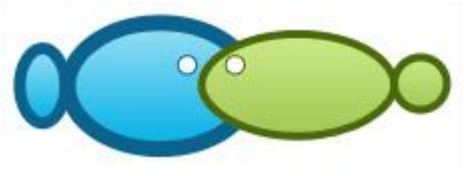

Crab fisheries on the north coast of the Karawang region, West Java, Indonesia

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Abstract. Crabs have an important economic value that is able to increase the income of the fishermen from the coastal area of Karawang Regency, Indonesia. One of the obstacles in the development of crab fisheries in Indonesian regions, especially in the coastal area of Karawang Regency, is the lack of crab fisheries activities documentation. The purpose of this study is to reveal the documentation needed for making policies, such as the development of crab fisheries, welfare improvement policy, and a sustainable policy of crab fisheries. This study has been conducted in two locations as the basis of crab fisheries on the coast of Karawang Regency. The study was conducted for 17 months, from August 2018 to December 2019. Crabs measurement data and observations were carried out from the Fish Landing Center, local buyers, and small scale processing industry. We carried out data collection at sea as well, by following crab fishing operations (13 trips in total). Literature review was also conducted by collecting data from regional government reports, Ministry of Marine Affairs and Fisheries reports, and other publications related to crab fisheries in Indonesia. This papers aims to contribute to the management of crab fisheries by supplying the some of the data needed for good fisheries management planning.
Key Words: development, documentation, lack, management, obstacles, value.

Introduction. Karawang Regency is a northern part of the West Java Province, Java Island, Indonesia, directly related to the Java Sea. Geographically located between 107°02'-107°40'E and 5°56'-6°34'S, it has a total land area of 1753.27 km^2 or 3.73% of the West Java Province. Karawang Regency is one of the coastal areas of Indonesia (Regional Government of Karawang 2017). There are 30 districts with a total population of 2273579 people (Central Bureau of Statistic 2015). There are approximately 15 rivers in Karawang Regency that flow into the Java Sea, making it a potential coastal area for shrimp and crab fishing grounds. According to data from 2015, fishery resources in Karawang Regency come from: (1) seawater fisheries, with a production of 7369.66 tons; (2) general fisheries (rivers, freshwater and swamps), with a production of 339.97 tons; and (3) aquaculture (ponds and rice fields), with a production of 36954.56 tons (Regional Government of Karawang 2017). Based on the results of some bioeconomic analyses, crab fisheries can be increased to achieve maximum economic yield, the prospect of developing crab fisheries having a possibility of improvement (Duri 2014).

Crab is one of the superior marine products with high economic value in Karawang Regency. The main commodity of crabs is in the form of peeled crab meat, which is one of the mainstay export products to various countries. Fishermen in Pasir Putih are one of the largest crab producers in Karawang Regency. In Pasir Putih, there are 120 fishing boats that are always operating in all seasons (Widianto 2020). Crabs have a high price, which is able to increase fishermen earnings in the coastal area of Karawang Regency. The fishing of crabs became a major and quickly developing activity in the coastal area of Karawang Regency. One of many obstacles in the development of crab fisheries in Indonesian regions, including in Karawang Regency, is the lack of documentation of crab fishery activities, such as the number of ships, the number of fishermen, the amount of production, fishing season, the number of home industries, fishermen earnings, and others. This is a fundamental problem in small-scale fisheries development plans. The documentation is needed by the government as the basis for making policies, such as the

development of crab fisheries, welfare improvement policies, and crab fisheries sustainability policies. The reasons why this research is important are: (1) crab fisheries in Karawang Regency (Indonesia) are generally exploited by small-scale fishermen, so that data is not well documented; (2) crab fisheries are one of the major activities for fishermen in the coastal area of Karawang Regency (Indonesia), because of the high price of crabs and the low cost of crab farming. Crab fisheries have the potential to be developed to improve the welfare of small scale fishermen with relatively small scale capital. This study presents data on crab fisheries in Indonesia. The study can contribute to the management of crab fisheries by supplying data needed for good fisheries management planning.

Material and Method. This study was conducted in two locations as the basis of crab fisheries on the coastal area of Karawang Regency, namely Sukakerta and Pasir Putih villages (Figure 1). The two villages are in the Cilamaya Wetan sub-district. It was a 17 month study, from August 2018 to December 2019. Crabs measurement data and observation were carried out on land (Figure 2a), at the Fish Landing Center, from local buyers, and in the small scale processing industry. Crabs measurement data and observations were also carried out at sea (Figure 2b), by following crab fishing operations (13 trips). We had 1052 total samples of crabs measured during the period (on land and the sea). The tool used for weighing the crab was a scale with an accuracy reaching 0.1 g (Figure 3), and a caliper was used to measure the length and width of the carapace of the crab with an accuracy of 0.1 mm (Figure 4). We interviewed 71 crab fishermen. Literature review was conducted by collecting data from regional government reports, Ministry of Marine Affairs and Fisheries reports, and other publications related to crabs in Indonesia.

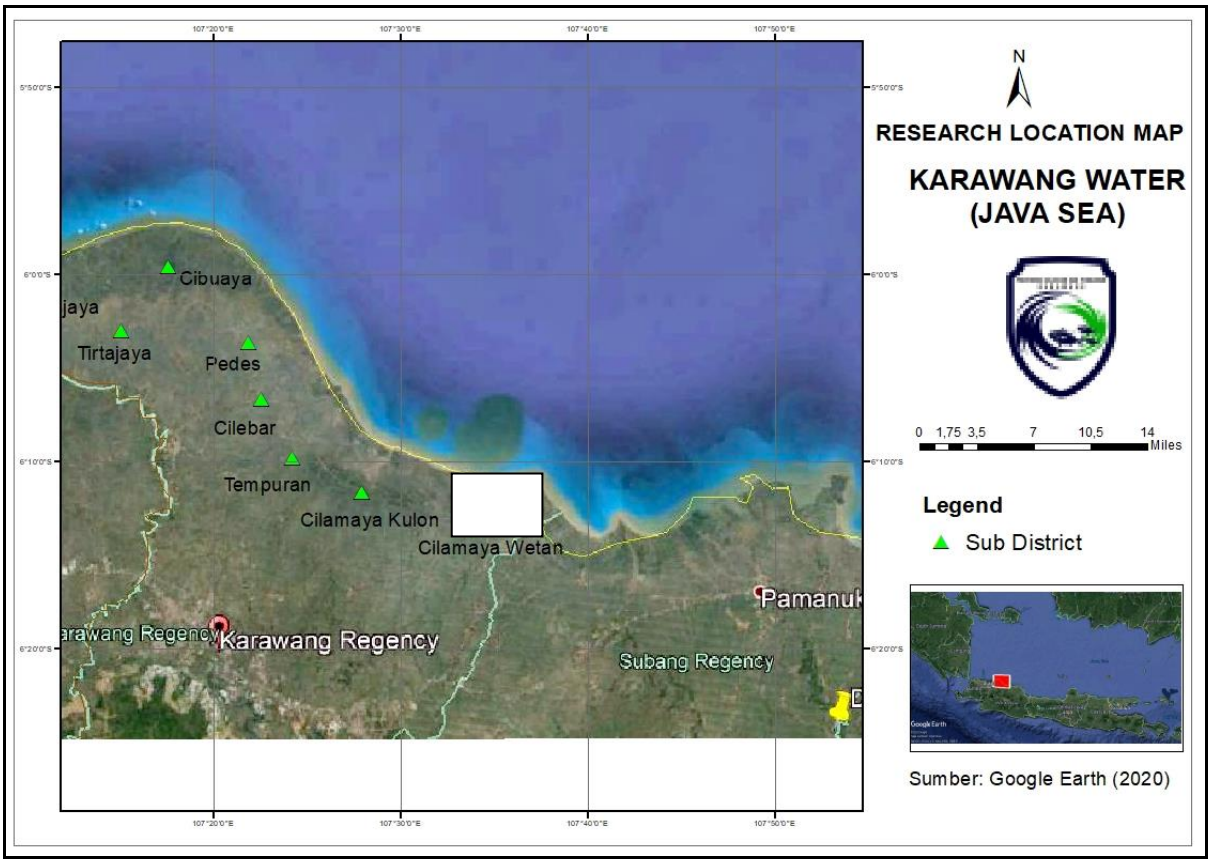

Figure 1. Research location; the two villages representing the study area are in Cilamaya Wetan subdistrict (white square).

Figure 2. a - data collection on land; b - data collection on sea.

Figure 3. Weighting of crabs.

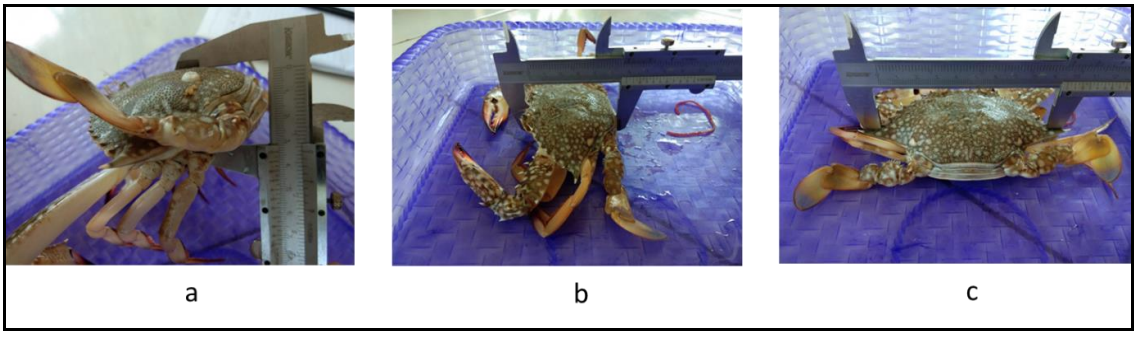

Figure 4. Measuring: a - the thickness; b - the width; and c - the length of the carapace of crabs.

Results and Discussion. The sea on the coastal area of Karawang Regency provides productive natural resources for fishermen. The seabed is sloping and the depth rarely exceeds 30 m. The seabed is generally muddy and sandy, so it is a productive fishing ground for shrimp and crab. Documentation on crab catch data such as species and size of crabs is very important for the development of crab fisheries. The sustainability of crab fisheries must be maintained, for example by avoiding the catch of small crabs.

From the results of measurements and weighing, the crabs captured and landed in Karawang had maximum values for carapace length, width, thickness and weight were 18 cm, 10 cm, 4.6 cm and 442 g, respectively. The minimum carapace length, width, thickness and weight were 6 cm, 3 cm, 1.8 cm and 7 g, respectively. Based on the data from the whole sample of crabs, the percentage of small crabs with the length of the carapace below 10 cm was 10.4%. The average length of the carapace was 11.93±5.3 cm. The minimum legal carapace length of crabs is 10 cm for all species, as stated by the Directive the Ministerial Regulation No. 02 of 2014 and revised by the Ministry of Marine Affairs and Fisheries Regulation No. 56 of 2016.

Three species of crabs were identified: *Portunus pelagicus*, with the common names of "blue swimming crab", "flower crab", "gazami" (in Taiwan, Japan); *Portunus trituberculatus*, with the common names of "horse crab", "Japanese blue crab", gazami (in Japanese); *Charybdis feriata,* with the common names of "crucifix crab" and "crucifix swimming crab". Based on statistical data from the Fisheries Office of Karawang (2017), the crab production and prices from 2012 to 2016 are presented Table 1. The crab price continued to increase yearly, except for 2016. The income of fishermen can reach USD 33.3-40 USD monthly, but fishermen who own boats can gain up to 1000 USD per month per one boat. In 2020, the average price of crab was 2.13 USD per kg, and the highest price of crab was 8 USD per kg.

Table 1

Production and price of crabs in the coastal area of Karawang Regency, Indonesia

Year	*Production (Ton)*	*Price (USD per kg)*
2012	1298.49	1.2
2013	1412.26	1.82
2014	874.01	2.22
2015	1798.56	2.33
2016	2664.7	2.18

Source: Fisheries Office of Karawang (2017).

Crab fishermen in the coastal area of Karawang District do not only catch crabs around the coastal waters, but also on other islands' waters, such as Kalimantan and Sumatera waters. Fishermen catching crabs around coastal waters generally have only one fishing day, but those who catch crabs in Kalimantan or Sumatera waters generally can reach more than 30 fishing days. The size of the traps used is different; the traps used to catch crabs in Kalimantan and Sumatera waters were larger than those used to catch crabs around coastal water.

The education level of crab fishermen on the coastal waters is dominated by elementary school graduates, only a few being junior high school graduates. The age of fishermen on the coastal water is generally young, around 20-30 years. The highest catches of one-day fishing can reach 100 kg in the fishing season, usually in February, but in April, when lowest catches occur, the production is only 8 kg. The average catch of crabs per day is 25 kg. Fishermen catching crabs in Kalimantan and Sumatra waters can have the highest catches reach 2.5 tons, and the lowest catches 400 kg.

The Gross Domestic Product (GDP) of the Indonesian fisheries sector is dominated by the export value of five main commodities: shrimp, tuna, crab, squid-octopus and seaweed. In 2017, the export value of crab ranked the third largest after shrimp and tuna with a value of 152.7 million USD (Central Bureau of Statistics 2018). Crabs are derived from capture fisheries and aquaculture products, where the export volume of Indonesian crabs is dominated by capture fisheries (65%) and the rest is from aquaculture (35%). These crabs are exported in the form of frozen, fresh and processed products using the HS codes 030614 (frozen crab), 030624 (fresh crab), and 160510 (processed crab). The Central Bureau of Statistics noted that the volume and value of Indonesian crab exports from 2012 to 2017 increased each year between 0.67% and 6.06%. The United States, China and Japan were the main export destinations for crab exports during this period.

Crab fisheries for *P. pelagicus* in Indonesia are a fast growing industry with high economic value. Total crab meat exports increased from 10.9 thousand tons in 2014 to 15.8 and 19.4 thousand tons in 2015 and 2016, respectively (Indonesia Crab Association 2016). Crabs from Indonesia are mostly exported to USA (Indonesia Crab Association 2016). Crab fisheries have supported the welfare of 65000 fishermen and 130000 crab processors (Ministry of Marine Affairs and Fisheries 2014; Indonesia Crab Association 2016).

The main fishing gears used for catching crabs are gill nets and traps. Several trawling vessels catch crabs as a bycatch (Sustainable Fisheries Partnership 2014). Nearly 80% of Indonesian crab production is exported to the United States and very

little is consumed in the domestic market (Indonesia Crab Association 2016). Sea crab stocks, especially in Sumatra waters, are relatively healthier and the crab size is bigger than in other regions (Bahtiar et al 2016). The estimated amount of crab catch in Indonesia is 48673 tons per year and has been stated in the Ministerial Decree No. 47 of 2016.

Crabs are found throughout Indonesian waters, but most of the crab fishing ground are concentrated in the north coast of Java, Lampung (Sumatera) and Sulawesi (Ministerial Decree number 47 of 2016). The crab production in the north coast of Java is 47.49% of the total national crab production. Crab production in Indonesia has been steadily increasing since the mid-1990s and sharply increased in the early 2000s. National crab production each year increased by around 4000 tons. Since 1977, crab catches increased, reaching 52000 tons in 2014. The average crab production is 16683 tons per year from 1977 to 2014.

Crab fisheries management is expected to provide sustainable biological, social and economic benefits for fishermen and the government. For long-term sustainability and to increase income from crab fisheries, the maximum economic yield (MEY) and the maximum sustainable yield (MSY) are the basis for determining suitable management of crab fisheries management. MSY only takes biological parameters into account, while MEY is trying to optimize the benefits of fisheries in fisheries management (Grafton et al 2007; Guillen et al 2013). The utilization status of crab fisheries in Indonesia is still below the optimal limits in the MSY and MEY. In the MSY and MEY, the average status of crab utilization is still in the range of 29-49% from the limit.

The number of crab catches for fishing recommended by the Directorate General of Capture Fisheries (Ministerial Decree No 47 of 2016) is 48673 tons per year. Indonesia has the Fisheries Management Plan (FMP) as a part of its crab management policy. This FMP was endorsed by the Ministry of Marine and Fisheries Affairs Regulation No. 70 of 2016. Another step towards environmentally friendly crab fishing is the issuance of the Ministerial Regulation No. 02 of 2014 and revised to the Ministerial of Marine and Fisheries Affairs Regulation number 56 of 2016 concerning the 10 cm minimum size of the length of the carapace of crabs for all species that can be captured. This minimum size restriction rule will maintain the stock of crab fishery resources in the hope that large and mature crabs are captured and small ones are allowed to grow in the waters. Table 2 presents the production, effort and crab catch per unit effort (CPUE) caught using traps in Indonesia from 2000 to 2014 according to Directorate General of Capture Fisheries data (2014).

Table 2

The production, effort and crab catch per unit effort (CPUE) caught using traps in Indonesia

Year	*Production (Ton)*	*Efforts (Trap)*	*CPUE (Ton per trap)*
2000	14053	23454	0.599173
2001	22040	34089	0.646543
2002	19586	38350	0.510717
2003	30530	53722	0.568296
2004	21854	69094	0.316294
2005	17107	84467	0.202529
2006	26686	85443	0.312325
2007	29174	85978	0.339319
2008	38838	76528	0.507501
2009	35000	63643	0.549943
2010	43002	38885	1.105876
2011	42411	49486	0.85703
2012	39126	47437	0.824799
2013	52396	65084	0.805052
2014	52488	80456	0.652381

Note: source: Directorate General of Capture Fisheries (2014).

Indonesia continues to encourage the improvement in the quality of crabs as one of its leading export commodities. The Ministry of Marine Affairs and Fisheries also targets the volume of crab exports, which should have increased in 2020. Crab was expected to be able to make a major contribution to the 2020 fishery product export target of 6.47 billion USD.

Conclusions. Based on the data from the whole sample of crabs, it is found that the percentage of small crabs with the length of the carapace below 10 cm was 10.4%. Three species of captured crabs were identified in Karawang: *P. pelagicus*, *P. trituberculatus*, and *C. feriata*. Based on statistical data from the Karawang Fisheries Service, the trend of crab production and price increases every year. Crabs are found throughout Indonesian waters, but most of the crab fishing grounds are concentrated in the north coast of Java, Lampung (Sumatera) and Sulawesi. The Ministry of Marine Affairs and Fisheries Republic of Indonesia has targeted the volume of crab exports to increase in 2020. Crab is expected to be able to make a major contribution to the 2020 fishery products export. Crab fisheries management is expected to provide sustainable biological, social and economic benefits for fishermen and the government.

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Conflict of interest. The authors declare that there is no conflict of interest.

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