Square test is one of non parametric statistical test that often used for two variable research, where both of them was even for test the differences if two or more sample proportion[9], in this case, used variable is depth. Chi – Square applied for case where a

differences between observed data and expected data. In first step is set the Degree of Freedom, Expected frequency value, and P value from test with looking at some things as followed :

The degrees of freedom (df) are equal to the number of levels (k) of the categorical variable minus by 1

$$Df = k\text{-}1 \tag{2}$$

The number of expected frequency at each level of the categorical variable is equal to the sample size multiplied by the proportion of the null hypothesis:

$$Ei = n.Pi \tag{3}$$

Where E is the expected frequency for the i-level of a categorical variable, n is the total sample size, and Pi is the hypothesis of the number of observations at the i-level. While the statistical tests are used through formulas [4] :

$$X^2 = \sum \frac{(O-E)^2}{E}$$

$$\tag{4}$$

The statistical analysis results obtained to draw the conclusions of the proposed hypothesis are by comparing the calculated chi-square with the chi-square table in the test level (α) 0.05 at the degree of freedom of each source of diversity and Error.

2.5 Kruskal-Wallis Data Analysis

Kruskal Wallis used to see differences in the composition of lobster puerulus species collected using lobster seed attractors (lerep) at different depth settings. This test also requires a hypothesis or initial assumption to be tested to determine the differences in the composition of the type of lobster puerulus collected with the lobster puerulus attractor at each setting depth (14 m and 20 m).

The Kruskal-Wallis test, also called the H test, is an alternative procedure from One Way ANOVA. The Kruskal-Wallis test assumes that the variance between the population k (treatment) is the same, but the population k has a continuous distribution and has the same shape, and not as in the ANOVA test. Kruskal Wallis is a nonparametric alternative method, it can be used for ordinal or ranked data[9, 10].

3 Results

3.1 Morfology of Lobster Puerulus

Puerulus lobster species were caught and recorded during the research process can be seen below :
1. Ornate Lobster (*Panulirus ornatus*)
It has the characteristics of an antenna that has a bulb lit in the dark and there is a black ring in the middle of the antenna. When the puerulus phase is still transparent the body has black eyes on its
2. Scalloped Lobster (*Panulirus homarus*)
It has an antenna and there is a line of black shadows as much as 6 pieces 1 striking ring in the middle. When the puerulus phase, still transparent the body has black eyes on its head

3. Painted Lobster (*Panulirus versicolor*)

It has a plain white antenna and milky white. When the puerulus phase is still transparent the body has black eyes on its head

4. Pronghorn Lobster (*Panulirus penicillatus*)

It has the characteristics of a reddish antenna on the end. When the puerulus phase is still transparent the body has black eyes on its head.

3.2 Depth and Species Composition

The number of catches of lobster puerulus species at 2 different depths during the study obtained the results as in the table and figure as follows.

Table 1. Composition of Puerulus Lobster depths between 14 Meter and 20 Meter

Depth	Lobster Puerulus				Total
	Scalloped	**Pronghorn**	**Ornate**	**Painted**	
14 Meter	756	64	67	22	**909**
20 Meter	758	67	56	10	**891**
Total	**1514**	**131**	**123**	**32**	**1800**

Lobster caught during the study at two depth catching locations can be seen in Table 1. Where in the depth location of 14 meters, 4 species were found including 67 Ornate Lobster (*P. ornatus*) ,756 Scalloped Lobster (*P. homarus*), 22 of Painted Lobster (*P. versicolor*) and 64 of Pronghorn Lobster (*P. penicillatus*), while for the Puerulus species of Pakistan Lobster (*P. polyphagus*) and *P. longipes* were not found at this 14 meter depth location. Lobster purulus species that are numerous in depth of 14 meters are the type of Scalloped Lobster (*P. homarus*) while the lowest is Painted Lobster (*P. versicolor*).

At a location of 20 meters depth found 4 species, including 56 Ornate Lobsters (*P. ornatus*), 758 Scalloped Lobster (*P. homarus*), 10 Painted Lobster (*P. versicolor*) and 67 Pronghorn Lobster (*P. penicilatus*), whereas for species of puerulus Pakistan Lobster (*P. polyphagus*) and *P. longipes* were not found at this location. Puerulus lobster species that are found in locations with a depth of 20 meters are the same as at depths of 14 meters, namely the type of Scalloped Lobster (*P. homarus*) while the lowest is Painted Lobster (*P. versicolor*).

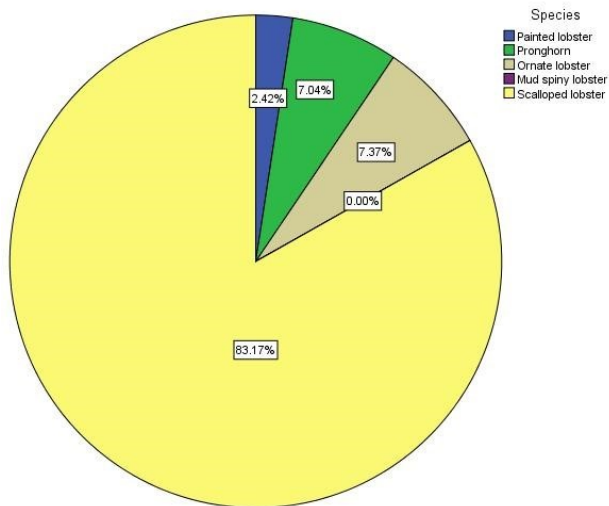The percentage graph of catches at each depth based on catch composition is as follows:

Fig. 1. Percentage Chart of Puerulus Lobster Composition at 14 meter of depth

   Based on the difference in the depth of the catch composition at a depth of 14 meters which was repeated 35 times with a total of 909 puerulus lobsters. Puerulus lobster catch composition based on a depth of 14 meters obtained the percentage of each type of puerulus as follows. The highest percentage is found in puerulus species of Scalloped Lobster as much as 83%, then followed by species of Pronghorn Lobster as much as 7% and Ornate Lobster as much as 7%. The smallest percentage at a depth of 14 meters is the Painted Lobster puerulus species which is as much as 3%.
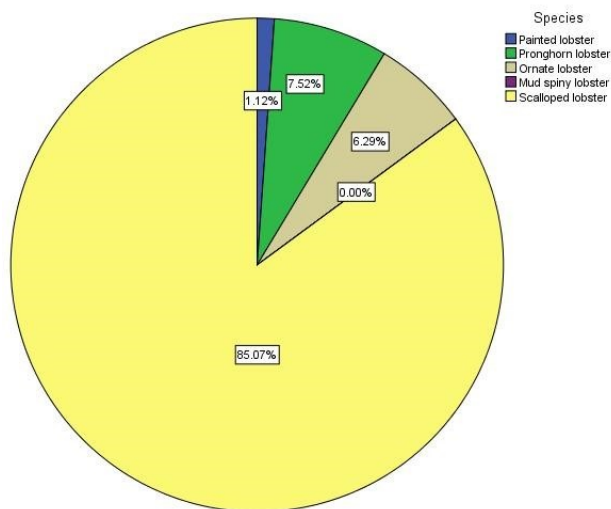

Fig. 2. Percentage Chart of Puerulus Lobster Composition at 20 meter of depth

   Based on the difference in depth of catch composition at a depth of 20 meters, 35 repetitions were repeated with a total of 891 puerulus lobsters. Puerulus lobster catch composition based on a depth of 20 meters obtained the percentage of each type of puerulus as follows. The highest percentage is found in the species of Scalloped Lobster puerulus by

85%, then followed by the Pronghorn Lobster as much as 8% and Ornate Puerulus by 6%. The smallest percentage at a depth of 20 meters is found in the Painted Lobster puerulus species, which is as much as 1%.

3.3 Puerulus Lobster Species Analysis

Analysis of Lobster puerulus species composition aims to determine and statistically prove whether the composition of lobster larvae at two depths (14 m and 20 m) is different or not, so the statistical tests are performed using the chi-square analysis method.

3.4 Relation Between Depth and Species

Data obtained in the study were then processed using SPSS to determine the relationship between depth and species caught, both at 14 meters depth and 20 meters depth. SPSS (chi-square) test results are obtained as in the following Table 7.

Table 2. Chi-Square Test about Depth Relation and Catch of Lobster Puerulus

Spesies	Depth			
	14 meter		20 meter	
	Observed	Expected	Observed	Expected
Scalloped	756	765	758	749
Pronghorn	64	66	67	65
Ornate	67	62	56	61
Painted	22	16	10	16
Chi Square = 5,3756, df = 3, *p>0,05*, H0 is Accepted				

In the results of the chi-square calculation above shows the value of 5.376 while the chi-square table at p = 0.05, df = 3 is 7.815, so the conclusions accept H0 ($X2$ (3) = 5.376; p> 0.05) and reject H1.So, Hypothesis H0 or different depths do not affect the number of lobster puerulus species composition.

3.5 Species Composition / Depth

There was no difference in the composition of puerulus lobster species at the two locations. Furthermore, further tests to determine differences in species composition at each depth location are used ANOVA test. The analytical method used is the Kruskal-Wallis nonparametric test. This test is carried out with the help of the SPSS statistical application. The Kruskal-Wallis calculation results are as follows:

3.5.1 Species Composition at 14 Meter of Depth

The Kruskal-Wallis test used to determine whether there were differences in Puerulus Lobster species at each depth. From the results of the Kruskal-Wallis test at a depth of 14 meters using the SPSS application the results are as shown in Table 3.

Table 3. Normality Test at 14 Meter of depth

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Spesies	Statistic	df	Sig.	Statistic	df	Sig.
Value	Ornate	.216	35	.000	.908	35	.007
Result	Scalloped	.160	35	.023	.903	35	.005
	Painted	.307	35	.000	.756	35	.000
	Pronghorn	.210	35	.000	.795	35	.000

Table 4. Mean Rank at 20 Meter

Ranks

	Species	N	Mean Rank
Value Total	Ornate	35	66.43
	Scalloped	35	122.11
	Painted	35	35.60
	Pronghorn	35	57.86
	Total	140	

From a depth of 14 meters puerulus lobster species found 4 puerulus species caught include Ornate, Scalloped, Painted and Pronghorn. Sampling was done 35 times with the same depth and each has a different number of frequencies. Calculations using SPSS obtained the most results from the four species of lobster puerulus caught were sand puerulus which had a mean rank of 120.09. Then the smallest result is the Painted Lobster puerulus species, the mean rank is 33.63.

Table 5. Kruskal-Wallis Test at 14 Meter of Depth

Test Statistics[a,b]

	Value
Chi-Square	88.888
Df	3
Asymp. Sig.	.000

On the results of the Kruskal-Wallis non parametric test calculation from Table 4 above shows the above output shows that the kruskal-wallis calculation statistics (the same as the chi-square calculation) is 88.888 while the chi-square table at $p = 0.05$, df = 3 is 7,815, so the conclusion rejects H0 ($X2 (3) = 88.888$; $p <0.05$) and accept H1. Hypothesis 0 = there are differences in the composition of puerulus species at a depth of 14 meters
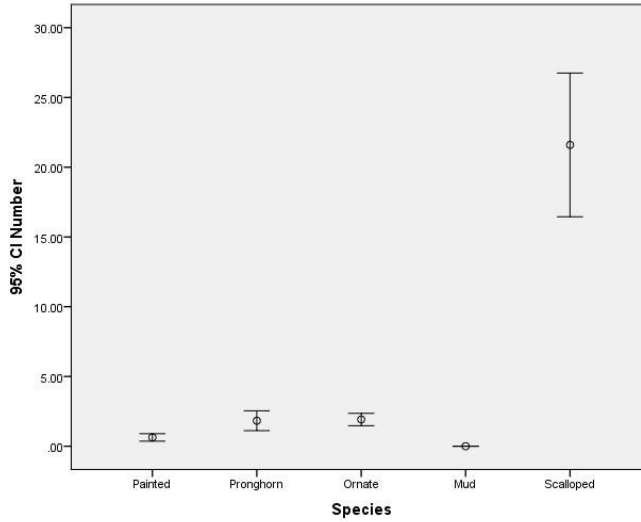
Fig. 4. Subset of Spesies Puerulus at 14 Meter of Depth

The chart above shows the grouping of lobster species based on the mean results collected in tail units. The subset graph illustrates the average collection of each species per day. Values are obtained by drawing a center line to a vertical line number, obtained in the most dominant daily collection found in Scalloped Lobster species. It can be said that the average yield of Scalloped Lobster seeds differs from the other species.

3.5.2 Species Composition at 20 Meter of Depth

The Kruskal-Wallis test was used to determine whether there were differences in species of lobster puerulus at each depth. From the results of the Kruskal-Wallis test at a depth of 20 meters using the SPSS application the results are as shown in Table 5.

Table 6. Normality Test at 20 Meter of depth

Species	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Ornate	.250	35	.000	.859	35	.000
Scalloped	.215	35	.000	.742	35	.000
Painted	.452	35	.000	.582	35	.000
Pronghorn	.228	35	.000	.764	35	.000

Table 7. Mean Rank at 20 Meter

Species	N	Mean Rank
Ornate	35	63.73
Scalloped	35	120.09
Painted	35	33.63
Pronghorn	35	64.56

Species	N	Mean Rank
Ornate	35	63.73
Scalloped	35	120.09
Painted	35	33.63
Pronghorn	35	64.56
Total	140	

From a depth of 20 meters the puerulus lobster species found 4 species caught including the puerulus of Orante lobster, Scalloped lobster, Painted lobster and Pronghorn lobster. Sampling was done in 35 times with the same depth and each has a different number of frequencies. From the calculation using SPSS, the highest results obtained from the four species of lobster puerulus that were caught were puerulus type of Scalloped Lobster which had a mean rank of 120.09, and the smallest result was a species of Painted Lobster puerulus, with a mean rank of 33.63.

Table 8. Kruskal-Wallis Test at 20 Meter of Depth

Test Statistics[a,b]	Value
Chi-Square	86.892
Df	3
Asymp. Sig.	.000

On the results of Kruskal-Wallis nonparametric test calculation Table 11 above shows the output above shows that the kruskal-wallis calculation statistics (the same as the chi-square calculation) is 86.892 while the chi-square table at $p = 0.05$, df = 3 is 7.815 , so the conclusion reject H0 ($X2$ (3) = 86.889; $p < 0.05$) and accept H1. Then, Hypothesis H0 = there is a difference in the composition of puerulus species at a depth of 20 meters.
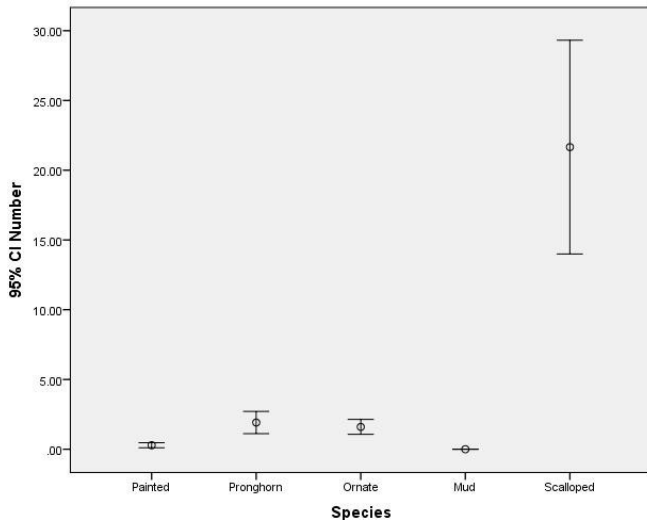

Fig. 5. Subset of Spesies Puerulus at 20 Meter of Depth

The subset graph at a depth of 20 meters shows the grouping of lobster species based on the mean collected in tail units. The subset graph illustrates the average collection of each species per day. Values are obtained by drawing a center line to a vertical line number, obtained in the most dominant daily collection found in Scalloped Lobster species. It can be said that the average yield of Scalloped Lobster seeds differs from the others are considered to be the same collection results.

Puerulus lobster when the research was placed at a depth of 14 meters and 20 meters. lobster larva's attractor material is unsame in different locations. Waring is main material, for example was widely used by fishermen in the Trenggalek, Banyuwangi and Lombok areas [2][11] Sampling was carried out 35 times by repeating 35 times as well. From 35 repetitions, 4 species of puerulus were found including the Ornate puerulus species (*P. ornatus*). Scalloped puerulus(*P. homarus*). Painted puerulus (*P. versicolor*), and Pronghorn puerulus (*P. penicilatus*). The results of puerulus lobster identification are based on the characteristics described by lobster fishermen according to the table and compare with the reference book of Clive Jones (unpublished).

Previous study found that there were six species of puerulus inhabit Eastern Indian Ocean of East Java[12]. From the research, there were 4 species of captured puerulus species, including Ornate puerulus, Scalloped puerulus, Painted puerulus and Pronghorn puerulus. This is different from previous studies that have been carried out in Trenggalek district that three types of lobster larvae were found, there are Ornate lobster (*Panulirus ornatus*) larvae, the Scalloped Lobster larvae (*Panulirus homarus*) and the Painted Lobster larvae (Panulirus versicolor)[13]. Whereas in the Banyuwangi district as stated by that more lobster larvae species were found in Banyuwangi waters. There were 5 species of which are Scalloped Lobster (*Panulirus homarus*) Color lobster (*Panulirus longipes*), Ornate lobster (*Panulirus ornatus*), Pronghorn lobster (Panulirus peniculatus), Painted Lobster (*Panulirus versicolor*). In the southern waters of Trenggalek and Banyuwangi districts, it was found during the puerulus and juvenile phases while in Pacitan south it was found only the puerulus phase. This might be due to several reasons including: types of contractions, collectors' materials or tools used are different, depth, habitat, and time [14, 15]. It is believed that different phases of lobster life require different environmental conditions because the development of lobster physiology influences sensitivity or censorship to the needs and changes in the environment[16].

4 Conclusion

Four species of lobster were found during 35 repetitions with 2 different depths on the coast of Wawaran Pacitan district, including Scalloped Lobster *(Panulirus homarus)*, Pronghorn Lobster (*Panulirus penicillatus*), Ornate Lobster (*Panulirus Ornatus*) and Painted Lobster (*Panulirus versicolor*). The depth difference between 14 meters and 20 meters do not affect the number of puerulus species compositions collected. From each depth there are differences in the number of species composition. Scalloped Lobster (*Panulirus Homarus*) have a higher significance value than the other three species.

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