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Habitat and Population Structure of Lobster from Southern of West Java

Dedy Cahyadi Irianto[1,*], Etty Riani[2], Bambang Widigdo[2], Yonvitner[2]

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ABSTRACT
Losbter is a an important and highly economical resources on Coastal Area, in Indian Ocean, including southern part of Java. The research on there area in Pamengpeuk (Garut), South Cianjur, Ujung Genteng conducting to study of habitat and distribution, water quality and lobster population structure. The data analysis are spatial distribution, habitat suitability, population structure from length data distribution. The research result shown the lobster larvae dominant on coastal and near beach, and adult lobster on deeper zone than larvae, and water quality relatively good. The species dominant found are Panulirus homarus and Panulirus pennicilatus) with composition 48%:52%. The size structure in Ujung Genteng relatively growth rapidly than Cianjur and Pamengpeuk. The finding of lobster research in this area are environmental quality appropriate where P homarus and penniculatus as dominat species, with good growth rate.

Keywords: Indian Ocean, Habitat Suitability, Lobster, Distribution, Sustainability

INTRODUCTION

The southern waters of West Java directly face the Indian Ocean. Therefore, the southern region of West Java has potential resources that can be utilized by the surrounding community. Ujung Genteng, Cianjur, Pameungpeuk are examples in the Southern region of Java that have potential resources both in terms of beauty and biota (Widaningsih 2019). Lobster (*Panulirus*) is a biological resource of significant interest due to its various advantages over other biological resources. Indonesia has seven types that can be found, namely, scalloped spiny lobster (*P. homarus*), longlegged spiny lobster (*P. longipes*), pronghorn spiny lobster (*P. penicillatus*), mud spiny lobster (*P. polyphagus*), tropical rock lobster (*P. ornatus*), painted spiny lobster (*P. versicolor*), and white whisker spiny lobster (*P. femoristriga*) (Pratiwi 2020). These lobsters are distributed throughout almost all Indonesian waters and live in shallow waters to a depth of 100 - 200 meters below sea level with a temperature range of 20-30°C. (Pratiwi, 2018).

Utilization of lobster resources in Indonesia mostly comes from fishing activities as part of the fishing production on large scale (Maulana, et al, 2024) . This large-scale exploitation of lobsters is strengthened by the use of technology which increasingly supports this. The development of lobster aquaculture in Indonesia is very slow because it still uses simple technology and requires higher costs compared to catching consumption-sized lobsters. This condition causes an overstock of lobster seeds, and a decline in the stock of consumption-sized or adult lobsters.

The activity of catching consumption-sized lobsters on a large scale needs to be followed by good regulation, and so that it does not impact to a decline in stocks, extinction of the species, an imbalance in the ratio between males and females, as well as other biological aspects (Kadafi, *et al*., 2005). Lack of control over fishing intensity also causes "over fishing" which will result in, among other things, a smaller average size of lobsters caught. The smaller size causes the economic value of lobsters to be lower. Therefore, to prevent a decline in the lobster population, it is necessary identify the population distribution, biology indikator including length size and weitght, and ecology (water quality habitat) and ecosystem of lobster.

A research in Pelabuhanratu found the total lenght of lobster is 40 cm, growth rate 0,36-0,41

*Corresponding author
✉ Dedy Cahyadi Irianto
dedycaiyan@gmail.com

[1]Program Studi Pengelolaan Pesisir dan Lautan, Sekolah Pascasarjana, IPB University
[2]Departemen Manajemen Sumberdaya Perairan, Fakultas Perikanan dan Ilmu Kelautan, IPB University

(Nurcholis et al, 2018). Habitat suitability for sea water temprerature of lobster commonly found between 20-30 in Ekas Bay-Lombok (Budiyanto, 2021). That mean, lobster is tropical fish that have wide range tolerance for ecosystem adaptation. Studying the habitat, biological conditions and population of lobsters is a baseline for designing sustainable management strategy. In this research, habitat, fishing techniques and the population area distribution are explored. The population data obtained is an indicator of the status of the lobster population which is the aim of this research conducted.

METHOD

Research Sites

This research was carried out in the Southern Region of Java that divided into three location points, namely, Ujung Genteng, Cianjur, and Pameungpeuk. Data collection was carried out in February 2023 – June 2023, including primary data and secondary data. Primary data was taken using random drawing with a total of 382 lobsters with a data collection interval of one month. Apart from that, primary data is also supplemented with interview data with local fishermen to get more in-depth information regarding the lobster population. Lobster biometric observations include carapace length, weight and sex determination. Determining sex is based on the location of the genitals. The male genitalia are located between the legs of the fifth path, are oval in shape, and at the end of the fifth path there are no branches. Meanwhile, the female genitals are located between the legs of the third path, are round, and at the end of the fifth path there are branches. Secondary data for this research was obtained from literature studies and previous research related to lobsters. Carapace length measurements were obtained from direct measurements using a 30 cm ruler measuring instrument with a smallest scale of 0,1 cm. Weight data was obtained from direct measurements using digital scales with the smallest scale of 0,01 gr.

Analysis

Distribution

The distribution of lobster populations from several observation locations in the South of West Java was identified using a participatory mapping approach. This mapping was carried out based on information about fishermen's experience of catching both lobsters and their larvae. The information conveyed is mapped on a survey location map, so that distribution information is obtained. Participatory mapping analysis uses analysis based on spatial information with mapping techniques. The result is an interpretation of the fishing area seen visually on the distribution map found.

Bio-population

The biology of the lobster population analyzed is the composition, size distribution and growth of the adult population. Species composition is the ratio between the number of individuals of a species to the total number of individuals. The composition of the lobster catch is represented in the form of a catch graph for all types of lobster caught (Irfannur *et al*. 2017). According to Asvin *et al*. (2019), Lobster species composition is calculated using the following equation (Krebs, 1989):

$$Ki = \frac{ni}{\mathrm{N}} \times 100\%$$

Ki represents the percentage of lobster abundance (%); ni represents the individual numbers of the species-i
(ind); and N represents the total number of individuals of all species (ind).

Length Frequency Distribution

Data related to carapace length and lobster weight are represented in the form of tables and graphs of the distribution and frequency of size of each type of lobster caught (Widianti et al. 2021). Size distribution and frequency are obtained from the results of measuring the length and weight of lobsters which are grouped into length classes and class intervals. Next, the number of length class intervals and class intervals is determined using the Sturges formula (Sugiyono 2012), as follows:

$$\text{Class width (i)} = \frac{\text{(The largest value - the smallest value)}}{\mathrm{K}}$$

Where the K value is obtained from:

$$K = 1 + 3{,}3 \log n$$

The K value is the number of classes, and n is the number of lobster size distribution data obtained from carapace length data.

Growth Parameters

Growth parameters (K dan L∞) are determined using the ELEFAN I method (Gayanilo et al. 1994) which refers to the following von Bertalanffy equation.

$$Lt = L\infty \, (1 - e^{-K\,(t - to)})$$

Information:
L(t) = carapace length at age (t) (mm)
t = relative time
L∞ = lobster asymptotic carapace length (mm)
K = lobster growth rate

The growth parameter t_0 is calculated using the Pauly equation (1987) as follows: log $(-t_0)$= - 0,3922 - 0,2752 log (L_∞) - 1,038 log (K)

RESULTS & DISCUSSION

Distribution

The distribution of adult lobsters and lobster larvae is evenly distributed in the waters south of Java (Wibowo *et al.* 2019). The results of participatory mapping of fishing areas for lobster larvae and adult lobsters are based on areas around the coast. Adult lobsters are predominantly found in waters near the edge with rock and gravel substrates, while lobster larvae are more common at the edges and in the middle, as shown in the following figure.

The fishing area for adult lobsters is in theoretical waters and along the southern coastline of Java to a depth of 1-5 meters. The area for catching lobster larvae in the Karang Panggang coastal area is in Ujung Genteng. Other larva fishing areas are Karang Gantungan Beach, Cidora Beach, and Pameungpeuk. In the biological life cycle, lobsters migrate towards the coast from the larval, post-larval, to small, permanent lobster stages (Setyanto *et al.* 2020). This location shows that lobsters thrive in waters near the coast around river mouths, small bays and protected areas. Because of this distribution near the coast, fishermen also catch fish in locations not far away. At the three observation locations, fishing activities for lobster larva and adults were carried out using different fishing gear. Because of their sticky nature, catching clear lobster larva uses traps made of paper which are commonly known to local people as pocong, while catching adult lobsters is done by diving.

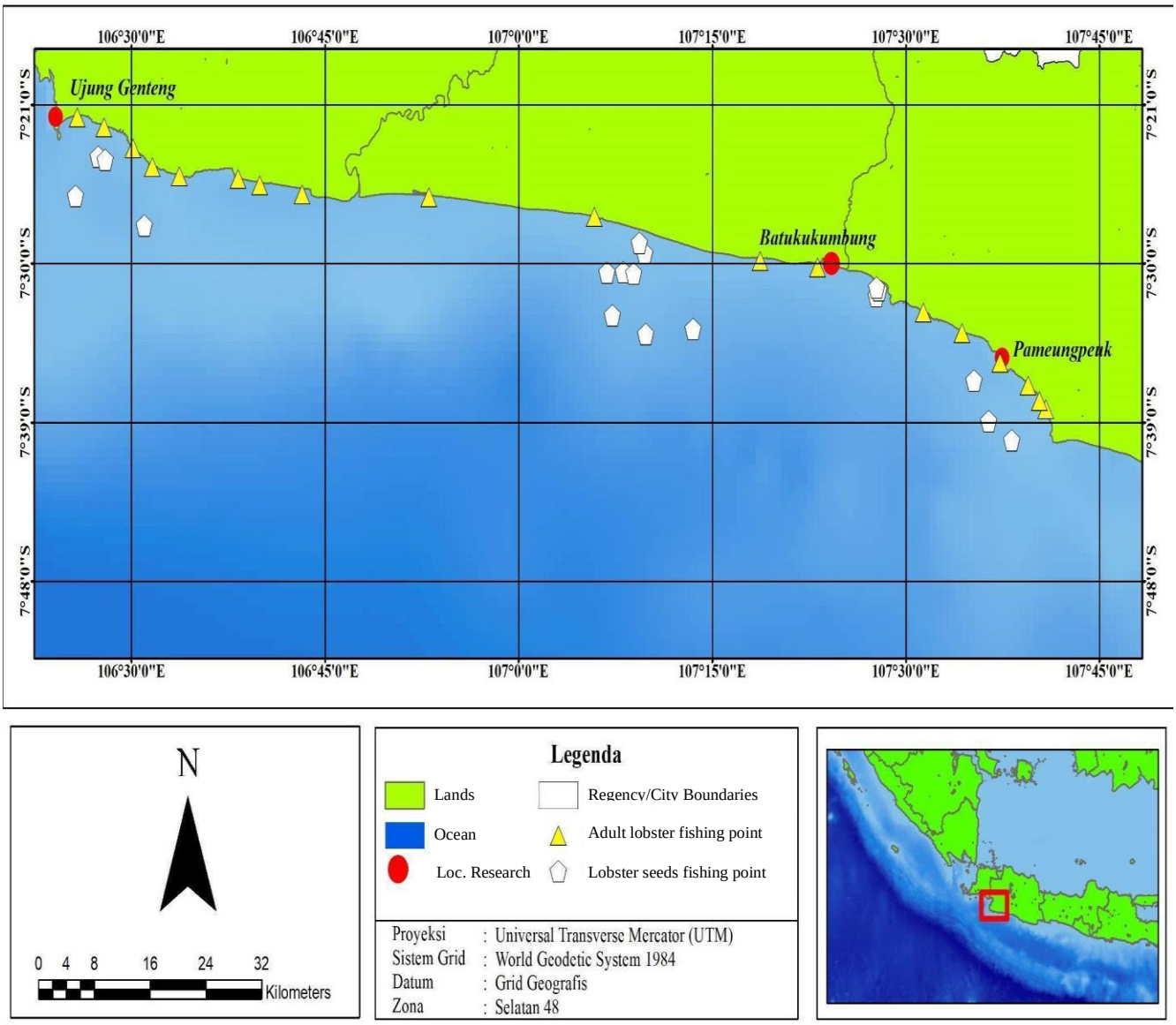

Figure 1. Lobster fishing locations in Ujung Genteng, Cianjur and Pameungpeuk.

Table 1. Types of fishing equipment for catching clear lobster seeds and adult lobsters

Lobster	Fishing Equipment	Information
Clear Lobster Seed		The name of this fishing gear is *Pocongan*. This tool is made like a fan and is installed vertically by attaching it to a chart. Then the clear lobster seeds will stick to the fan gap which is considered their place of protection
Adult Lobster		Adult lobster fishing gear uses ordinary nets assisted by tires for catching near coral. This fishing gear is used to accommodate lobsters caught from compressor diving, and usually live near coral.

In relation to lobster habitat, living habits are also influenced by the quality of the aquatic environment. Environmental indicators such as temperature, salinity, regulated oxygen, pH, depth and substrate are key parameters. From the data obtained, lobsters appear to live in a normal environment, and can live to a depth of 90 m in rocky, sandy and coral habitats. The range of lobster parameter values is presented in (Table 2).

The results of the environmental parameters are environmental conditions that are commonly known for lobster fishing. Environmental information that is known to the public such as water conditions, availability of brood or adult populations, growth rate, frequency of presence of seeds, and fishing habits of fishermen are indicators of lobster stocks. That mean, the southern coast of Java is a suitable location for adult lobster and larve. Fishermen's responses to several key parameters related to community habits are as shown in Table 3.

Table 2. Habitat characteristics of lobster fishing areas.

Parameter	Unit	Result	Location	Source
Temperature	°C	29 - 31	Teluk Gerupuk, NTB	Erlania *et al*. (2014)
Salinity	psu	29	Teluk Palabuhanratu	Rombe *et al.* (2018)
Dissolved Oxygen	ppm	7-8	Teluk Prigi	Sabrini *et al.* (2019)
pH		7 - 8,5	Teluk Prigi	Sabrini *et al.* (2019)
Depth	meter	1-90	Kebumen	Kadafi *et al*. (2006).
Substrate	-	Sand, rock, and coral	Kebumen	Widianti *et al*. (2021)

Table 3. Results of respondents' analysis of lobster bio-ecology.

Indicator	Location		
	Ujung Genteng	Cianjur	Pameungpeuk
Status of Indicator	Good	Good	Good
Habitat population	Low	Low	Low
Growth of lobster seeds until they are ready for consumption	More than 5 months	More than 5 months	More than 5 months
Frequency of appearance of clear lobster seeds	Every month	Every month	Every month
Frequency of fishermen catching clear lobster seeds	4 times or more in a week	4 times or more in a week	4 times or more in a week

The growth of clear lobster seeds until they become lobsters ready for consumption (minimum carapace length of 4 cm) takes more than 5 months. This time period is the custom of the community of lobster catchers and collectors who carry out clear lobster seed cultivation activities until maturity. According to Marlina (2022), growing lobster seeds to small lobsters measuring 30 grams takes approximately 4 months, while further rearing to reach consumption size requires more than 14 months. The long process of enlargement to reach a size suitable for consumption is the reason why fishermen are rarely interested in cultivating enlargement plants. Apart from that, the lack of technology and feed innovation, as well as expensive production costs, also slow down the development of the lobster business.

The frequency of appearance of translucent lobsters occurs every month. The availability of clear lobster seeds means fishermen continue to catch them even in limited quantities and the results are not the same throughout the year. Adult lobster fishing activities are generally 4 or more times a week. Fishermen explained that in 2019 they only took lobster seeds one to two times a week, because the catch was still large. However, from 2021 until now fishermen have caught seeds more than 4 times a week. Apart from the fact that there are not as many as in 2019, because many people are involved, the price of lobster seeds on the market is an attraction for fishing fishermen to increase their income. Apart from that, the demand from buyers, including exporters and domestic buyers, never stops looking for lobster seeds. Meanwhile, demand for adult lobsters is relatively limited and not throughout the year.

Species Composition

Lobsters caught in the waters of Ujung Genteng, Pameungpeuk and Cianjur are dominated by pronghorn spiny lobster (*P. penicillatus*) and scalloped spiny lobster (*P. homarus*). Caught lobsters will be collected by collectors before being distributed. The following is the composition of pronghorn spiny lobster (*P. penicillatus*) and scalloped spiny lobster (*P. homarus*) that caught in the waters of Ujung Genteng, Pameungpeuk and Cianjur (Figure 2).

The comparison of catches between the two is not much different. The catch was dominated by pronghorn spiny lobster (P. *penicillatus*) at 52% (207 fish) and scalloped spiny lobster (P. *homarus*) at 48% (191 fish). These two types are the dominant species in the waters south of Java. Other species that are also often found are painted spiny lobster (P. *versicolor*) and longlegged spiny lobster (P. *longipes*) (Yonvitner et al, 2019).

Length Frequency Distribution

Adult lobsters that were caught were measured for carapace length to determine the size structure. The frequency distribution of length is determined using a frequency distribution approach from length data. The frequency distribution of length is determined within the same length class interval, then plotted in a graph. The following is a graph of the frequency distribution of lobster length in the waters of Cianjur (Figure 3a), Pameungpeuk (Figure 3b), Ujung Genteng (Figure 3c).

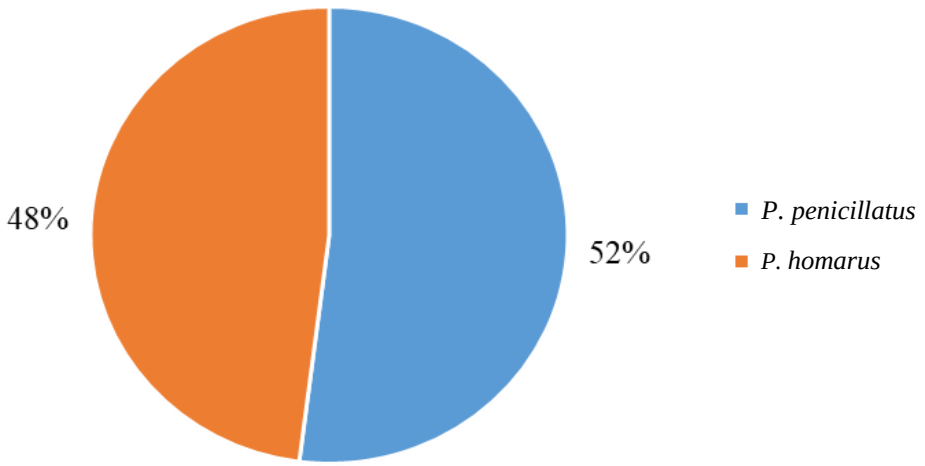

Figure 2. Catch composition of pronghorn spiny lobster (*P. penicillatus*) and scalloped spiny lobster (*P. homarus*)

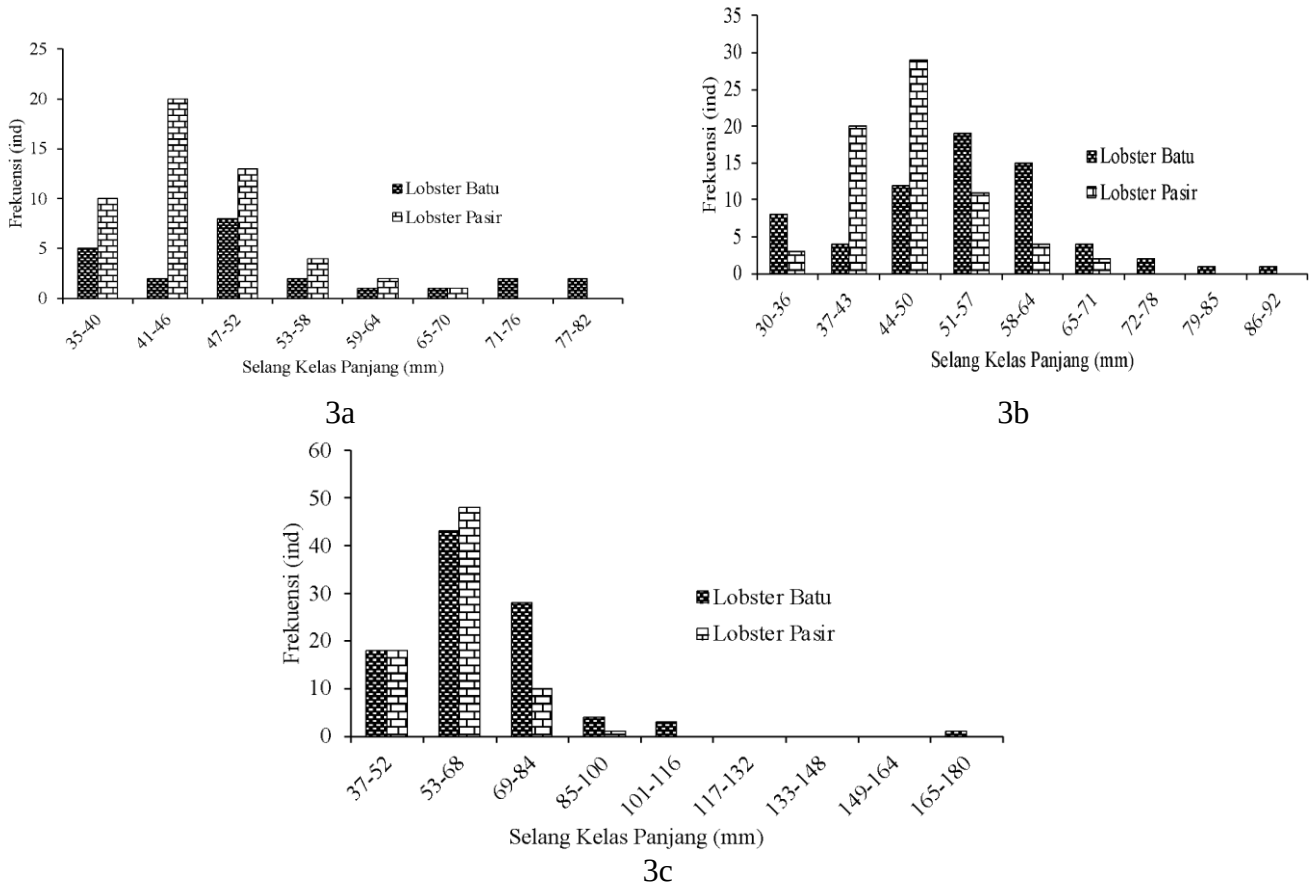

Figure 3. Length distribution of adult lobsters in Cianjur (3a), Pemengpuek (3b) and Ujung Genteng (3c).

The frequency distribution of lobster length in Cianjur waters ranges from 35-82 mm. Pronghorn spiny lobsters (*P. penicillatus*) have a maximum length of 78 mm and a minimum length of 35 mm. Scalloped spiny lobsters (*P. homarus*) have a maximum length of 68 mm and a minimum length of 35 mm. Pronghorn spiny lobsters (*P. penicillatus*) caught with the highest frequency were in the 41-45 mm class interval, while scalloped spiny lobsters (*P. homarus*) were in the 41-46 mm class interval.

The frequency distribution of lobster length in Pameungpeuk waters, Garut ranges from 30-36 mm. Pronghorn spiny lobsters (*P. penicillatus*) have a maximum length of 89mm, and a minimum length of 30 mm. Scalloped spiny lobsters (*P. homarus*) have a maximum length of 68mm, and a minimum length of 32 mm. Pronghorn spiny lobster (*P. penicillatus*) caught with the highest frequency were in the 41-45 mm class interval, while scalloped spiny lobsters (*P. homarus*) were in the 41-46 mm class interval.

The frequency distribution of lobster length in the waters of Ujung Genteng, Sukabumi ranges from 37-52 mm. Pronghorn spiny lobsters (*P. penicillatus*) have a maximum length of 180mm, and a minimum length of 37 mm. Scalloped spiny lobsters (*P. homarus*) have a maximum length of 100 mm and a minimum length of 40 mm. Pronghorn spiny lobsters (*P. penicillatus*) and scalloped spiny lobsters (P. *homarus*) were caught with the highest frequency in the 53-68 mm class interval.

Based on the data above, pronghorn spiny lobsters (P. *penicillatus*) and scalloped spiny lobster (P. *homarus*) from Ujung Genteng waters are greater than other waters in southern West Java. The population that is mostly caught in Ujung Genteng is also longer in size compared to other areas. This condition shows that each region has differences in growth and environment.

Growth

Based on the two dominant types of lobster caught, the condition of biological parameters was observed by examining the growth coefficient (*K*), asymptotic length of the lobster ($L\infty$), and theoretical age when the lobster length is zero (t_0). The results of the analysis of lobster growth parameters were found after all populations from all fishing locations were combined. This combination is to obtain an example that is sufficient to determine the growth value as follows (Table 4).

Table 4. Lobster growth parameters.

Growth Parameter	Scalloped Spiny Lobster (*P. homarus*)		Pronghorn Spiny Lobster (*P. penicillatus*)	
	Male	Female	Male	Female
$L\infty$	113,87	91,11	194,07	125,55
K	0,22	0,42	0,42	0,63
to	-0,53	-0,29	-0,23	-0,17

Based on the results obtained, male Scalloped Spiny Lobster (P. *homarus*) have an asymptotic length of 113.87 mm, a growth coefficient (K) value of 0.22 per year, and t0 of -0.53 per year. Meanwhile, female Scalloped Spiny Lobster (P. *homarus*) have an asymptotic length of 91.11mm, a growth coefficient (K) value of 0.42 per year, and t0 of -0.29 per year. The male Pronghorn Spiny Lobster (P. *penicillatus*) have an asymptotic length of 194.07 mm, a growth coefficient (K) value of 0.42 per year, and t0 of -0.23 per year. Meanwhile, female Pronghorn Spiny Lobster (P. *penicillatus*) have an asymptotic length of 125.55 mm, a growth coefficient (K) value of 0.63 per year, and t0 of -0.17 per year. Yonvitner *et al* (2019) found in Bumbang Bay, the growth rate coefficient ranges from 0,2-0,49 per year, that relatively similar with this research.

From this analysis, it can be seen that female lobsters grow faster than male lobsters, as well as the ability to reach infinity length. Based on population comparisons, the Pronghorn Spiny Lobster (P. penicillatus) grows faster and is smaller in length. The fast growing and developing condition of the Pronghorn Spiny Lobster (*P. penicillatus*) is thought to occur because the ability to utilize food from the benthic population is better than the Scalloped Spiny Lobster (*P. homarus*).

CONCLUSION

Research on lobster ecobiology in the southern waters of West Java, the condition of the ecosystem and aquatic environment is quite good and supports the life of the lobster population. Clear seed lobsters are caught in waters that are relatively close to the coast because they are still planktonic, making them easier to catch with fixed fishing gear such as pocong. The Pronghorn Spiny Lobster (P. *penicillatus*) grows and develops faster, and also has a better growth rate than the sea lobster. The Ujung Genteng waters look very suitable for lobsters and population development to foster industry-based businesses. The critical situation is related to the development of food, and the capture of the translucent population to become stock for the development of adult lobster cages.

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