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Analysis of Distribution and Season of Crab (Portunus pelagicus) in Indonesia Waters

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ABSTRACT

Blue swimming crab (BSC) (Portunus pelagicus) is an Indonesian export commodity for America. The distribution of BSC can be found in the waters of Java, Madura, Sumatra, Bangka Belitung, Kalimantan and Sulawesi. Differences in BSC habitat conditions and climatic conditions in various Indonesian marine locations influence the distribution and abundance of BSC in each location. Information on the distribution and seasonality of BSC in Indonesian waters is still limited. Analysis of the distribution and season of BSC in Indonesian waters based on a study of catch numbers for 2022-2023 PT Kelola Mina Laut. The highest number of catches was in the Madura, West Java and East Java regions, with the lowest number of catches in the Sulawesi and Bangka Belitung regions. The highest total catch occurred in quarter 2 (April-June) and the lowest total catch occurred in quarter 3 (July-September). This research data can be a basis for developing and exploring the potential of BSC in several Indonesian marine locations, but further analysis needs to be carried out regarding other factors that can influence the distribution and season as well as the catch of BSC fishermen in Indonesian waters.

INTRODUCTION

Crab (Portunus pelagicus) is a decapoda with the characteristics of having a flattened shape, bluish carapace color, and having swimming legs. Classification of Portunus pelagicus, Kingdom: Animalia, Phylum: Arthropoda, Subphylum: Crustacea, Order: Decapoda, Family: Portunidae, Genus: Portunus. Crab or blue swimming crab (Portunus pelagicus) is a type of crustacean that has high economic value with a wide geographical distribution. Crabs are distributed in coastal areas from the Indo Tropics to the Western Pacific region (Tahon and Shaker, 2023).

Indonesia is the largest producer of crab products with total production of crab meat products in 2019 reaching 11,701 Tons (United States International Trade Commission, 2021) and 28,806 Tons in 2022 (Ministry of Maritime Affairs and Fisheries, 2022). The potential of crab fishing areas is spread throughout Indonesia's waters, because it has aquatic habitat characteristics that are suitable for crab life (tropical seas) (Tahon and Shaker, 2023). The distribution of crabs in Indonesia waters has differences in each region which is influenced by seasons, water temperatures, currents, food abundance, and other factors that can affect crab habitat (Putri et al., 2021). Limited information about the potential of crabs in several areas of Indonesia's waters results in the utilization of crab potential is not optimal, on the one hand, crabs have a life cycle and seasons that affect the catch of crabs (Yulianto et al., 2024).

Information of crab potential in several areas of Indonesia can be analyzed based on the level or number of crab product exports in each region or region (based on BKIPM export data), but not all crabs from each region get crabs from the same area as the export area (Baihaqi et al., 2022). Information about the potential of crabs in each area of Indonesia's waters is important to analyze, so that it can determine the distribution and season of crabs (Duan et al., 2022) in Indonesia waters. Information on the distribution or potential of crab catches in Indonesia waters can be analyzed based on data from the catch of the crab processing industry (Mustofa et al., 2021). PT Kelola Mina Laut is a company engaged in the seafood industry with superior products, namely pasteurized crabmeat (Novitasari et al, 2023) and raw material sources from various areas of Indonesia's waters (Permaiyati and Erlina, 2023). Information about crab catch data from the crab processing industry can be a source of information about the potential of crabs and the season of crab existence in several areas of Indonesia waters.

METHOD

This research was conducted in April-May 2024. The research data comes from data on the receipt of crab meat from PT Kelola Mina Laut in 2022-2023. Crab meat receipt data is grouped by supplier region (origin of crab meat) and time of receipt of crab meat. The grouping of the origin of crab meat is divided into nine groups, namely Kalimantan, Bangka Belitung, Banten, West Java, Central Java, East Java, Madura, Sulawesi, and Sumatra. The grouping of crab meat receipt times is quarter 1 (January-March), quarter 2 (April-June), quarter 3 (July-September), and quarter 4 (October-December). Data analysis was carried out descriptively by analyzing the potential and season of crab in several locations based on the results of receiving crab meat in several regions and the time of receipt.

RESULTS AND DISCUSSION

Data of the receipt of crab meat comes from several areas of Indonesia waters and is divided into several distribution areas, namely Kalimantan Island, Sulawesi, Bangka Belitung, Sumatra, Java, and Madura. Mapping on Java Island was carried out several regional segmentations because it had the largest value of crab meat acceptance, so that the division of regions was carried out, namely East Java, Central Java, West Java, and Banten. Data on crab meat receipts in 2022-2023 shows that crab meat receipts from the highest to lowest regional yields, namely Madura (355.8 Tons, 27.3%), West Java (228.6 Tons, 17.5%), East Java (211.5 Tons, 16.2%), Banten (174.8 Tons, 13.4%), Central Java (91.2 Tons, 7.0%), Sumatra (79.5 Tons, 6.1%), Kalimantan (70.9 Tons, 5.4%), Bangka Belitung (53.8 Tons, 4.1%), and Sulawesi (36.6 tons, 2.8%) (Figure 1 and Figure 2).

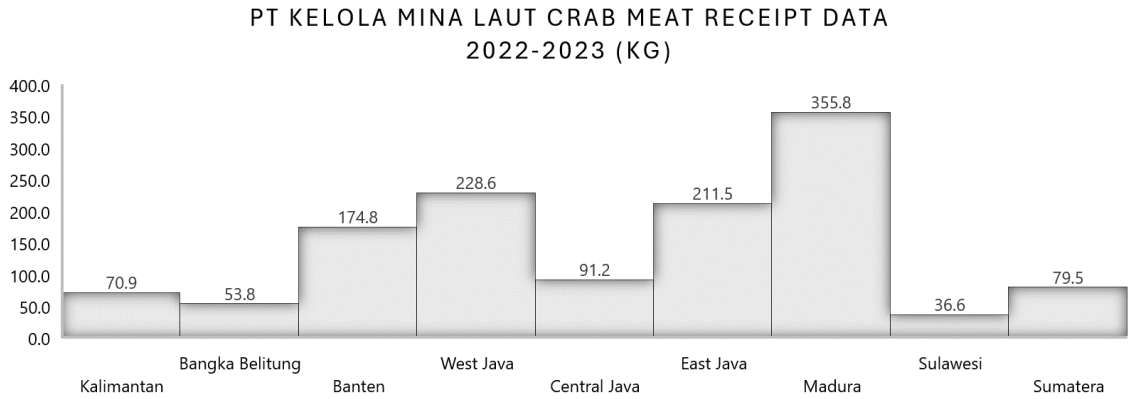


Figure 1. Crab Meat Receipt Data in 2022-2023 (Tons)

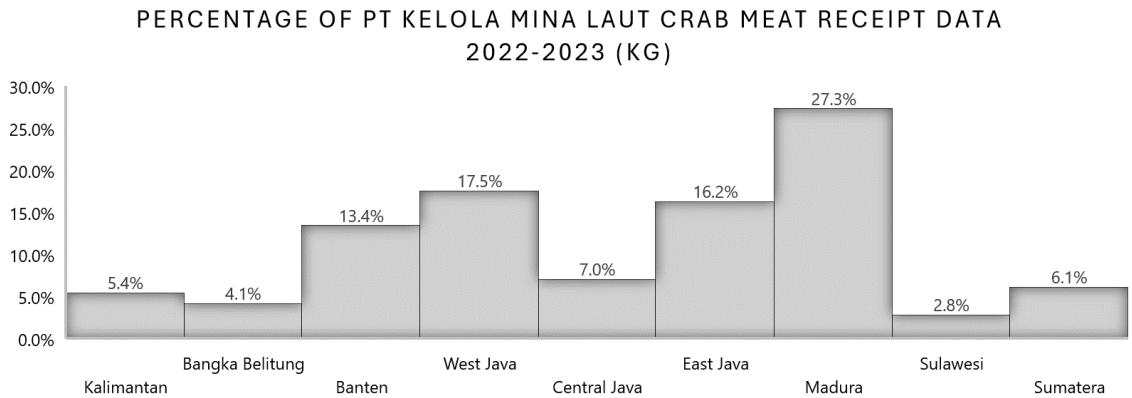
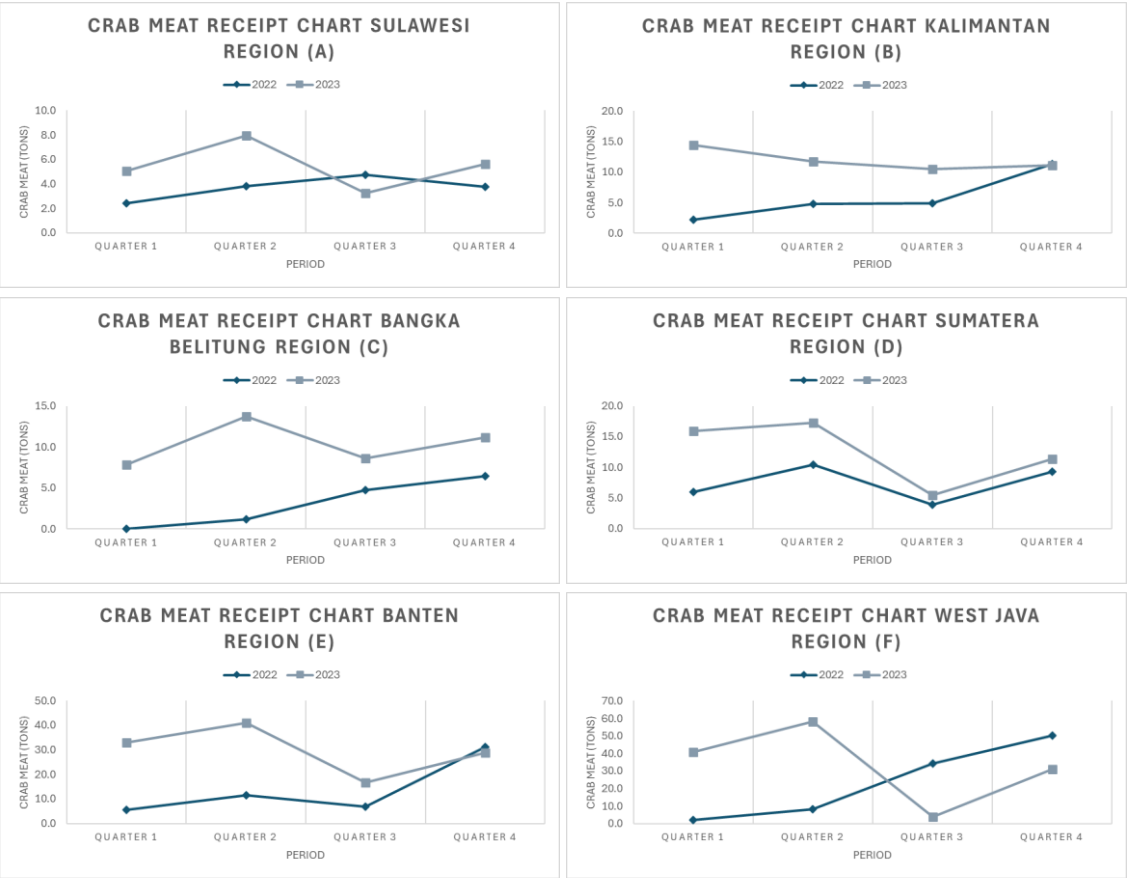


Figure 2. Crab Meat Receipt Data in 2022-2023 (%)

Data on the results of crab meat receipts based on region and time are shown in Figure 3. Crab meat receipt data in each region has fluctuated and has a variable graph pattern in each region. Crab meat receipts in 2022 in the 2nd and 3rd quarters tended to increase compared to the 1st quarter receipts that occurred in the Sulawesi, Kalimantan, Bangka Belitung, West Java, Central Java, and East

Java regions. Crab meat receipts in 2022 in the Sumatra, Banten, and Madura regions tended to decrease in the 3rd quarter, in contrast to other regions, while the total receipts in 2022 showed a pattern of periodic increases from quarters 1, 2, 3, and 4.

Crab meat receipts in 2023 in the 3rd quarter tended to decline and increased again in the 4th quarter which occurred in the Sulawesi, Bangka Belitung, Sumatra, Banten, West Java, Central Java, East Java, and Madura regions. Crab meat receipts in 2023 for the Kalimantan region tend to decrease from quarters 2, 3, and 4. Crab meat receipts in 2023 cumulatively from all regions show an increasing pattern of crab receipts in quarters 2 and 4, while in quarters 1 and 3 they tend to have low revenue values, especially in quarter 3. An analysis of crab meat receipts from 2022-2023 shows a pattern of increasing crab meat receipts starting from quarters 1-4 (2022) and quarters 1-2 (2023), then experiencing a drastic decline in quarter 3 (2023) and increasing again in quarter 4 (2023). Based on the season prediction from the data, Figure 3J shows the high season of crab receipts in the 2nd quarter and the low season of crab receipts in the 3rd quarter.



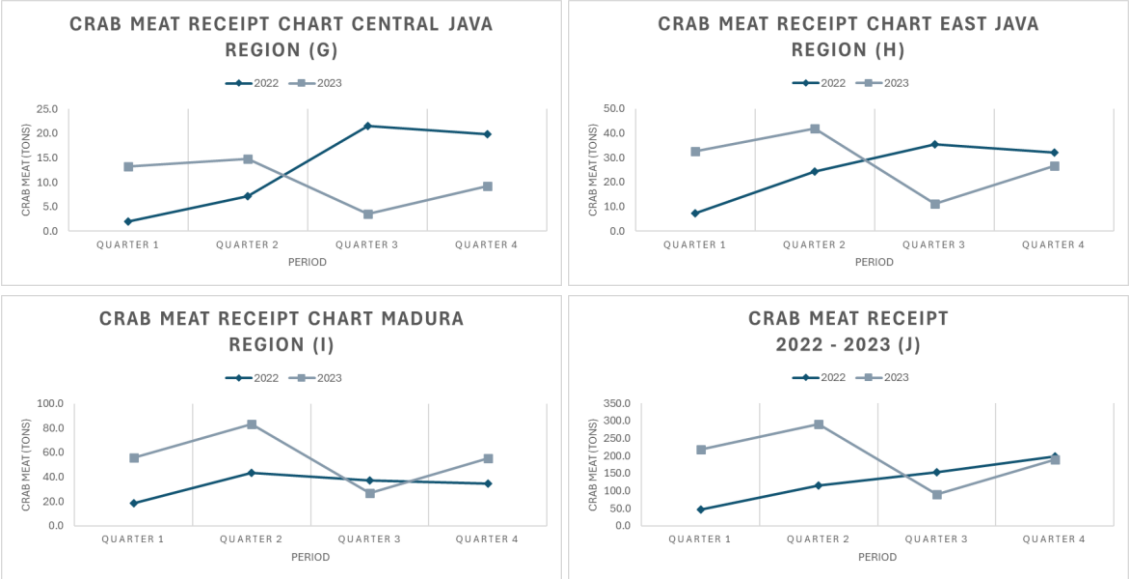


Figure 3. Crab Meat Receipt Graph (Quarterly) 2022-2023 Region (A) Sulawesi, (B) Kalimantan, (C) Bangka Belitung, (D) Sumatra, (E) Banten, (F) West Java, (G) Central Java, (H) East Java, (I) Madura, and (J) Total 2022-2023

Data on the potential distribution of crabs based on distribution patterns in Indonesia in 2022, 2023, and the percentage of global distribution of crabs in 2022-2023 based on meat receipt data are shown in Figure 4, Figure 5, and Figure 6, respectively. The distribution pattern of crab receipts in 2022 (Figure 4) shows the lowest to highest distribution patterns (data on crab meat receipts) in the Bangka Belitung (12.4), Sulawesi (14.8), Kalimantan (23.1), Sumatra (29.6), Central Java (50.4), Banten (55.4), West Java (94.8), East Java (99.0), and Madura (134.2).

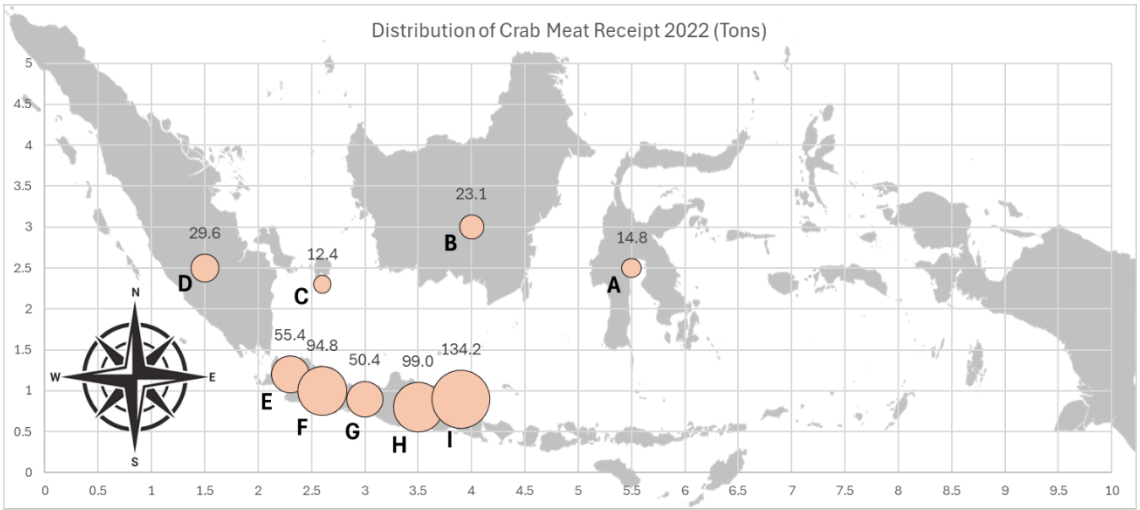


Figure 4. Distribution of Crab Meat Receipt in 2022 (Tons): Regions (A) Sulawesi, (B) Kalimantan, (C) Bangka Belitung, (D) Sumatra, (E) Banten, (F) West Java, (G) Central Java, (H) East Java, and (I) Madura

The dominance of the distribution of crab meat receipts is on Madura Island and Java Island. The distribution pattern of crabs in 2023 (Figure 5) shows the lowest to highest distribution patterns in Sulawesi (21.9), Central Java (40.8), Bangka Belitung (41.4), Kalimantan (47.8), Sumatra (50.0), East Java (112.5), Banten (119.4), West Java (133.8), and Madura (221.6).

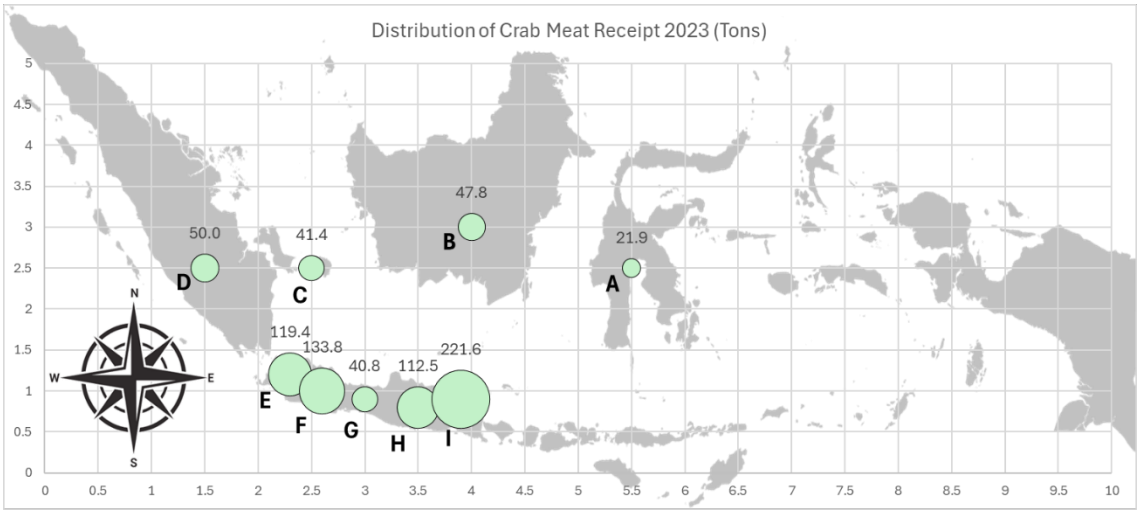


Figure 5. Distribution of Crab Meat Receipt in 2023 (Tons): Regions (A) Sulawesi, (B) Kalimantan, (C) Bangka Belitung, (D) Sumatra, (E) Banten, (F) West Java, (G) Central Java, (H) East Java, and (I) Madura

The distribution pattern of crab meat receipts globally in 2022-2023 shows the lowest to highest distribution patterns in Sulawesi (2.8%), Bangka Belitung (4.1%), Kalimantan (5.4%), Sumatra (6.1%), Central Java (7.0%), Banten (13.4%), East Java (16.2%), West Java (17.5%), and Madura (27.3%). The distribution pattern of crab meat receipts in 2022-2023 is concentrated in the Java and Madura Island regions. The lowest amount of revenue comes from areas outside Java and Madura, such as Sulawesi, Bangka Belitung, and Kalimantan. The mapping of crab fishing locations from PT Kelola Mina Laut crab meat receipt data is divided into two areas, namely the western area and the eastern area, the western area includes the areas of West Java, Banten, Sumatra, Bangka Belitung, and Kalimantan. The eastern area includes Central Java, East Java, Madura, and Sulawesi. The percentage of crab meat acceptance in the eastern area both in 2022, 2023 or globally (2022-2023) has the largest percentage of crab meat contributors compared to the western area crab meat receipts, which are 58.1%, 50.3%, and 53.4%, respectively (Figure 6).

The distribution of crab meat income is used as an interpretation of the distribution of crab meat in an area. The distribution of crabs in several areas of

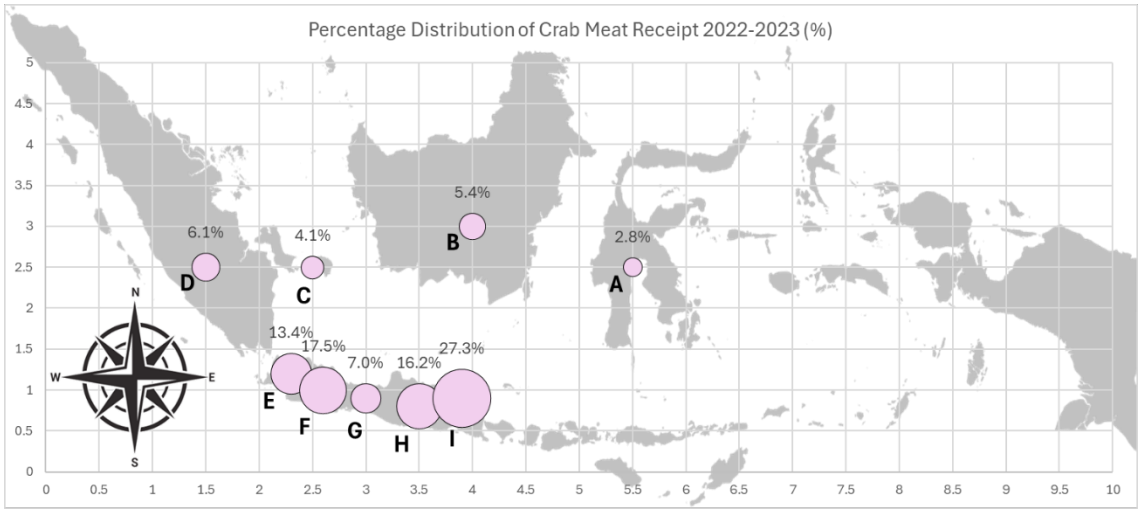


Figure 6. Distribution of Crab Meat Receipt in 2022-2023 (%): Regions (A) Sulawesi, (B) Kalimantan, (C) Bangka Belitung, (D) Sumatra, (E) Banten, (F) West Java, (G) Central Java, (H) East Java, and (I) Madura

Indonesia's waters has a diverse distribution influenced by the type of aquatic substrate, temperature, salinity, oxygen, currents, and water depth (Wu et al., 2022). The income level of crabs in an area is closely related to the crab season (Briggs et al., 2024). The condition of fishing ability and the means of fishing used (vessel size, fishing time, and type of fishing gear) affect the results of crab fishing (Baihaqi et al., 2022).

Data on crab meat receipts in the Sulawesi region in 2022 tends not to experience significant changes on average based on receipts in the 1st, 2nd, 3rd, and 4th quarters, but fluctuates in 2023. The abundance of crabs in the Sulawesi region is influenced by the season (Hamid and Wardiatno, 2018). The significant decrease in the number of receipts occurred in the 3rd quarter after previously having the highest revenue value in the 2nd quarter. The decrease in the number of crabs can be caused by overfishing of crabs in the fishing ground area (Yao et al., 2024). The exploitation of crab fishing in the Sulawesi region can reach a value of 85%. The ratio of mortality and crab catches in the Sulawesi region shows a value of 3.43 which indicates high fishing pressure (Nurdin et al, 2022). The waters of Sulawesi have various types of crabs, where there are 133 species dominated by P. pelagicus, P. granulatus, P. vigil, C. affinis, C. anisodon, T. sima, T. spinimana from Family Portunidae (78%), C. hepatica from Family Calappidae (5%), and D. sinica from Family Dorippidae (6%), which causes not all species to be used because only special species such as P. Pelagicus can be produced. The crab season in the Sulawesi region was also recorded to occur in January-June and experienced a significant decline in July-December (Hamid and Wardiatno, 2018). The

distribution of the crab population is similar to the pattern of crab meat acceptance, where the peak of crab meat acceptance occurs in the 2nd quarter (April-June) and the decrease in the number of crabs occurs in the 3rd quarter (July-September).

The Kalimantan region has a distribution pattern of crab receipts based on time that tends to be more natural, where changes in fluctuations are not visible. Crab receipts in the 1st, 2nd, 3rd, and 4th quarters of 2022 tend to increase. The highest revenue in the Kalimantan region occurred in the 1st quarter of 2023. The high season of crabs in the Kalimantan region occurs in December-February. December is the new moon cycle while January and February are the full moon cycles which affect the maturation, moulting, and reproduction processes, so that the number of catches is relatively large during the lunar cycle (Putri et al., 2021). The distribution of crabs in the Kalimantan region has a fast mortality rate (short-lived), but the growth of crabs in the Kalimantan region is relatively fast. The death rate of crabs in the Kalimantan region can be caused by several factors such as predation, pressure when plowing, disease and water quality (Rabaoui et al., 2021). The mortality rate of crabs is quite high (1.17-1.35 per year), while the utilization rate of crabs is 0.68-0.77 per year which shows the utilization rate in overfishing status (Tirtadanu and Suman, 2017).

The distribution pattern of crab meat receipts for the Bangka Belitung, Sumatra, West Java, and Banten regions tends to have a similar distribution pattern in both 2022 and 2023, except for the 2022 pattern for the Bangka Belitung and West Java regions. The uniformity of crab receipt patterns can be caused because fishermen in the Bangka Belitung, Sumatra, West Java, and Banten regions have similarities or proximity to the crab fishing area. The distribution of crabs can occur in uniform and random patterns (Ahmed et al., 2021). The variation in the number of crabs in the Lampung region is spread across several areas such as Gambas and Wakil with stratification of 2-4 miles from the coastline (Radifa et al., 2020).

The distribution of crabs in Lampung waters is influenced by the season, where crabs are abundant in December-July (Yulianto et al., 2024). The crab spawning season occurs every year with a peak in July (Putri et al., 2021). Crabs will tend to be in deeper waters, so that during the spawning season the number of fishermen's catches tends to decrease (Yu et al., 2024). Overfishing during the crab season led to a significant decrease in the number of crabs in Q3. The number of crabs in Sumatran waters is influenced by seasonal changes and the number of catches (Nurjanah and Dimenta, 2023). The value of the indication of exploitation in the Lampung area is 0.71, indicating the value of over exploitation (Yiulianto et

al., 2024). The number of crab catches is also influenced by the efficiency of the use of fishing gear. Fishermen in the Bekasi area, West Java, use bubu as a fishing tool. Damage to bubu during the fishing process due to currents and collisions reduces the number of catches (Baihaqi et al., 2022).

The characteristics of the pattern of the results of the receipt of aquatic crabs in the Banten Region tend to have the same pattern and season as the Sumatra region. The characteristics of fishermen in the Banten region are fishermen with a small fishing scale with a vessel size of < 5 GT and use bubu and gillnet nets as fishing tools. The high season in the waters of Banten occurs in December-February and the medium season occurs in September and October, like the season in the Sumatra region (western season). The eastern season of crabs in the Banten and Sumatra fishing areas occurs in June-September, where in the eastern season the number of crab catches in the Bangka Belitung, Sumatra, West Java, and Banten regions is less than in the western season (Agus et al., 2016). The size of crab carapaces in the Banten region tends to be large (Aulia et al., 2023). The decline in the number of crab receipts in the 3rd quarter decreased drastically, which can be caused by overfishing. The death of crabs in Banten Bay is suspected to be more influenced by fishing activities than natural factors. The value of the exploitation rate of males and females exceeds the optimum exploitation value of BSC, which is 0.5 per year. High mortality is due to overfishing (Aulia et al., 2023).

The distribution pattern of crab meat receipts in Central Java, East Java, and Madura has the same pattern of catch results in 2023, but in 2022 the pattern of crab receipts in the Madura region is different from that of Central Java and East Java. The uniformity of crab meat receipt patterns is due to the close fishing locations in Central Java, East Java, and Madura, but the results of crab meat receipts in Central Java show the lowest value compared to East Java and Madura regions which can be caused by several factors such as aquatic substrate (Radifa et al., 2020), fishing tools and times (Nugraheni et al., 2015), migration patterns (Marchessaux et al., 2023), as well as water quality conditions (Maryani et al., 2023). The use of crabs in the Central Java region tends to be carried out on a small scale with < 5 GT vessels using fishing gear in the form of bubu. Crab fishing in the Central Java region tends to be carried out at a depth of 12 m, where the abundance of crabs is found in waters with a depth of > 13 m so that the catch is not optimal (Nugraheni et al., 2015).

The type of water substrate in the Central Java region tends to be muddy and contains little oxygen (Apriliyanto et al., 2014). Crabs have a habit of living in sandy substrates, where in mud substrates (fine-clay dust) there are very few or no crabs (Johnston et al., 2021). Crabs will tend to go into deeper waters to find a

suitable substrate (Putri et al., 2021). Crabs caught in the Rembang area of Central Java have a smaller size compared to crabs in offshore areas, due to the high intensity of fishing in coastal waters (Mustofa et al., 2021). The crab season in the Central Java region occurs in December-February, while in May-August it is the famine season (wind and large waves), so that crab catches decrease in May-August (Nugraheni et al., 2015). Female crabs also migrate to the fishing ground area in December in the Central Java region (Ernawati et al., 2014). The distribution pattern of crabs is greatly influenced by the type of aquatic substrate, season, weather, climate, temperature, salinity, oxygen, current, and water depth (Marks et al., 2021).

The waters of East Java and Madura have a high crab population, where the value of crab meat receipts in East Java and Madura accounts for 16.2% and 27.3%, respectively (Figure 6). The distribution of crab numbers in the waters of East Java and Madura can be caused by water conditions that are in accordance with the crab environment. The water temperature for crab habitats is in the range of 21-27 ^{o}C, which can support the metabolic process of crabs to grow and reproduce (Champion et al., 2020). The water quality condition of the Madura region also shows a good quality index, with not strong currents due to geographical conditions causing the existence or population of crabs in the Madura region to be quite high (Maryani et al., 2023). The decrease in the number of crabs in the 3rd quarter was due to the influence of seasons, waves, and rainfall which also affected the ability of fishermen to catch crabs (Mustofa et al., 2021).

The distribution of crabs based on mapping plots (Figure 4, Figure 5, Figure 6) shows that there are different patterns of crab distribution in several areas of Indonesia. The distribution of crabs is dominated in the Java and Madura islands caused by the influence of seasons, substrate conditions, and water quality (Maryani et al., 2023). The location of crab processing companies also affects the area of receipt and reach of taking crab raw materials (Permaiyati and Erlina, 2023), so that Java and Madura are areas with high crab potential.

CONCLUSIONS AND SUGGESTIONS

The distribution of crabs in Indonesia is diverse and influenced by temperature, season, weather, current, wind, substrate, and the ability of fishermen to catch crabs. The highest distribution pattern of crabs is found in the Java and Madura islands. The Madura region has the highest crab potential and accounts for 27.3% of the total crab meat receiving area in Indonesia. Further analysis of other factors that can affect the amount of crab meat receipts needs to

be carried out to obtain information about crab meat receipt factors in various regions of Indonesia.

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