ASOSIASI PENGELOLAAN RAJUNGAN INDONESIA

APRI

Sustainable
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Stock Assessment Report

Indonesian Blue Swimming Crab 2025

1. INTRODUCTION

1.1. Background

The blue swimming crab (*Portunus pelagicus*) is one of Indonesia's most valuable fishery commodities. Since the early 2000s, Indonesia's blue swimming crab production has continued to increase, making the country one of the world's largest suppliers. Data from the Ministry of Marine Affairs and Fisheries (MMAF) show that production once reached more than 80 thousand tons per year during 2010–2015, with stable export trends to the United States, Japan, and Europe. In terms of value, exports of blue swimming crab and processed crab products have been worth more than USD 300 million annually, making it one of Indonesia's leading fishery commodities contributing to national foreign exchange earnings.

Beyond its role in international trade, the blue swimming crab also has an important social dimension. The fishery is largely supported by small-scale fishers operating vessels under 5 GT and using simple gear such as foldable traps and bottom gillnets. The supply chain involves multiple actors, from fishers and collectors to small-scale processing units (mini plants) and large processing industries. Therefore, the sustainability of blue swimming crab stocks is closely tied to the livelihoods of coastal communities across regions such as the North Coast of Java, Sumatra, and Sulawesi.

However, the high global demand and increasing fishing pressure over the past two decades pose serious challenges to stock sustainability. Several biological indicators suggest symptoms of overfishing, including a decline in the average size of crabs caught and a high proportion of egg-bearing females. Previous studies in several fishery management areas (WPPNRI) also reported that the Spawning Potential Ratio (SPR) values in some locations fell below the target reference point (<20–30%), indicating reduced reproductive capacity of the stock. If left unmanaged, this condition may reduce stock productivity in the long term, lower economic returns, and even threaten the sustainability of Indonesia's crab industry. Therefore, stock assessment of the blue swimming crab is crucial. The results of such studies are expected to support scientific, adaptive, and collaborative management of the fishery, helping to sustain crab stocks, improve the welfare of coastal communities, and maintain Indonesia's position as one of the world's largest producers of blue swimming crab.

1.2. Objectives

This study aimed to provide up-to-date information on the status of blue swimming crab stocks in Indonesia based on biological and fishery data and to evaluate the level of exploitation of Indonesia's blue swimming crab fishery.

2. METHODS

2.1. Study Area

The study area cover FMA-571, FMA-712, and FMA-714. These include sampling sites for biological analyses at six provinces, such as North Sumatera (Batubara), Lampung (Labuhan Maringgai), West Java (Cirebon), Central Java (Rembang), East Java (Gresik and Pamekasan), and Southeast Sulawesi (Muna Barat) (Figure 1).

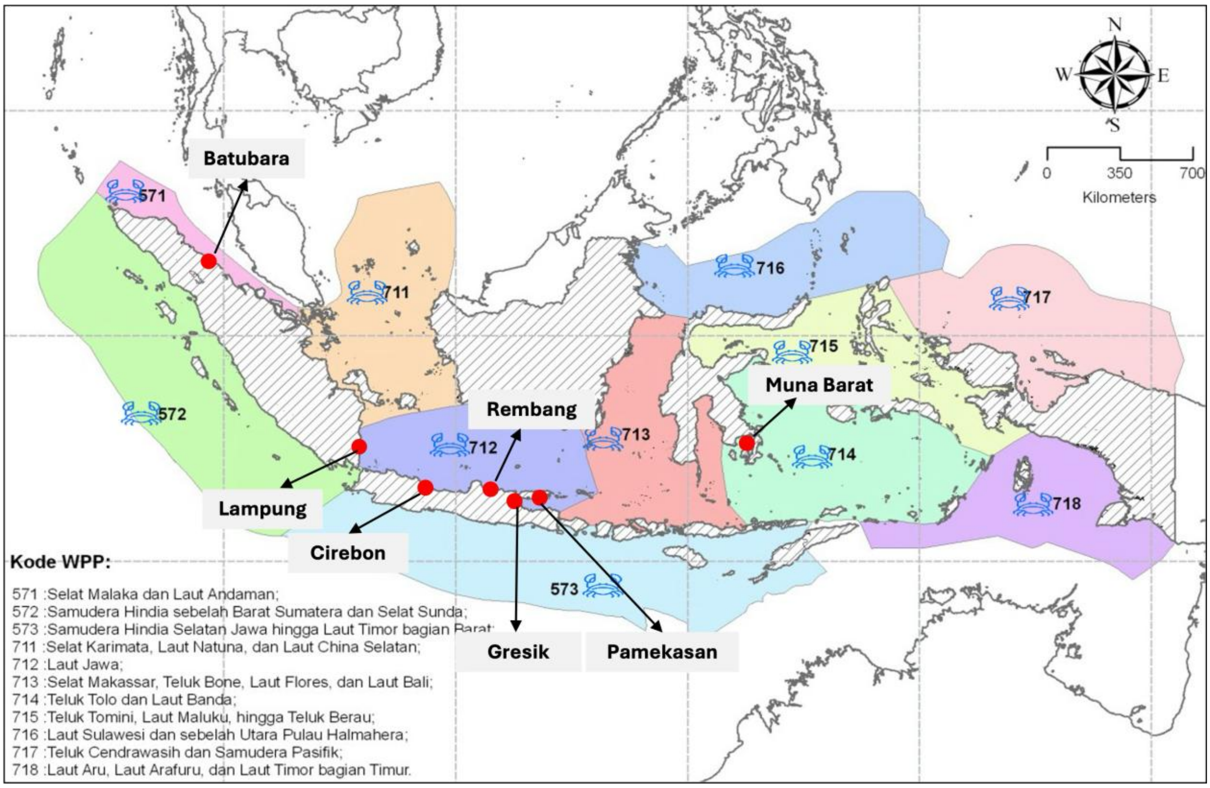

Figure 1. Sampling sites for Blue Swimming Crab research activities in FMA-571, FMA-712, and FMA-714 (Batubara, Labuhan Maringgai, Cirebon, Rembang, Gresik, Pamekasan, and Muna Barat) over period January to August 2025

2.2. Data Collection

2.2.1. Landing survey

Information on catch of BSC and fishery was collected by enumerators using sampling sheets. Information on retained and reject crab were also collected. Enumerators interviewed the crab collectors on fishing activities such as fishing day, day at sea, type of gar used and its number of the gear, fishing ground, landing, fishing numbers. By end of the month, the electronic data were sent to APRI database.

2.2.2. Biological survey

Biological samplings on the BSC were conducted 2-3 days a week per month. Samplings were randomly sized from the catches of fish trap and gillnet in landing sites and one trip in fishing boat per month. BSC samples was analysed individually for sex, carapace width (CW in mm), body weight (W in g). CW was measured to the nearest 0.1 mm using digital calliper. Gonad maturity stages was determined using the scale of 3 level, immature, mature and berried females.

2.3. Data Analysis

2.3.1. Carapace width – weight relationships

Data on carapace width and weight is important in the crab fisheries management. Carapace width– weight relationship of BSC was fitted using power regression for male and female BSC separately.

2.3.2. Life history parameters

The growth parameters of BSC are determined by fitting the von Bertalaffy growth function to the length frequency to the length frequency data using ELEFAN 1 incorporated in FiSAT II (Gayanilo et al., 2005). Natural mortality was estimated using the empirical formula Pauly (Sparre & Venema, 1999). Size at first maturity ($CW_{50\%}$) of BSC is estimated by fitting a logistic curve to the relationship between proportion mature and size class (King, 1995).

2.3.3. Spawning Potential Ratio (SPR)

The spawning potential ratio is an index of the relative rate of reproduction in an exploited stock. The basic concept of SPR is a proportion of the unfished reproductive potential left by fishing pressure. By explanation, unfished stock and individuals in an unfished stock have an SPR of 100% (SPR100%) and fishing mortality decreases SPR100% from the unfished level to SPRX% (Prince et al., 2014). SPR method is recommended for applying to stocks in poor data fisheries (Brooks et al., 2010).

2.3.4. Exploitation rate

Length and Converted Catch Curve (LCCC) method analysed monthly data of carapace width frequency to estimate instantaneous mortality coefficient (Z), natural mortality coefficient (M) and fishing instantaneous mortality coefficient (F). Exploitation rate (E) of BSC was calculated by the following the equation : $E = F/(F+M)$. A stock has over exploited if $E>0.5$ or under exploited if $E<0.5$, so the carapace width at 50% retained, L50 or Lc will be: $L50 = -a/b$

2.3.5. Catch Per Unit Effort

The catch per unit effort (CPUE) is an indirect measure of the abundance of a target species. Changes in the catch per unit effort are inferred to signify changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while an unchanging CPUE indicates sustainable harvesting. CPUE is a relative measure of abundance, it can be used to estimate absolute abundances. The main difficulty when using measures of CPUE is to define the unit of effort. It can be used to estimate absolute abundance of closed populations in the presence of successive removals (Ricker, 1958, De Lury, 1947).

3. RESULTS AND DISCUSSION

3.1. BSC size distribution

The size frequency distribution of blue swimming crabs collected from January to July 2025 shows a total of 37,442 individuals with carapace widths ranging from 58 mm to 182 mm and an average size of 117 mm (Figure 2). The population is dominated by crabs measuring between 105–125 mm, with the peak around 110 mm, indicating the presence of a strong cohort of medium to large-sized individuals.

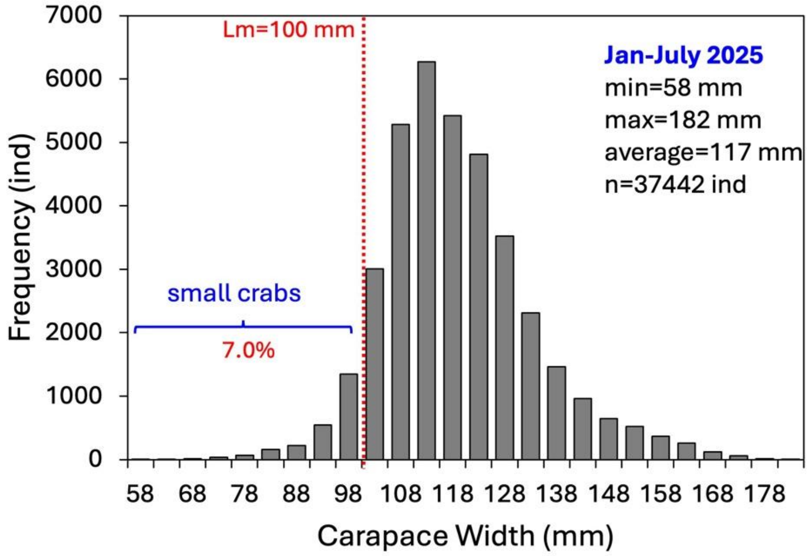

Figure 2. Carapace width distribution for blue swimming crab in Indonesia

Figure 2 showed the size at first maturity (Lm) was about 100 mm, and only 7.0% of the catch consisted of immature crabs below this threshold, while the vast majority (93%) were already mature. This suggests that the crab stock is being exploited at a relatively sustainable level, as most individuals harvested have reached maturity. However, the capture of immature crabs, although relatively low, highlights the importance of continued monitoring and appropriate management measures to minimize juvenile harvest and support long-term sustainability.

3.2. Immature and egg berried female crabs

Percentage of immature crabs across three FMA is shown in Figure 3. Highest percentage of immature crab was found at FMA 712, followed by FMA 714 and FMA 571.

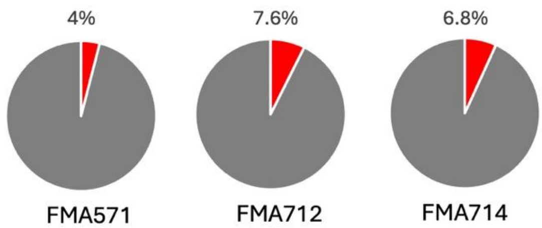

Figure 3. Percentage of immature blue swimming crab across three Fishery Management Area (FMA) in Indonesia

Figure 4 presents the proportion of egg-berried female crabs (EBF) within the sampled population. It showed that 11.3% of egg berried female crabs were caught, while the remaining 88.7% were non-berried females. This indicates that only a small fraction of the female population was in the reproductive stage at the time of sampling.

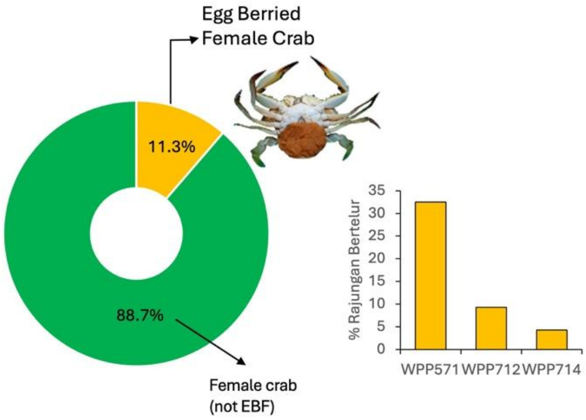

Figure 4. Percentage of egg berried female crab across three Fishery Management Area (FMA) in Indonesia

Based on the spatial variation in the percentage of egg-berried females across different FMAs. The highest proportion of berried females was observed in WPP 571 (around 33%), while much lower percentages were found in WPP 712 (about 12%) and WPP 714 (around 5%). The higher proportion of berried females in WPP 571 highlights the importance of this area as a potential key spawning ground, which may require stricter management measures (e.g., seasonal closures or protection zones) to safeguard reproductive females and ensure sustainable crab recruitment.

3.3. Estimates of Spawning Potential Ratio (SPR)

Figure 5 illustrates the Spawning Potential Ratio (SPR) of blue swimming crab populations across several regions (FMAs) in Indonesia. SPR is an indicator of the reproductive capacity of a stock, with higher values reflecting healthier and more sustainable populations. Generally, an SPR below 20% is considered heavily overfished, while 20–30%indicates a stock under pressure but still capable of reproduction, and values above 30–40% are more favorable for sustainability. Highest SPR were observed in Lampung (36%), suggesting relatively healthy spawning potential and better prospects for sustainable harvest. Moderate SPRs were found in Batubara (25%), Rembang (25%), Pamekasan (21%), and Muna Barat (20%). These regions show reduced but still functioning reproductive capacity, requiring careful management to avoid further decline. Meanwhile, lowest SPRs were observed in Cirebon (15%) and Gresik (16%), indicating critical overfishing pressure where reproductive potential is significantly impaired.

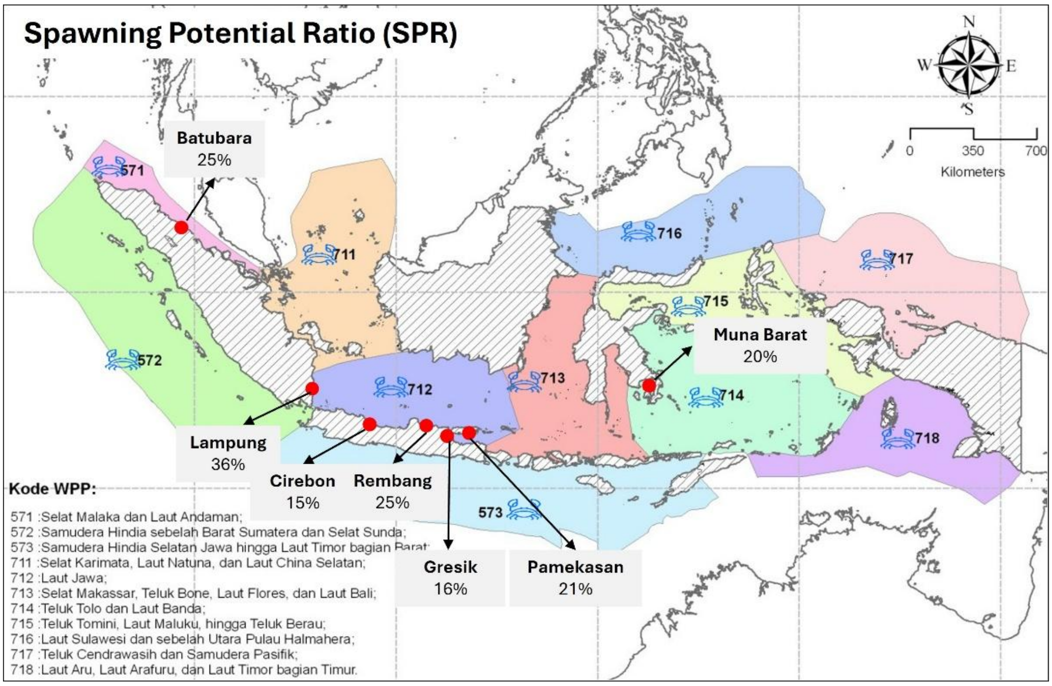

Figure 5. Estimates of Spawning Potential Ratio (SPR) for Blue Swimming Crab across region in Indonesia

The Spawning Potential Ratio (SPR) trends of blue swimming crab populations from 2019 to 2025 across four management areas (FMA 571, 712, 713, and 714) are shown in Figure 6. Two biological reference points are used: the target reference (~30%), representing sustainable harvest levels (green zone, not overfished), and the limit reference (~20%), below which stocks are considered overfished (red zone). Based on Figure 5, FMA 712 (green points) indicated SPRs remains above the 20% limit and often close to the 30% target, indicating stocks are not overfished and are in relatively good condition. SPR values at FMA 571 and FMA 713 (orange and yellow points) mostly fluctuated between 20–25% SPR, which means the populations are under fishing pressure, below optimal levels, but not yet critically overfished.

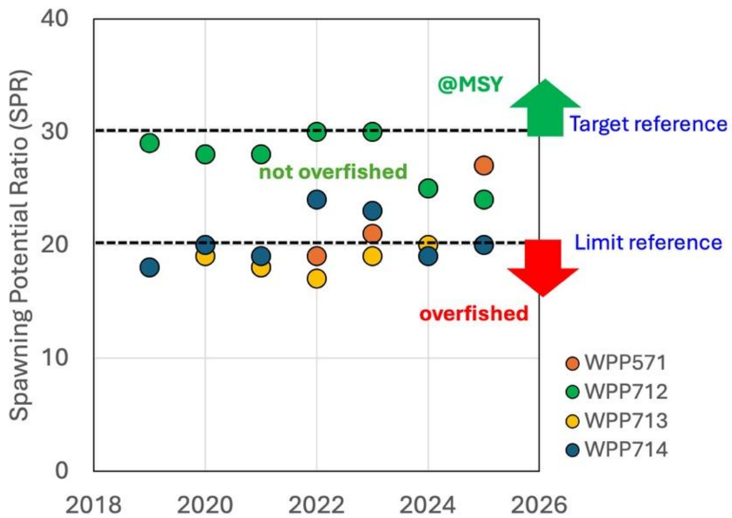

Figure 6. Trends of Spawning Potential Ratio (SPR) for Blue Swimming Crab across region in Indonesia

While FMA 714 (blue points) had SPR values consistently below the 20% limit, showing clear signs of overfishing, with reproductive capacity highly reduced. The results indicate spatial differences in stock status. FMA 712 is relatively healthy and near the management target, while FMA 571 and FMA 713 require precautionary management to prevent further decline. WPP 714 is already in a critical overfished state, requiring urgent recovery measures such as stricter harvest control, seasonal closures, or protection of spawning females.

3.4. Catch per Unit Effort (CPUE)

The trend of Catch Per Unit Effort (CPUE, kg/trip) for blue swimming crab fisheries in four management areas (FMAs) from 2021 to 2024 are shown in Figure 7. CPUE is often used as an indicator of stock abundance, where higher values suggest better catch rates and potentially healthier stocks. FMA 712 (green line) showed a clear upward trend, rising from about 3 kg/trip in 2021 to nearly 8 kg/trip in 2024. This suggests improving catch rates, possibly reflecting better stock condition or reduced fishing pressure. FMA 714 (blue line) remains relatively stable between 4–5 kg/trip across the years, indicating steady catch rates without major signs of stock decline or recovery. FMA 571 (orange line) stays low and fairly flat, fluctuating around 2–3 kg/trip, suggesting low productivity and potentially depleted stocks. FMA 713 (yellow line) consistently records the lowest CPUE (1.5–2.5 kg/trip), showing poor stock condition and limited catch potential.

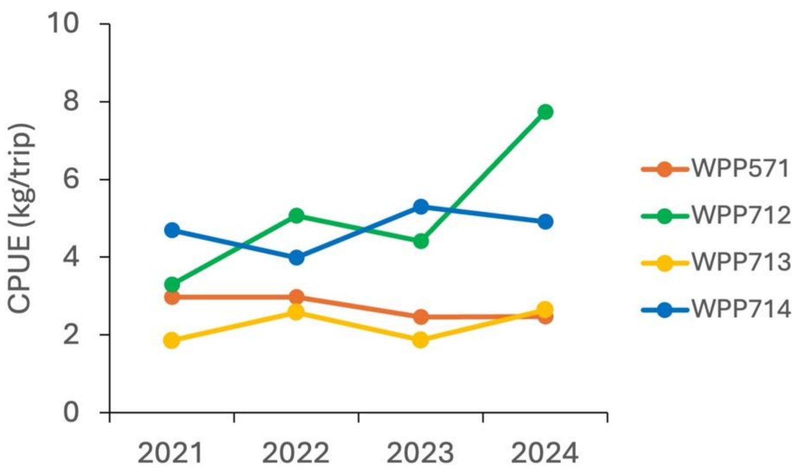

Figure 7. Trends of Catch per Unit Effort (CPUE) for Blue Swimming Crab across region in Indonesia

The results indicate strong spatial variation in stock abundance. FMA 712 appears to be in the best condition with increasing CPUE, while FMA 713 shows the weakest performance, suggesting overexploited or depleted stocks. FMA 571 and FMA 714 remain at intermediate levels, with stable but relatively low productivity.

4. CONCLUSION

The size distribution indicates that the majority of blue swimming crabs caught are above the size at first maturity, with only a small proportion of immature individuals (<100 mm CW), suggesting relatively responsible harvesting. However, Spawning Potential Ratio (SPR) analysis reveals spatial disparities, with some areas (e.g., Lampung and WPP 712) maintaining near-target reproductive capacity, while others (such as Cirebon, Gresik, and WPP 714) fall below the limit reference point, indicating overfishing and reduced reproductive potential. CPUE trends further support these findings, with WPP 712 showing increasing catch rates, WPP 714 remaining stable but low, and WPP 571 and WPP 713 exhibiting persistently poor productivity. Overall, the results highlight that while certain regions still sustain viable crab populations, several key fishing grounds are under heavy exploitation pressure. This condition calls for region-specific management interventions, including stricter size limits, protection of berried females, seasonal closures, and effort controls, to restore depleted stocks and ensure the long-term sustainability of the fishery.