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Export demand patterns for blue swimming crab from Indonesia to United States : impact of fishing seasons in FMA 712 (2018 to 2022)

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Abstract. Blue swimming crab (*Portunus pelagicus*) is a significant fishery export commodity from Indonesia, especially the fisheries management area (FMA) 712. The aim of this study was to analyze the relationship between export demand and fishing season in FMA 712 during the last five years (2018–2022) based on export volume, prices, and fishing season information. Fishing season in Indonesia was classified as the west season with high rainfall (November to May) and the east season with low rainfall (June to October). The data were analyzed by correlation and trend analysis. The results showed that the export demand for blue swimming crab fluctuated with the fishing season. Demand for blue swimming crab tends to increase in the west season due to abundant supply from a favorable fishing season, leading to decreased prices due to international market competition. Conversely, demand for blue swimming crabs declines in the east season due to reduced supply from an unfavorable fishing season, resulting in increased prices due to limited availability. To address fluctuations, market diversification, product quality improvement, and sustainable fishery resource management are essential to balance profitable exports and marine preservation. Other variables that may influence export demand, such as global economic and political factors, were not included in this analysis.

Keywords: blue swimming crab; export demand; fishing seasons; fisheries management

1. Introduction

The blue swimming crab (*Portunus pelagicus*) is a highly sought-after marine species, prized for its succulent meat and delicate flavor. It is widely distributed across tropical and subtropical waters, making it a significant economic resource for many coastal communities around the world. In recent years, the demand for blue swimming crab in the global seafood market has surged, leading to intensified fishing efforts to meet consumer needs. Fisheries Management Area (FMA) 712 is a critical region for the blue swimming crab fishery, encompassing vast coastal areas in different countries. This region has



experienced growing attention from commercial fishing fleets due to its rich crab populations. During the period of 2015 to 2019, the annual production in this area reached approximately 51,557 tons, contributing to around 53% of the total national crab production [1]. The growing global market demand and the corresponding rise in prices have led to an upward trend. This has spurred escalated fishing endeavors, specifically aimed at the blue swimming crab, notably within FMA 712. Consequently, it is potential for the emergence of overfishing scenarios [2], potentially leading to a decline in the natural stock of the blue swimming crab [3], and a decrease in the size of the crab obtained [4]. This raised concerns about the sustainability and ecological impact of fishing pressure activity. As known that this fishery has been included in priority fish product management in Indonesia, and it has also been a priority in the fisheries improvement program to obtain eco-labeling certificates, for example, from marine stewardship council (MSC), especially in FMA 712 [5].

Understanding the export demand pattern of blue swimming crab is very important for sustainable fisheries management and effective conservation measures. The export dynamics of this species can provide insights into market trends, international trade patterns, and the economic significance of the blue swimming crab industry. Additionally, the analysis of fishing season's impact on the export demand of blue swimming crab is essential for identifying potential vulnerabilities in the fishery and developing adaptive management strategies. The period from 2018 to 2022 is particularly significant for studying the export demand pattern and the impact of fishing seasons on the blue swimming crab fishery in WPP 712. This five-year timeframe allows for a comprehensive analysis of the trends, considering both short-term fluctuations and long-term patterns that may have emerged during this period. The data collected during these years can shed light on potential shifts in demand, changes in export destinations, and the influence of market conditions on the export volumes and prices. Despite the importance of understanding the export demand pattern and the impact of fishing seasons on blue swimming crab in WPP 712, limited research has been conducted in this specific context. Existing studies often focus on the ecological aspects of blue swimming crab management or general seafood trade patterns without considering the temporal variations associated with fishing seasons. This paper aims to address this gap in the literature by providing a comprehensive analysis of the export demand dynamics and the influence of fishing seasons on the blue swimming crab fishery in FMA 712.

This study aims to give valuable insights into the relationship between fishing seasons, export demand, and the ecological health of the blue swimming crab populations. The findings from this research will be pertinent to governments, regulatory bodies, and stakeholders involved in the blue swimming crab industry, guiding their efforts to preserve this valuable marine resource for future generations.

2. Methods

2.1. Study area

The research was conducted within FMA 712, a region known for its diverse and unique ecological features. This particular location was selected based on its significance as a habitat for numerous species, especially blue swimming crabs, and its ecological importance in the larger context of FMA 712. By conducting our research in FMA 712, this study aimed to contribute scientific knowledge that can aid in sustainable blue swimming crab fisheries management.

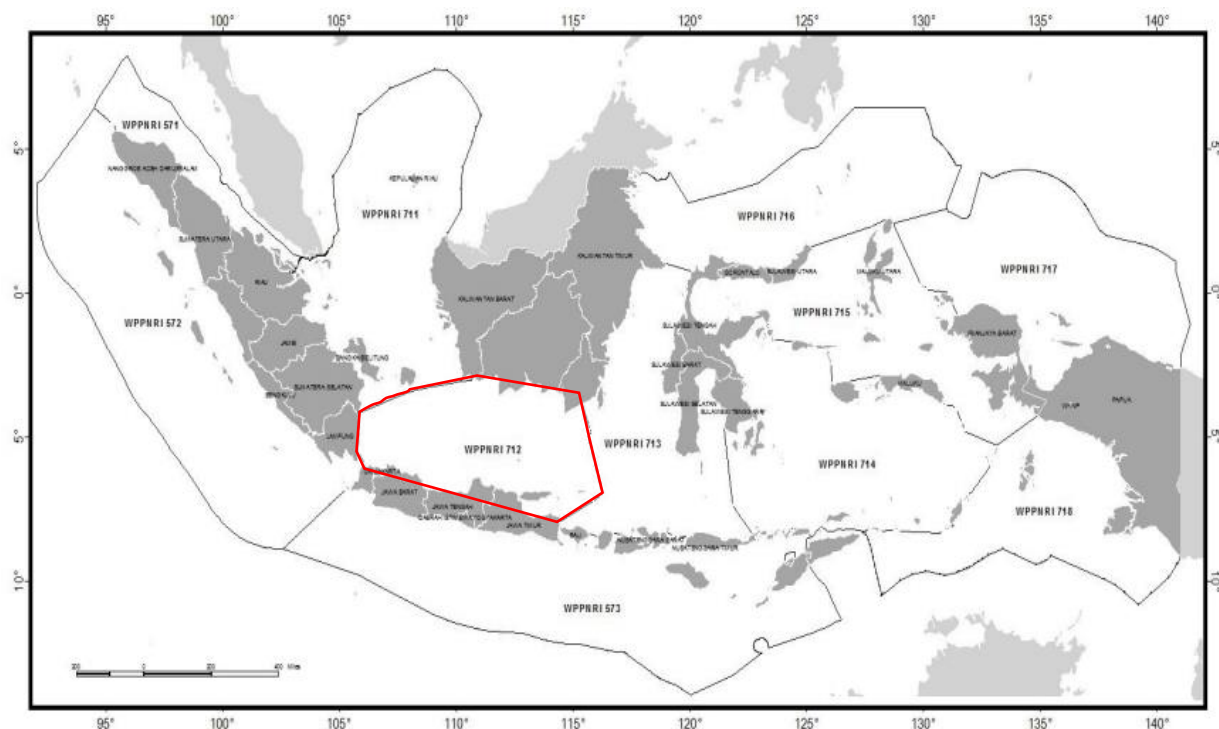


Figure 1. Map of Fisheries Management Area (FMA) 712 (source : [6])

2.2. Data collection

Data on total and price exports of blue swimming crab (pasteurized and fresh crab meat) were collected through literature studies, and secondary data were obtained from the Foreign Trade database and Crab report [7], as well as the Indonesian Agency of Fish Quarantine, Quality Control, and Safety of Fishery Products (BKIPM) from 2018 to 2022 [8]. While the fishing season period was identified from several kinds of literature and fishermen's experiences,

2.3. Data analysis

The descriptive analysis method is used to show trends in blue swimming crab exports from Indonesia to the US. Meanwhile, correlation analysis is used to find out the correlation between export demand (including volume and price) and the fishing season (west and east). The fishing season in FMA 712, is divided into two, namely the western season (December–February) and the eastern season (June–August).

3. Results and discussion

3.1. Export Demand Pattern Indonesia to US in the past five years (2018-2022)

Indonesia significantly dominates the import contribution of US crab pasteurization, with 41.987% of the total contribution of 70 exporting countries. The large territorial waters of Indonesia provide a great opportunity to catch quality crabs in line with efforts to improve quality and implement the principles of sustainable crab fisheries. The balance of these two aspects makes Indonesia the country with the highest percentage contribution to fulfilling the US global market (Figure 2).

Percentage Export Contribution Pasteurized Crab Meat

All origin - 2018 till 2022

■ Substitution (origin sample)

■ Non-Substitution (origin sample)

■ origin non-sample

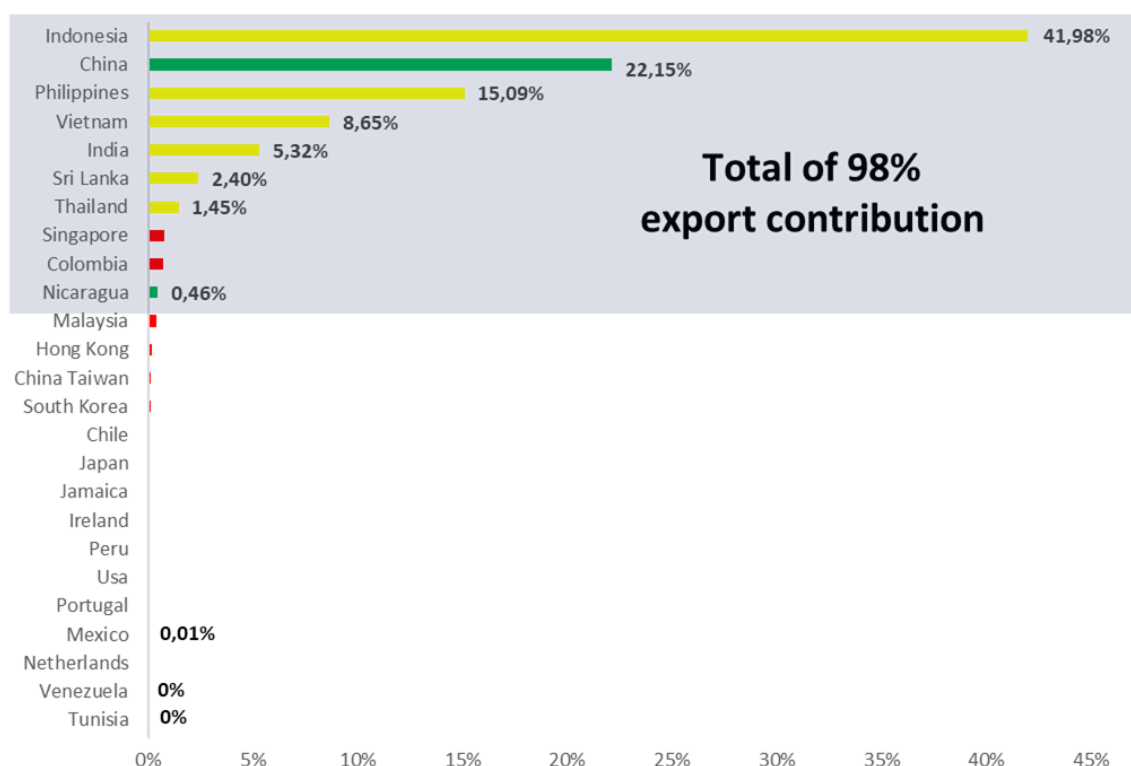


Figure 2. Export contribution of all origins (Source : Foreign Trade, 2023).

Indonesia's export demand for blue swimming crabs successively increased until 2021 before declining again by 13.9% at the end of 2022, but overall it increased to 12.7% in five years. (2018-2022)

Table 1. Pasteurized and Fresh Crab Meat Export (Incl. Indonesia) 2018-2022

by country	YTD 2018	YTD 2019	YTD 2020	YTD 2021	YTD 2022	%Chg 5 Ytd.
Indonesia	17,532,006	19,206,488	20,108,984	22,948,360	19,762,907	12.7%
Philippine	5,699,993	5,388,108	3,203,496	7,149,998	4,346,336	-23.7%
Vietnam	3,636,321	3,385,501	2,977,771	3,905,723	5,612,820	54.4%
India	2,885,817	3,848,868	1,382,227	3,770,471	4,326,131	49.9%
Srilanka	1,713,722	1,292,490	812,634	1,045,352	413,917	-75.8%
Thailand	777,443	635,019	449,561	246,048	148,201	-80.9%
total	32,245,302	33,756,474	28,934,673	39,065,952	34,610,312	7.3%
(without substitution)						
China	10,174,037	4,942,102	3,929,389	8,566,601	6,593,914	-35.2%
Nicaragua	191,339	303,829	120,385	202,464	314,912	64.6%
Venezuela	86,949	594,187	945,623	446,282	423,148	386.7%
Mexico	6,446	0	157,540	255,577	71,889	-1015.2%
Tunisia	-	-	69,281	441,267	632,565	N/A
(Total substitution)	10,458,771	5,840,118	5,222,218	9,912,191	8,036,428	-23.2%
Other	2,109,084	5,456,324	7,720,356	13,432,944	7,708,716	265.5%
Total	44,813,157	45,052,916	41,877,247	62,411,087	50,355,456	12.4%

(Source : Foreign Trade, 2023)

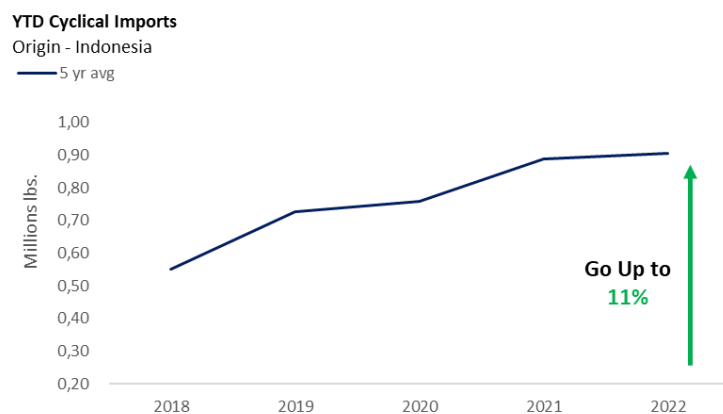


Figure 3. Year-to-date (YTD) Cyclical exports from Indonesia to the US over the past 5 years

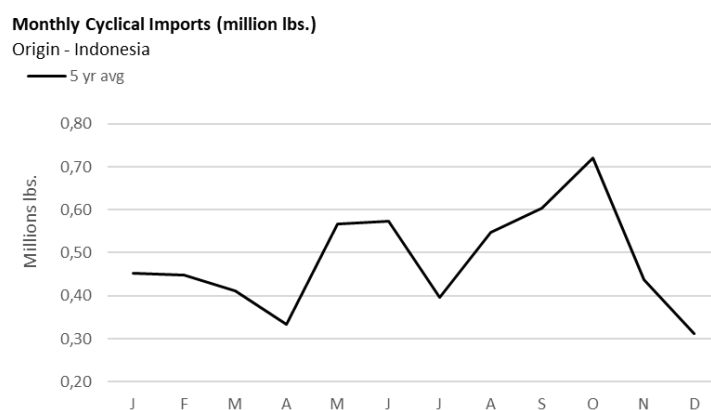


Figure 4. Monthly Cyclical exports from Indonesia to the US over the past 5 years

In the last 5 years (2018–2022), Indonesia's export volume has increased compared to the previous 5 years (2013–2017) when viewed from the perspective of monthly production. The beginning of 2022 will be a new era of increased demand for crab imports from Indonesia post-Covid. Although, in mid-2021 (June–August), we had explored the position of the highest demand volume from 1.38 to 1.58 million lbs. The trend of Indonesia's export volume by month is used as a reference for the link between total exports and the crab fishing season (west and east seasons) (Figure 5).

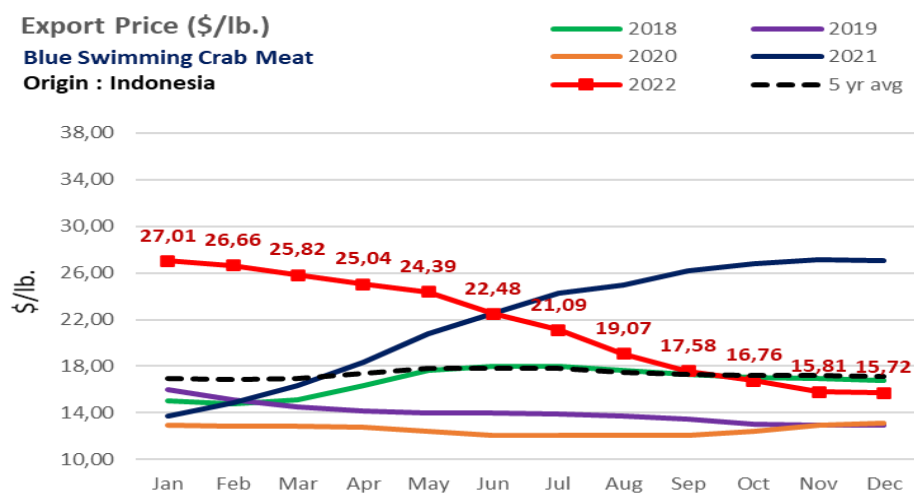


Figure 5. Export Price of Blue Swimming Crab Meat (Past and Fresh) from Indonesia to the US (2018–2022)

In 2022, the blue swimming crab market increased early in the year to close to the last five-year average in September before finally declining to below the five-year average in October–December to \$18.59. This is quite a cause for concern given the price of raw materials abroad, which has begun to rise.

3.2. Fishing season impact

The Indonesian crab fishing season is based on weather, ocean currents, and wind. The climate in the Java Sea follows a seasonal pattern, where the dry season occurs from June to September and the rainy season lasts from November to March. Changes in the distribution and abundance of fauna in these waters are influenced by rainfall, with salinity being an important factor. In particular, wind patterns in the Java Sea follow the monsoons in Indonesia. In the west monsoon (December–February) and east monsoon (June–August), the wind blows harder, with speeds ranging from 0.9–7.11 m/s. The peak of this season occurs in January (west season) and August (east season), with speeds reaching 7.11 m/s and 6.79 m/s, respectively [9, 10].

Table 2. Correlation result between fishing season, total, and price export of blue swimming crab from Indonesia to US.

		Fishing Season	Total Export	Price
Fishing Season	pearson correlation	1	,666**	0,348
	sig. (2-tailed)		0,000	0,060
Total Export	pearson correlation	,666**	1	,639**
	sig. (2-tailed)	0,000		0,000
Price	pearson correlation	0,348	,639**	1
	sig. (2-tailed)	0,060	0,000	

Information: *** R-pearson - significantly related

The link between fishing season and total exports and prices needs to be further identified in the last five years (2018–2022) to find out the trend of Indonesian crab exports to the US. Table 1 shows a positive association of 0.666 (moderate correlation) [11] between catch seasons (west and east) and total exports (million lbs.), but not so with price (uncorrelated at r-Pearson 0.348). When there is a surge in stock during the fishing season, there will be an increase in total exports (million lbs.). Average exports for 2018–2022 follow the trend of catch stocks for each season, where the west season is higher than the east season (Figure 6).

YTD (avg) Exports Past. & Fresh crab meat Indonesia to US

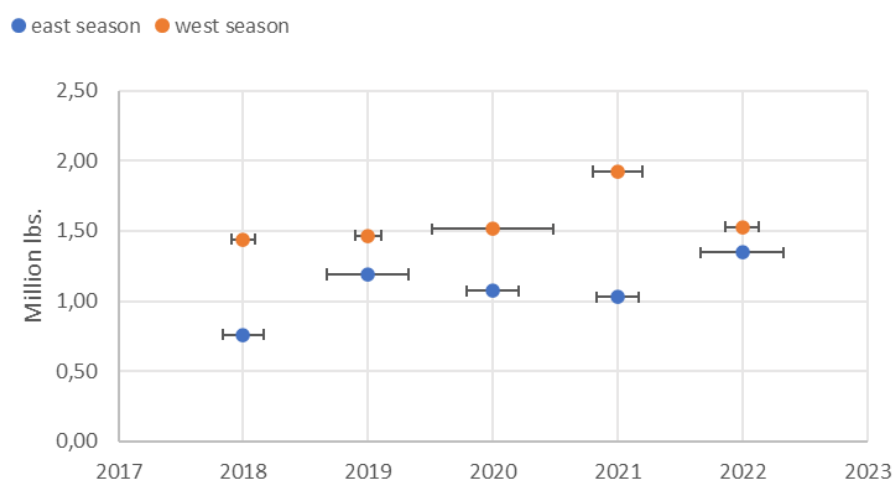


Figure 6. Trend of Average Exports Past. And Fresh Crab Meat Indonesia to US (2018-2022) based on Fishing Season.

Meanwhile, total exports over the past five years correlated with prices with an r-Pearson value of 0.639. This shows that the total export demand for Indonesian blue swimming crab (past and Fresh crab meat) to the US is moderately related to price.

4. Conclusion

The fluctuation in export demand, both positive and negative, was closely related to the fishing seasons and export prices. During the peak fishing seasons, when the stocks were plentiful, there was a corresponding rise in the total exports to the US. Despite fluctuations in the total export volume, variations in the export prices impacted the overall revenue generated from the blue swimming crab export to the US. These findings highlight the significance of sustainable management and conservation measures for the blue swimming crab population, as well as the importance of pricing strategies to optimize export revenues.

Author statement

All authors had equal contributions to this study and agreed to the published version of the manuscript.

Credit authorship contribution statement

Wita Setioko: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Visualization, Writing – original draft. **Suradi Wijaya Saputra:** Supervision, Writing – review & editing. **Dian Wijayanto:** Supervision, Writing – review & editing. **Aninditia Sabdaningsih:** Supervision, Writing – review & editing.

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