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BIOLOGICAL ASPECTS OF *Panulirus homarus* IN PANGANDARAN WATERS, PANGANDARAN DISTRICT

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ABSTRACT

The fishery potential in Pangandaran Regency is quite large, consisting of large pelagic fish, small pelagic fish, demersal fish and crustaceans, but has not been utilized optimally. This study aims to analyze the biological aspects of panulirus homarus, namely species composition, sex ratio, frequency of carapace length distribution in Pangandaran waters. Information about the biological aspects of lobster is important so that lobster stocks in nature can be used optimally. Panulirus homarus samples were obtained from local collectors at Cikidang Fish Landing Base, Fish Auction Place Bojongsalawe, and Fish Auction Place Madasari in October to November 2021. Data analysis in this study used Microsoft Excel. The results showed that there were six species of lobster caught in Pangandaran, namely panulirus homarus, panulirus ornatus, panulirus penicillatus, panulirus versicolor, panulirus longipes, and panulirus polyphaus. The male gender of sand lobster is 327 (47%), while the female gender of sand lobster is 366 (53%).

Keywords: ***exploitation rate; mortality; growth parameters***

INTRODUCTION

Pangandaran Regency is an area that has potential in the marine tourism sector and capture fisheries (Nurhayati 2013). Pangandaran fishery potential is quite large (Apriliani *et al.* 2021). The reason for the large fishery potential of Pangandaran is because it is one of the areas included in the WPP 573 Indian Ocean zone which includes the waters of the western tip of Sumatra Island to the South Coast of Java (Firhandy *et al.* 2018). Based on data from the Department of Maritime Affairs, Fisheries and Food Security (DKPKP) of Pangandaran Regency (2020), Pangandaran's fishery production from 2016 to 2020 is sequentially 24,565.98 tons, 2,528.55 tons, 2,339.46 tons, 2,471.16 tons and 1,062.94 tons. Utilization of potential marine fish resources in Pangandaran waters has not been carried out optimally (Dewanti *et al al.* 2018). The potential resources of Pangandaran marine fish include large pelagic fish, small pelagic fish, demersal fish and crustaceans which are dominated by demersal fish (32.9%) and crustaceans (30.7%) (Apriliani *et al.* 2017).

Lobsters are included in a group of crustaceans scattered throughout Indonesian waters (Triharyuni 2017). Lobster is one of the catch fisheries commodities in Pangandaran which has a high selling value (Lintang 2020). Panulirus homarus is one of the most caught lobsters in Pangandaran because it has a high selling value (Kuslani and Sumindar 2017). This is influenced by the panulieus homarus habitat near the coast with a depth of 1 – 90 m, but the size of the caught panulirus homarus is still below the size allowed by ministerial regulations (Rahman *et al.* 2018). According to the Ministerial Decree No. KP. 12 of 2020, the carapace size of panulirus homarus that can be caught is carapace size > 6 cm with a weight of 150 grams per head.

The majority of Pangandaran people work as fishermen (Nurhayati 2013). Pangandaran fishermen use bottom *krendet* to catch lobsters (Sumindar *et al.* 2016). Based on data from the Department of Maritime Affairs, Fisheries and Food Security (DKPKP) of Pangandaran Regency, lobster production from 2016 to 2020 respectively is 3.70 tons, 4.96 tons, 6.56 tons, 7.15 tons, and 15.92 tons. This shows that there is a lot of lobster potential in Pangandaran. The price of lobster (*Panulirus spp.*) according to data from

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the Department of Marine Fisheries and Food Security (DKPKP) of Pangandaran Regency starts from Rp. 300,000 to Rp. 1,000,000 per kilogram.

Some areas that have the potential to spread lobster in Indonesia include West Sumatra, South Java, Bali & Nusa Tenggara, Sunda Shelf, Malacca Strait, and East Kalimantan, South/West Kalimantan, East Sumatra, North Java, South Sulawesi, North Sulawesi, Maluku and Papua (Hilal 2016). There are 6 types of lobster in Indonesia, namely panulirus polyphagus, panulirus versicolor, panulirus longipes, panulirus ornatus, panulirus homarus, and panulirus penicillatus (Rokhmin 2020). Types of lobster that have been identified in the Pangandaran waters which are part of the Southern Java waters include panulirus homarus, panulirus penicillatus, panulirus ornatus, and panulirus versicolor (Rahman *et al.* 2018).

According to Rahmani (2020) lobster production in Pangandaran has exceeded the *Maximum Sustainable Yield* (MSY). MSY is the maximum sustainable fishery condition (Mahmud and Bubun 2016). This will affect the population and availability of lobster stocks in their natural habitat if fishing activities continue to increase (Triharyuni 2017). According to Wiadnyana *et al.* (2019) Fishing activities are likely to affect the balance of male and female lobster populations in the wild. Therefore, it is necessary to study the biological aspects of lobsters. The biological aspects include the composition of the type of lobster catch, sex ratio, and the frequency of distribution of lobster carapace length. Information on the composition of the type of catch can determine the availability of lobster species in nature (Asvin *et al.* 2019). The frequency distribution of length can be used as information to study a population and stock (Ningrum *et al.* 2015). Sex ratio is used as an indicator to estimate spawning ability (Wujdi *et al.* 2015).

Information about the biological aspects of lobster is important so that lobster stocks in nature can be used optimally. Data on carapace length and lobster weight were carried out to find information related to lobster catching conditions in the implementation of Permen KP No. 12 of 2020 concerning regulations on carapace length and weight of lobsters that are allowed to be caught. The results of this study are expected to be used as input for policies regarding the use of lobster in the Pangandaran area. In addition, information on biological aspects will be very useful as a basis for sustainable fisheries management.

MATERIALS AND METHODS:

This research will be conducted from October 2021 to November 2021 in Pangandaran Waters, Pangandaran Regency. Data collection was carried out for two months with data collection every day. Lobster sample measurements were carried out every day of every month. Data was collected from lobster catches in Pangandaran waters which landed at the Fish Auction Place (TPI) and fish monger. Sources of data obtained from primary data, namely the type of lobster identified using the WWF lobster identification book, counting the number of individual catches based on the type and secondary data, namely records of lobster catches per month, fishing areas and lobster fishing gear units used in Pangandaran waters, production data fisheries and lobster catch production data from DKPKP Pangandaran Regency (2020). Legal regulations regarding lobster catching are obtained from Permen KP No. 12 of 2020.

Data Analysis of Lobster Species Composition

According to Asvin *et al.* (2019) Species composition is a comparison between the total number of individuals with the number of individuals of a species with the aim of knowing the percentage of the type of lobster caught. The data that has been obtained through participation activities and interviews with fishermen, then tabulated into *Microsoft excel* to calculate the composition of the catch based on the type of lobster caught. The composition of the Lobster species is calculated using the Krebs formula, (1989) in Asvin *et al.* (2019) as follows:

$$K = (N_i/N) \times 100\%$$

Description:
K_i : Composition of the 1st species (%)
N_i : Number of individuals of the 1st species
N : Total number of individuals

Lobster Sex Ratio

Sex ratio analysis aims to determine the balance of male and female lobsters in nature (Chodrijah *et al.* 2018). Lobster sex ratio can be calculated using the following equation:

$$NK = (Nb/Nj) \times 100\%$$

Description:
NK : Sex ratio
Nb : Number of female lobsters for each type of panulirus homarus
Nj : Number of male lobsters for each type of sand

Lobster Carapace Length Frequency Distribution

Length frequency analysis was obtained from carapace length data which was tabulated long frequency was obtained from the results of carapace length measurement data using a caliper with an accuracy of 1 mm.

RESULTS AND DISCUSSION:
General Condition of Research Locations

Pangandaran Waters is one of the potential locations for lobster distribution because the characteristics of the waters are in accordance with the lobster distribution area, namely having rocky coral, rocky sand, fine sand, and coral rocks not far from the beach. Panulirus homaruss like rocky coral environments and rocky sand with a depth of 1 – 90 meters. Lobster fishing locations in Pangandaran waters include Legok Java to the border of Cilacap Regency. The fishing gear used in lobster catching activities in Pangandaran waters include stocking nets, gates, and sirens (Rahman *et al.* 2018). Locations for primary data collection are located at three local fish auction places (TPI) and lobster baskets. The Fish Auction Places (TPI) include PPI Cikidang, TPI Bojongsalawe, TPI Madasari. Lobster catching locations are around the waters of Pangandaran Regency.

Panulirus homarus Identification

The lobster catches that were collected during the research were identified using the 2015 WWF identification book. The research focused on panulirus homarus. The research was conducted from October to November 2021 in Pangandaran waters. An explanation of the panulirus homarus that has been identified using the 2015 WWF lobster identification reference book and journal articles is as follows. The morphology of lobster species in Pangandaran waters can be seen in Table 1.

Panulirus homarus is one of the most caught species in Pangandaran waters, Pangandaran Regency. Panulirus homarus has a brownish or greenish base color body and on the surface of the belly segment scattered white spots. During the research activity, the number of panulirus homarus caught in Pangandaran waters was 693 tails with a maximum weight of 480 grams and a maximum carapace length of 104 mm. Sand Lobster type body appearance seen in Figure 1
Information:

Table 1. Lobster Type Morphology in Pangandaran Waters

Type of Lobster	Color	Length (cm	Habitat
Panulirus homarus	Has a greenish or brownish base color with scattered bright spots that adorn the entire surface of the abdominal segment	20-25	Coastal waters and shallow sea waters with a depth of 15 meters
Panulirus ornatus	Has a greenish body base color with a thin line pattern which is black and yellow on each body	20 – 35	shallow waters on the beach with a depth of 1 -8 m
Panulirus logipes	Has a variety of colors, including purple, green, red, and gray, and forms a beautiful pattern	20 – 25	Shallow rocks and water coral with calm currents, sometimes can be found at a depth of 130 m
Panulirus versicolor	Has a green belly and skeleton of a head and a black carapace	20 – 30	Can be found in rocky waters and coral reefs for shelter with a depth of 4 – 12 m
Panulirus polyphagus	Has a characteristic brown base body with white transverse stripes on each body segment.	20 – 25	Areas with a mud substrate, sometimes on a rocky bottom with a depth of 3 – 90 m
Panulirus penicillatus	Has a light green to brownish green base color and male lobsters have a slightly darker color	20 – 30	shallow coastal waters with coral cliffs or rocks with a depth of 1 – 4 m

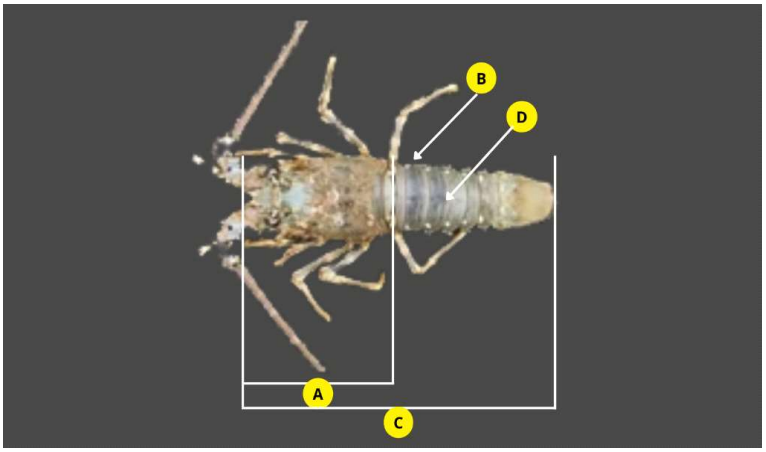

Figure 1. Panulirus homarus
(Source: Personal documentation)

A : Carapace length is about 12 cm
B : Bright spots that adorn the entire surface of the abdominal segment
C : Total length 20 – 25 cm with a maximum length of 30 cm
D : Green or brown base color

This type of lobster has a greenish or brownish base color with scattered bright spots that adorn the entire surface of the abdominal segment. There are white spots on the legs. The length of the carapace is about 12 cm. The average body length of a panulirus homarus is 20-25 cm with a maximum length of 30 cm. Panulirus homarus is suitable to be caught if it has reached a carapace length of more than 8 cm and a weight of more than 200 g (WWF 2015). Panulirus homarus has a characteristic that there are two large spines and on the back followed by small spines located on the antenna plate (Hutapea *et al*. 2016).

Coastal waters and shallow marine waters are the habitat of panulirus homarus with a depth of 15 m, with slightly murky water. Panulirus homaruss can be found in coral reef areas. Found on the bottom of sandy and muddy waters, sometimes under rocks, and close to incoming river water. Panulirus homaruss spread from the Indo-Pacific to Australia. Lobsters are spread from West Sumatra, Java (Panjaitan, Thousand Islands), South Sulawesi (Makassar), North Sulawesi (Manado), Maluku (Ambon), and Papua (Sururi *et al*. 2016).

Panulirus homaruss have a habit of living in groups that live in volcanic and granite vents. How to catch this type of lobster can use fishing gear in the form of traps that are baited or can be by diving. Young lobsters are more tolerant of water quality (turbidity), while adult lobsters prefer clear waters (Pratiwi 2013).

Panulirus homarus spawning in each water will be different due to the influence of environmental factors. The peak of panulirus homarus spawning on Lombok Island occurred in December, while the peak availability of panulirus homarus seeds occurred in July (Ihsan *et al.* 2019). Tabanan Bali waters and Pangandaran waters have the same panulirus homarus spawning season, from June to September with the peak spawning in October (Kembaren *et al.* 2015).

Composition of Lobster Species

The total number of lobsters landed at TPI and baskets was 1,156 tails. There were six types of lobster caught during the research in Pangandaran waters, namely panulirus homarus (*Panulirus homarus*), pearl lobster (*Panulirus ornatus*), bamboo lobster (*Panulirus versicolor*), batik lobster (*Panulirus longipes*), rock lobster (*Panulirus penicillatus*), and lobster. Pakistan (*Panulirus polyphagus*). In the picture above, the catch of panulirus homarus in Pangandaran waters has the highest number, namely 693 fish (60%) of the total number of lobsters caught as many as 1,156 fish. Other types of lobster caught in Pangandaran waters include pearl lobster, rock lobster, bamboo lobster, Pakistani lobster, and batik lobster. The percentages of each lobster were pearl lobster 342 (29%), bamboo lobster 31 (3%), batik lobster 44 (4%), Pakistani lobster 27 (2%), and rock lobster 19 (2%) during the study. The composition of catch types in Pangandaran waters can be seen in Figure 2.

This is in accordance with the results of research conducted by Widianti *et al*. (2021) regarding the composition of lobster catches at the Karangduwur Fish Landing Base (PPI), Kebumen Regency, Central

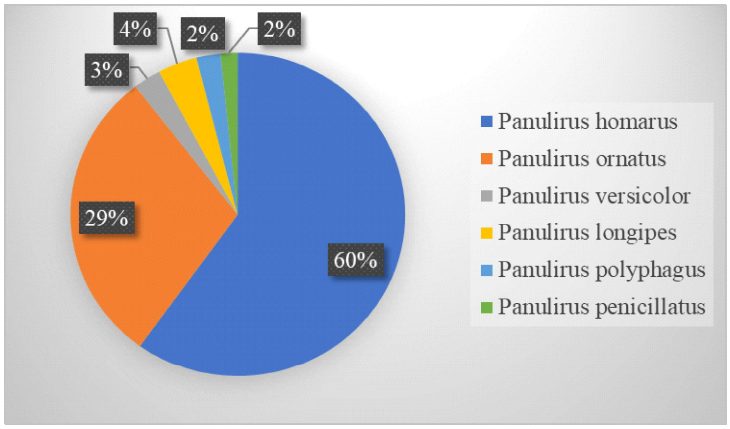

Figure 2. Composition of Lobster Species

Java, which consists of panulirus homarus, pearl lobster, bamboo lobster, batik lobster, Pakistani lobster, and rock lobster. The results of observations of 6,883 lobsters that landed at PPI Karangduwur which were dominated by panulirus homaruss were 5,657 (82%).

The results of the same study were carried out by Fauzi *et al*. (2013a) in the Southern Waters of Gunung Kidul, Yogyakarta and Pacitan, East Java, which consisted of the same six types of lobsters with 3,164 catches, dominated by rock lobsters at 57% and panulirus homaruss at 32%. The results of different studies conducted by Pranata *et al.* (2017) in the waters of Akudiomi Village, Yaur District, Nibire Regency, two types of lobsters belong to the *palinuridae* namely batik lobster and bamboo lobster, while one species belonging to the *scyllaridae* is fan lobster.

The similarity of lobster species caught in Pangandaran, Kebumen, Yogyakarta, and Pacitan locations was caused by the same environmental characteristics, while the difference in the composition of lobster species was caused by the time of catching (Hutapea *et al.* 2019).

Sex Ratio

Ratio is used to determine the comparison between male and female lobsters in nature by observing the physical or morphological characteristics of lobsters to determine the sex of lobsters. The distribution of panulirus homarus sex ratio in Pangandaran waters is distinguished by color. This was done to determine the comparison between the sexes of the dominant panulirus homarus. The sex percentage of panulirus homarus can be seen in Figure 3.

Based on the results obtained during the study, the number of identified panulirus homaruss was 693. The male gender of panulirus homarus was 327 (47%), while the female gender of panulirus homarus was 366 (53%). Differences in sex ratios in each release can be different, this is caused by three factors, namely differences in sexual behavior, environmental conditions, and fishing locations (Bakhtiar *et al.* 2013).

The sex comparison of panulirus homarus in Pangandaran waters is dominated by female panulirus homarus compared to male panulirus homarus. Differences in sex ratios may change at the time of the spawning period (Fitria *et al.* 2021). According to

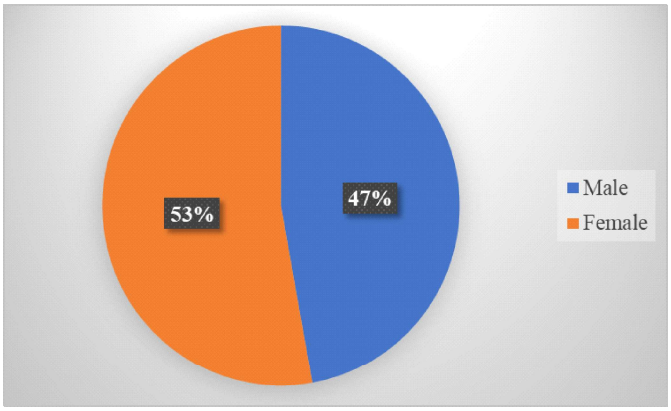

Figure 3. Sex Ratio Panulirus homarus

Kuslani and Sumindar (2017), lobster spawning has a long time with a peak in November to December, while according to Kembaren *et al.* (2015) that the panulirus homarus spawning season has increased from June to September. During the research, one panulirus homarus was found laying eggs weighing 480 g and carapace length (104) mm.

This information on sex ratio is used as the basis for knowledge of reproductive biology and can be used as an indicator so that the sustainability of the lobster population can be maintained (Kembaren *et al.* 2015). The balance of male and female panulirus homarus populations in nature is influenced by fishing activities. Based on the results of Figure 16 that the balance or resilience of panulirus homarus in nature has not shown signs of fishing vulnerability. The spawning process can take place properly if there is fertilization of an egg cell by a sperm cell, so that recruitment will occur (Wiadnyana *et al.* 2019). Determination of the sex of the panulirus homarus can be seen based on the location of the genitals and based on the number of sheets of swimming legs (Dyanita 2022). The gender of the panulirus homarus in this study was carried out by looking at the number of swimming legs. The male panulirus homarus has one swimming leg while the female panulirus homarus has two swimming legs (Sukamto *et al.* 2017). The difference between female and male lobsters can be seen in Fugure 4.

Frequency Distribution of Carapace Length

Lobster Sand is the type of lobster caught by fishermen in Pangandaran waters the most during the research activity, which was 693 compared to other types of lobster caught in Pangandaran waters. Based on the carapace length measurement data, the panulirus homarus has a carapace length of 39 – 104 mm, an average length of 71.5 mm, and a mode size of 39 – 45.5 mm. According to Zairion et al. (2018) the average length of panulirus homarus gonad maturity is 81 mm. The number of panulirus homaruss caught with a carapace length of less than 80 mm were 652 (94%), while for panulirus homaruss with a carapace length of more than 80 mm as many as 41 fish (6%).

Panulirus homarus caught during the research activity in Pangandaran waters from October to November was dominated by panulirus homarus caught with a carapace length of less than 80 mm. This is influenced by the occurrence of panulirus homarus recruitment in October (Kembaren et al. 2015). Panulirus homarus recruitment is caused by an increase in panulirus homarus spawning that occurs from June to September (Kembaren et al. 2015). The catch of panulirus homarus below 80 mm is also influenced by the location of fishing carried out by fishermen, namely near the beach, because the panulirus homarus habitat is at a depth of 1 – 90 meters with rocky substrates and coral reefs, while panulirus homaruss measuring more than 80 mm are located more deep to grow and spawn. Based on the case of the caught lobster. Based on PERMEN KP No. 12 of 2020 concerning Management of Lobster (*Panulirus* spp.), Crab (*Scylla* spp.), and Rajungan (*Portunus* spp.) in the Territory of the Republic of Indonesia that catching panulirus homarus that is allowed to be caught must have a carapace length of more than 60 mm and a weight above 150 gr. When referring to the latest regulations, catching panulirus homarus in Pangandaran Waters is not yet feasible to catch entirely. The length distribution of panulirus homarus carapace can be seen in Figure 5.

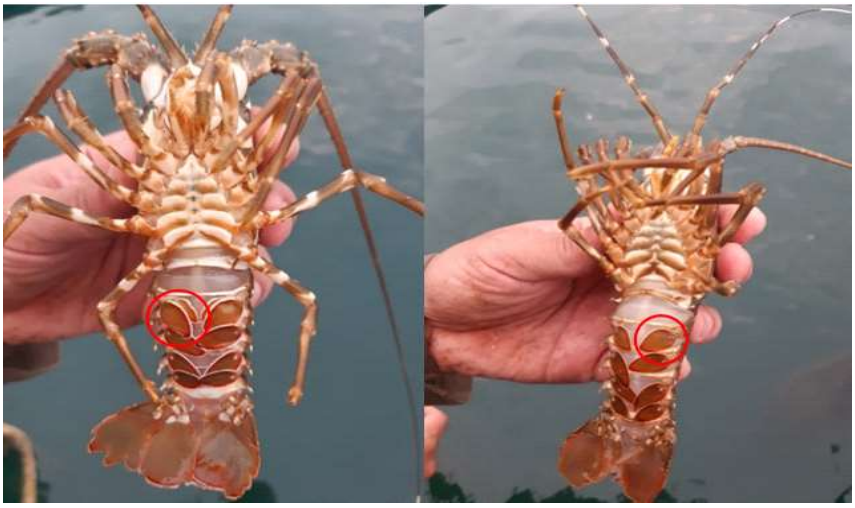

Figure 4. Difference Between Female Lobster (left) and Male Lobster (right) Based on Swimming Feet (Source: Personal documentation)

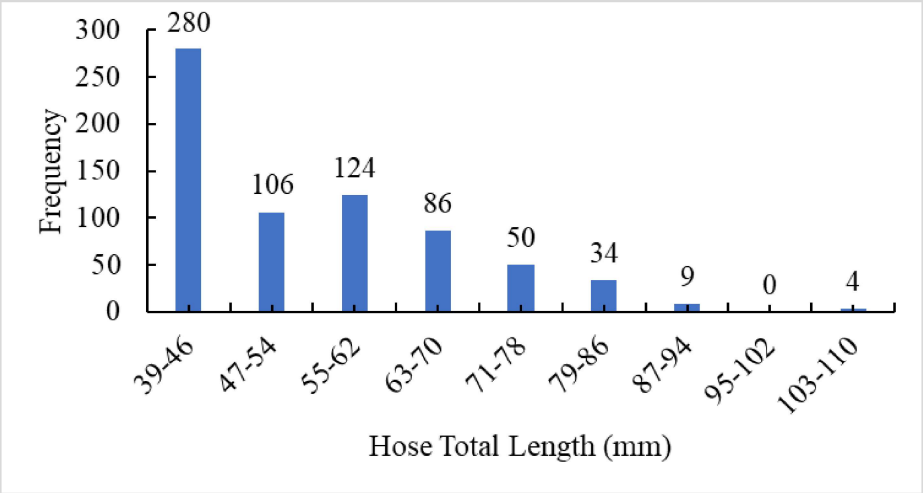

Figure 5. Length Distribution of Panulirus homarus Carapace

According to Kintani et al. (2020) in Pelabuhanratu Bay which was carried out for six months from October 2016 to March 2017, the number of panulirus homaruss measured was 218 with a carapace length of 27-69 mm, which was dominated by lobsters with a carapace length of 45-50 mm. In another study conducted by Natsir and Novita (2021) in April to June, the carapace length of the panulirus homarus was between 50-80 mm out of a total of 382 tails.

CONCLUSION:

The composition of the type of lobster caught in Pangandaran waters with a total catch of 1,156 fish consisting of six types of lobster, namely Panulirus homarus (60%), Panulirus ornatus (29%), Panulirus versicolor (3%), Panulirus penicillatus (2 %), Panulirus polyphagus (2%), and panulirus longipes (4%). The panulirus homarus sex ratio consisted of 327 (47%) male panulirus homaruss and 366 (53%) female lobsters.

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