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COMPARATION OF SPINY LOBSTER (*Panulirus* sp.) POPULATIONS FROM BANTUL AND CILACAP, CENTRAL JAVA, INDONESIA

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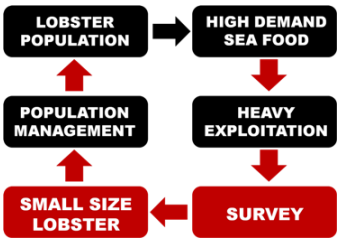
Graphical abstract



Abstract

Spiny lobster is known as a marine organism which is one of the popular seafood and has a high price. As a result, many lobsters are caught by fishermen. This study compares the spiny lobster captured from two different areas in southern coast of Central Java, namely Bantul and Cilacap. Samplings were done with nets which are usually used by fishermen. Further identification of the species was done, as well as the length and weight measurements. The results showed that the lobsters caught were dominated by *Panulirus homarus*. Most lobsters caught in the small size category. These results raise the concern of impending shortages of spiny lobster in nature. It also suggests that an integrated resource management is needed to sustain the natural population and to meet the high demand of spiny lobster.

Keywords: Endangered, *Panulirus* sp., seafood, spiny lobster

1.0 INTRODUCTION

Indonesia is an archipelagic country with high biodiversity, including marine resources, and is known as the center of megabiodivercity [1, 2]. This suggests that marine organisms found living in these waters are very diverse [3, 4]. The study of this diversity is not only at morphological level, but also to the level of genetic diversity [5–8]. Under these conditions, the exploitation of marine resources is very high, especially for those which can be consumed and have high economic value in the market [9]. Various types of marine organisms is an important export commodity for Indonesia [10, 11], which has an important role for the country's economy.

Problems will arise if such exploitation is not regulated, which will lead to extinction of the organisms, both at the level of locally and nationally [12]. It has been reported an increase in the rate of extinction of several marine organisms in Indonesia, such as [2, 13]. Therefore, the government issued regulations to maintain the natural population. For that we need a mechanism for the management of populations of various marine organisms to avoid overfishing. The management should be built based on credible scientific data and should be integrated [2]. One concern related to the above is the spiny lobster. This crustacean is one of marine products which become popular seafood with high prices in the market [14]. This leads to the development of a

commercial fishery business greatly to this lobster at many places. This leads to the development of lobster commercial fishery business at many places. This also further encourages fishermen to increase catches of lobster, which raises concerns for the decline in natural population [15].

Spiny lobster world production is about 260 000 t yr^{-1} and this is considered very large and in support for high demand for consumption [16]. Spiny lobster is an important economic resource, and in some areas have been exploited for decades. Panulirus in particular is one source of income in some countries such as Brazil and Caribbean, where this activity involving thousands of people [18]. However, aspects of basic biology and ecology of spiny lobster is generally unknown and very little information is available. Therefore, in order to develop management policies of spiny lobster population, it is necessary to increase understanding of the wild population. This study was conducted to look at the condition of spiny lobster populations in two locations targeted by fishermen to catch lobster in the southern coast of Java.

2.0 MATERIAL AND METHOD

All sampling were done randomly in Cilacap and Bantul districts at the southern coast of Java. These locations are known as high catching lobster areas. Samplings were conducted on February to August 2015 using a net with a mesh size ¾ inches (1 inch = 6.023 cm). In total, samplings were performed six times at both locations. All lobsters captured were put in a cool box to be identified morphologically in situ based on [19]. The lobsters were brought to the laboratory for subsequent measurements.

Measurement of the length and weight of each lobster were done in the laboratory. Total (TL) and carapace length (CL) were measured by using a caliper to the nearest 0.1 mm, based on the method by Radhakrishnan *et al*. [20]. In addition, the wet weight of the lobster was measured using electric balance to the nearest 0.1 g.

3.0 RESULTS AND DISCUSSION

There were five species of spiny lobsters caught in the two study sites namely *Panulirus homarus* (Linnaeus, 1758), *P. ornatus (*Fabricius, 1798), *P. versicolor* (Latreille, 1804), *P. penicillatus* (Olivier, 1791) and *P. poliphagus*. Total spiny lobsters caught during the study were 518, consisting of 243 lobster from Cilacap and 275 lobster from Bantul area.

The survey results indicate that there were only three species of lobster caught in Bantul, while in Cilacap five species of lobster were found. See Table 1. These results provide the two possible causes. First, Cilacap waters have suitable conditions for lobster. Each marine organism have specific water quality requirements in order to live well [21].

In the event of changes in water quality will affect the life of the organism and the response given by the population will vary depending on the type of organism [22, 23]. The presence of pollutants in the waters will provide a distraction for the life of an organism, populations and communities in an ecosystem [19, 24]. For regions that pollution or other disturbances occur, certain organisms that are sensitive to changes in the environment will tend to decline in number [25]. The presence of pollutants in the waters of Bantul, would have to be proved scientifically.

Secondly, the level of exploitation of the natural populations of spiny lobster is heavier occurred in Bantul compared to Cilacap. Demand for seafood such as lobster which has a high price [26] tend to be higher in tourist areas such as Yogjakarta which is close to Bantul. Yogjakarta is one of the very important tourist destinations in Indonesia, where domestic and foreign tourists very much [27], compared to Cilacap which is not a major tourist destination. An increase in the rate of capture of a particular organism which has an important economic value will accelerate the decline in natural populations. Another interesting thing is, 275 lobsters were caught in Bantul, as many as 258 individuals (93.82 %) is *Panulirus homarus*, which is much higher compared to *P. organtus* and *P. peniculatus*. This condition reflects two things, first, the quality in the waters of Bantul more suitable for *P. homarus*, secondly only limited number of this lobster were caught by a fisherman. On the other hand, it is showed that this species has a nutritional value better than other species for consumption.

Table 1 Number and percentage of different species of Spiny Lobster caught in Bantul and Cilacap, Central Java

Species	Bantul		Cilacap	
	Number	(%)	Number	(%)
P. homarus	258	93.82	166	68,3
P. ornatus	6	2.18	36	14.8
P. versocolor	0	0	26	10.7
P. peniculatus	11	4	2	0.82
P. polyphagus	0	0	13	5.35

Table 2 illustrates that in general the lobsters are caught in both places are dominated by a small lobster with size less than 200 g. Lobster caught in Cilacap generally smaller than those captured in Bantul. The number of large lobsters caught (> 300 g) on average was less than 10 %. It indicates the presence of large lobsters already very low.

Table 2 Weight interval class distribution and its percentage of spiny lobster collected from Bantul and Cilacap, Central Java

Weight Interval Class (g)	Bantul (%)	Cilacap (%)
< 99.9	13.6	**67.078**
100 to 199.9	**61.09**	25.10
200 to 299.9	11.64	5.35
300 to 399.9	8.36	0
400 to 499.9	5.46	2.47
> 500	0	0
Total	275	243

Table 3 shows that the largest lobster caught in Bantul has a weight of up to 688.5 g with a carapace length of 9.7 cm, while those caught in Cilacap has a weight of 771.7 g with a length of 10.3 cm. These data also confirms that the number of large lobsters in the wild is very limited.

Table 3 Length and weight of of spiny lobster collected from Bantul and Cilacap, Central Java

District	Lobster (no.)	Weight (g)		Carapace Length (cm)	
		Heaviest	Lightest	Longest	Shortest
Bantul	275	688.5	56.1	9.7	3.9
Cilacap	243	771.7	6.5	10.3	2,7

This condition is quite alarming, especially for the supply of lobster seafood for consumption. This could be due to the exploitation of lobster are not regulated, therefore many adult animals have been harvested. This condition required good management of natural populations [9, 28]. In the event of a natural population decline an organism due to overharvesting and not restricted, there will be local or even global extinctions [29]. Conservation and restoration of the population through restocking will be inevitable [30, 31]. To ensure the continuity of supply of spiny lobster which as a popular seafood for consumption, it would require a comprehensive management which may need to involve local wisdom [32] including lobster harvesting rules.

4.0 CONCLUSION

Spiny lobsters caught in the waters of Bantul and Cilacap are dominated by *Panulirus homarus*. Generally lobsters are caught in both locations are still small. The size of the lobster caught in both locations are generally small. Given that spiny lobster is one of the popular seafood species with high demand, it is important to have an integrated management system in order to maintain their natural populations as well as to meet high demand for spiny lobsters.

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