The social-ecological dynamic of small-scale fisheries in Coastal Area of Dumai City

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Abstract. Small-scale fishery activities that often occur in coastal areas Dumai City are part of the socio-ecological system, where the waters around the coastal areas provide services to several fishermen who live around and are interrelated with each other. This study aimed to identify the dynamic of social and ecological systems to the sustainability of small-scale fisheries in the waters of Dumai City. The are 3 research location in village, namely Pelintung, Tanjung Palas, and Bangsal Aceh. The research method is a survey using interview techniques with a questionnaire. The data analysis in this research is descriptive qualitative, fishing gear productivity, fisherman's income, and the relationship dynamics of the catch. The social characteristics of fishermen can be shown from their education, where most of the fishermen in Dumai City have elementary school education. The wives of fishers in Dumai City are mostly still taking care of the household, and only a few are processing fish. Fishers in Dumai City also carry out the duration of fishing operations based on the type of fishing gear (gillnet, scoop net, and portable trap). For the last seven years, the productivity of fishing with gillnet fishing gear has increased, while for scoop net and portable trap fishing gear, it has tended to decrease. The RPUE value of gillnet fishers shows the highest profit, where the average income in one trip is IDR 1,086,050.00 compared to other fishers. The fishermen's perception also shows that the catch of gillnet fishers during the last five years has increased.

Keywords: Dumai City; productivity; small-scale fisheries; social-ecological dynamic.

1. Introduction

Small fishers dominate fishing activities in Indonesia. More than 90% of Indonesian fishers belong to small-scale fisheries businesses that catch fish in coastal areas. This condition is a great opportunity and a challenge to strengthen small-scale capture fisheries businesses to be more advanced, independent, and sustainable [1]. Based on UU No. 45 of 2009 states that small-scale fishery activities are fishermen who catch fish to meet their daily needs using fishing vessels with a maximum size of 5 (five) gross tonnage (GT) and do fishing just around the coastal [2]. Small-scale fisheries activities often experience changes in fishing catches, changes in fishing gear to changes in livelihoods. Changes in these activities are influenced by ecological factors (biological and environmental) and social, economic, and historical factors in the environment where the small fishers live [3]. Small-scale fisheries have a relationship between the community and fish resources or the social-ecological system (SES), where small-scale fishing communities rely heavily on the health and abundance of fish resources associated with the ecosystem [4].

Several sectors support Dumai City’s economic activity in producing goods and services. Gross Regional Domestic Product (GRDP) as a measure of productivity reflects the entire value of goods and services produced by a region in one year. One sector that can improve the community’s economy is the
field of fishery resources. The productivity of fishery resources in Dumai City in 2017 was relatively high at 1,273 tons/year, of which 73.11 percent or 930 tons was the result of marine fish production with an economic value of Rp. 27.9 billion per year. The number of fishing households in Dumai City is 494 people (0.6 percent of the total household heads in Dumai City) [5].

Small-scale fisheries have a huge role and are still not realized by many parties, especially the government and academics. Research related to the progress and sustainability of small-scale fisheries becomes essential to be discussed and developed, this is because 90% of fishery activities in Indonesia are small-scale fisheries. Research on the dynamics of social and ecological factors associated with small-scale fisheries over a period of time will provide information about what changes are caused by small-scale fisheries. This research on the Social Dynamics and Ecology of Small-Scale Fisheries in Dumai Waters is beneficial for fishers in Dumai City, most of whom are small-scale fishers. The researcher hopes that the research results can be used as the basis for the local government to make policies related to capture fisheries activities in Dumai City. The purpose of the study was to identify changes in social and ecological systems to the sustainability of small-scale fisheries in the waters of Dumai City.

2. Material and methods
2.1. Data collection
This research was conducted in Dumai City by taking samples from Pelintung, Tanjung Palas, and Bangsal Aceh Villages as case studies. The research location was based on the number of small fishers and their activities following the data and results of interviews with the Department of Fisheries Dumai City. The research was carried out in September and October 2019. The map of the location of this research can be seen in figure 1.
The data needed in this study are primary and secondary. Primary data was collected through interviews with a questionnaire guide (question list) and in-depth interviews, while secondary data was obtained from fisheries statistics data from the Dumai City Fisheries Agency, Dumai City BPS, and other related literature to the research. The sampling technique used was simple random and snowball sampling [6] with 30 respondents.

2.2. Data analysis

2.2.1. Descriptive analysis. Descriptive analysis was a technical analysis that explains qualitative data [7]. The data analysis process in qualitative research includes raw data collection, data transcription, data reduction, data interpretation, and concluding. Validation or testing of data validity was done by source triangulation, which tests data obtained from one source and then compared with data from other sources. In addition, one source of information was used to corroborate and add evidence from other sources to increase the validity of the findings [8]. The data shown in this analysis was adjusted to the needs of the research to answer the research objectives in the form of descriptive paragraphs, tables, pictures, graphs, and diagrams. Descriptive analysis in this study was used to describe the social dynamics of fishers and the perception of fishers to catches over the past five years (increasing, decreasing, and status quo).

2.2.2. Productivity of fishing gear. The productivity of fishing gear is assessed based on the catch per unit effort (CPUE). CPUE can be used to see the abundance and utilization rate of fishery resources in the waters [9]. CPUE calculation is based on the division between total catch and effort. CPUE calculation using the following formula:

\[ CPUE_t = \frac{C_t}{E_t} \]  

(1)

Description, CPUE\(_t\) is catch per unit effort at time \(t\); \(C_t\) is caught at time \(t\); \(E_t\) is an effort at time \(t\).

2.2.3. Revenue per unit effort (RPUE). Analysis of fishermen's income from the catch was used to determine fishermen's income in a month. This analysis was built because the use of fishery resources at the research site is still using traditional fishing gear, so it was feared that the fishery business would not be effective and efficient. This calculation (RPUE\(_{ij}\)) can estimate fishermen's income based on the number of catches and commodity prices. RPUE calculation using the formula [10]:

\[ RPUE_{ij} = CPUE_{ij} \times P_{ij} \]  

(2)

Description, RPUE\(_{ij}\) is revenue per unit of effort on the stock-\(i\) at the \(j\) time; CPUE\(_{ij}\) is catch per unit of effort on the stock-\(i\) at the \(j\) time; \(P_{ij}\) is the average price that applies to the unit of stock-\(i\) at the time \(t\).

3. Result and discussion

3.1. The social dynamic of fisherman

The fisherman of Dumai City is located in four coastal districts of Dumai City, namely West Dumai District, East Dumai District, Medang Kampai District, and Sungai Sembilan District. The social characteristics of fishers in Dumai City are not much different from Indonesian fishers in general. Most of the fishers' education levels in Dumai City are elementary school graduates (SD), and some do not take the educational path. The number of fishing families in Dumai City varies, consisting of a wife and several children. Most of these fishermen have young children and are still in school, and only a few fishermen have children who are already working. The children of fishers in Dumai City primarily work in industry, and only a small number continue their father's profession as fishermen. As for the activities of the fishermen's wives, most of them are housewives, and there are several fishermen's wives who
work as fish processing (dried fish). Mostly, the fishermen and children of fishers switched professions to become employees in the industrial sector due to the higher industrial growth in Dumai City [11]. The following are the characteristics of the education level of the respondents (small fishermen), which can be seen in figure 2.

The activities of small fishers in Dumai City are mainly classified as small-scale fisheries. This condition is because fishers only operate vessels under 5 GT with traditional fishing gear. Fishermen's dominant fishing gear in Dumai City are gillnet, scoop net, and portable traps. The small-scale fishermen carry out fishing operations using relatively small vessels (under 5 GT) with their owners and traditional fishing gear such as fishing rods, nets, and types of traps fish [3]. The duration of operation of fishing gear for fishers is based on the type of fishing gear used. The following is the length of the fishing operation/trip, the catching season, and the target fish catch from fishers in Dumai City, which are presented in table 1.

The duration of fishing operations for fishers in Dumai City follows the type of fishing gear used by small fishermen. Based on the results of interviews and direct observations, it is stated that fishers with gillnets carry out fishing operations for 3-5 days in one trip. The fishing grounds for gillnet fishers are located around the waters of Bagan Siapi-api and Bengkalis, with the peak fishing season in July-August. The operation of catching gillnet fishers is highly dependent on weather conditions. In contrast to scoop net and portable trap fishers, their fishing operation lasts for one-day fishing. The scoop net fishermen usually catch fish in the morning until late in the evening. Then portable trap fishers catch four times in one day (morning, afternoon, evening, and night) during the peak season of fish. They take fish caught three times (morning, afternoon, and evening) during the regular season. This type of fishing gear is a trap, where the installation of fishing gear is carried out once a week. The fishing season for fishers using scoop net and portable trap fishing gear is usually carried out throughout the year. It is not affected by the weather except during religious holidays, breaks, and specific events. Besides that, most fishers in Dumai City do not carry out fishing activities on Friday due to Islamic prayer activities. However, the peak season for the catch occurs from March to May. Mainly, fishermen (scoop net and portable trap) in Dumai City operate fishing gear throughout the season and are not affected by the weather [11].

Figure 2. Characteristics of respondents' education level.
3.2. Production and catching effort

The production of gillnet, scoop net, and portable trap fishers from 2012 to 2018 experienced fluctuating developments. Gillnet fishing gear production decreased from 2012 to 2014 by 36% (94.4 tons). However, after that, it experienced an increase in production from 2015 to 2018 by 39% (207.8 tons), in contrast to scoop net fishing gear production, which experienced a downward trend from 2012 to 2018. The most significant decline in scoop net fishers production occurred in 2015, where the decline in production reached 59% (217.9 tons) from the previous year. Meanwhile, the portable trap fishing gear production also experienced fluctuating changes. From 2012 to 2014, there was a decrease in production, and from 2015 to 2018, there was an increase in production. The most significant increase in portable trap production occurred in 2017 by 44% (134.8 tons) compared to 2016.

In contrast to the development of catch production, the number of fishing efforts from gillnets, scoop nets, and portable traps tend to increase every year. The number of fishing gear efforts that experienced the highest increase in succession were portable traps, scoop nets, and gillnets with increasing values of 56%, 50%, and 26%, respectively. The increase in fishing effort is influenced by the number of catches received by fishermen. Fishers with portable traps and scoop nets tend to experience a decrease in catches, so they try to increase their fishing effort. In addition, the duration of the operation for catching portable traps and scoop nets is one-day fishing. In comparison, fishing operations are carried out for 3-5 days in one fishing effort for gillnets. One of the factors that can affect fishing activities is the amount of fishing effort made by fishermen in reaching fishing areas [12]. The following is a breakdown of

### Table 1. The dynamics of fishing for small fishers in Dumai City.

| Fishing Gear | Fishing time | Fishing Boat | Fishing ground | The peak of fishing season |
|--------------|--------------|--------------|----------------|---------------------------|
| Gillnet      | 3-5 day      | 5-10 GT      | Bagan Siapi-api, Bengkalis, Pulau Rupat Waters and surrounding | July-August |
| Scoop Net   | 1 day        | 2-5 GT       | Dumai Waters and Selat Rupat | March-Mey |
| Portable Trap | 1 day       | < 2 GT       | Dumai Waters | March-Mey |

### Table 2. Total catch production and fishing effort for gillnet, scoop net, and portable trap fishers from 2012-2018.

| Year | Fish Production by Fishing Gear (ton) | Effort (trip) |
|------|--------------------------------------|---------------|
|      | Gillnet | Scoop Net | Portable Trap | Gillnet | Scoop Net | Portable Trap |
| 2012 | 264.8   | 488.5     | 175.0         | 8,940   | 12,160    | 6,590         |
| 2013 | 208.4   | 539.6     | 173.2         | 9,450   | 18,500    | 7,560         |
| 2014 | 170.4   | 368.4     | 141.8         | 9,750   | 19,375    | 8,030         |
| 2015 | 325.5   | 150.5     | 152.5         | 10,026  | 22,918    | 8,456         |
| 2016 | 355.5   | 143.5     | 170.5         | 10,456  | 23,050    | 10,450        |
| 2017 | 503.6   | 130.7     | 305.3         | 11,345  | 23,620    | 12,150        |
| 2018 | 533.3   | 221.5     | 329.5         | 12,072  | 24,550    | 15,120        |

Source: Dumai City Fisheries Agency (2012-2018)
catch production and fishing effort from gillnet, scoop net, and portable trap fishing gear from 2012 to 2018 presented in table 2.

The development and increase in the production of fishing products is determined by several things, including the size of the ship, fishing technology, engine strength, and fishing aids. The scope and space for fishing carried out by small fishermen in Dumai City is getting narrower. This is indicated by the decrease in total catch production from 2012-2015 by 299.8 tons, but began to increase from 2015-2018 by 455.8 tons. This is due to changes in the use of drift gill net fishing gear by sondong fishermen, so that the fishing area is also wider. In contrast to production, fishing trips have increased from 2012-2018 by 24,052 trips. This can indicate that the use of fishing gear used by small fishermen in Dumai City has been effective. The fishing gear used efficiently and effectively will affect the increase in catch production [17]. The following is the development of catch production and total fishing effort from gillnet, scoop net, and portable trap fishing gear from 2012 to 2018 can be seen in figure 3.

Figure 3. Growth in total fish catch production and fishing efforts from gillnet fishing gear, scoop net, and portable trap from 2012-2018.

3.3. Productivity and revenue

Productivity is the fishing effort of each type of fishing gear used as an indicator to determine the effectiveness and technical efficiency of the fishing unit from the amount of effort carried out. The productivity value in this study was obtained from the division of total catch by total fishing effort. Based on the analysis results, it is indicated that the average productivity of each fishing gear is different. The highest productivity is in gillnet fishing gear with a value of 31.0 kg/trip, or higher when compared to the other two types of fishing gear. Productivity for portable traps and scoop nets are 15.5 kg/trip and 12.6 kg/trip, respectively. The fishing area influences this difference in production values, the number of trips, and the frequency of operation. That fishing effort is closely related to the frequency of catching and the number of fishing trips [13]. No less important factor in increasing the productivity value of fishing gear in Dumai City is the number of fishing efforts in reaching fishing areas.

Revenue per unit effort (RPUE) in this study is used to calculate the estimated economic value of fisheries obtained by fishermen in one fishing effort. The RPUE value is obtained from the catch per unit effort (CPUE) data and the price of each catch commodity. The interviews and calculations result exhibited that fishers obtained the highest RPUE value with gillnet fishing gear with Rp. 1,086,050/trip, while the value of RPUE with portable trap and scoop net each gets a value of Rp. 618,400/trip and Rp.
6.000/trip. This value is the gross receipts from fishers after catching fish before deducting operational costs and other costs. The value of the RPUE obtained depends on the type of commodity caught and the amount of production. The economic value of fishery productivity is influenced by the number of catches and the type of commodity caught. Suppose the catch obtained is an economically important fish commodity. In that case, the production value will be high, but if the commodity catch is an important non-economic commodity, the production value will be low [14]. The following are details regarding the number of catches, revenue per unit effort, and productivity from interviews result with fishers, which can be seen in table 3.

### Table 3. Number of fish catches, revenue per unit effort, and productivity of small fishers based on fishing gear.

| Fishing Gear | Mean of Catch/Trip (Kg) | Fishing Time/Trip (Day) | Productivity (Kg/trip) | Mean Price of Catch (Rp/Kg) | RCPUE (Rp) |
|--------------|-------------------------|-------------------------|------------------------|-----------------------------|------------|
| Gillnet      | 150.2                   | 5                       | 31.0                   | 35,000                      | 1,086,050.00 |
| Scoop Net   | 12.6                    | 1                       | 12.6                   | 40,000                      | 506,000.00 |
| Portable Trap | 15.5                   | 1                       | 15.5                   | 40,000                      | 618,400.00 |

Figure 4. Dynamics of small-scale fisheries productivity by type of fishing gear from 2012-2018.

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#### 3.4. Dynamics of fishing gear productivity

The dynamics of productivity for gillnet fishing gear, scoop net and portable traps can be seen from the trend of their development in the last 7 years from 2012 to 2018. The results of the analysis of the productivity of gillnet fishing gear, scoop net and portable traps from 2012 to 2018 show different developments. The development of gillnet fishing gear productivity shows an increasing trend. Gillnet's productivity shows an increase of 2.74 kg/trip every year for the last 7 years. In contrast to gillnet fishing gear, portable trap fishing gear shows a declining productivity development. The decrease in productivity of portable traps is 0.399 kg/trip over the last 7 years. As for the decline in the productivity of scoop net fishing gear by 5.48 kg/trip for the last 7 years. The highest average productivity for the
last 7 years is for gillnet fishing gear which has a productivity of 32.03 kg/trip, while portable trap and scoop net fishing gear has an average productivity of 21.20 kg/trip and 16.53 kg/trip. These results indicate that the gillnet fishing gear is the most productive fishing gear compared to others. It’s stated that the gillnets are one of the most productive types of fishing gear used in catching fish, both inshore and offshore [15]. the productivity value of each type of fishing gear from 2012 to 2018 can be seen in figure 4.

Based on the analysis results, it is stated that the productivity value of gillnet fishing gear is an efficient fishing gear used by fishermen in Dumai City. This condition is indicated by the average number of fishing efforts made by gillnet fishermen, which is lower but more productive for catching fish. The fishing effort for each fishing gear is generally different and highly dependent on the type of fishing gear used. The efficiency level of using fishing gear can be seen from the high productivity value. The higher level of fishing effort makes fishing productivity smaller [16,17].

3.5 Perception of catch dynamics

This perception of changes in catch is needed to describe the current condition of the catches for the last five years based on perceptions from fishers of gillnet, portable trap, and scoop net fishing gear. Based on the results of interviews with fishers in Dumai City regarding changes in catches over the last five years. It was stated that 60% of fishers with portable traps and scoop nets stated a decrease in catches, while 60% of gillnet fishers had increased catches over the last five years. One of the causes of the decline in catches is an indication that the existence of fishery resources around the waters of Dumai City has decreased in stock, and the fishing ground is getting farther away from scoop net and portable trap fishers. Meanwhile, gillnet fishers have an alternative fishing ground around the waters of Dumai City and can reach the waters of Bengkalis and Bagan Siapi-API and the surrounding waters. This perception also supports the productivity analysis of the fishing gear used by fishermen in Dumai City. The results also show an increase in productivity for fishers with gillnet fishing gear, and fishers with portable traps and scoop nets productivity tends to decrease (see figure 4). The analysis of fishermen's perceptions in supporting the sustainability of fisheries management is critical. These results can be used as a basis for stakeholders to formulate policies from the perceptions of fisheries business actors directly
The following is an answer from the perception of small fishers in Dumai City regarding changes in fish catches over the last five years, as shown in figure 5.

4. Conclusion
The results show that the social characteristics of fishers in Dumai City are the same as fishermen in general, where the education level of fishers is a mostly elementary school (SD). The wives of fishers in Dumai City are mostly still taking care of the household, and only a few are processing fish. Fishers in Dumai City also carry out the duration of fishing operations based on the type of fishing gear (gillnet, sondong and pengerih). The productivity of gillnet fishing gear is the most productive fishing gear with a productivity value of 31.0 kg/trip, or higher than the other two types of fishing gear. Productivity for portable traps and scoop nets are 15.5 kg/trip and 12.6 kg/trip, respectively. Based on the analysis results of the fishing productivity trend of fishers using gillnet fishing gear over the last seven years, it tends to increase, while sondong and pengerih fishing gear tend to decrease. The RPUE value of gillnet fishers shows the highest profit, where the average income in 1 trip is Rp. 1,086,050.00 compared to other fishers. The fishermen's perception also shows that the catch of gillnet fishers during the last five years has increased. Based on the study results, it can be concluded that gillnet fishing gear is an efficient fishing tool used by small fishers in Dumai City from the social and ecological dynamics of fisheries that occur in the waters of Dumai City.

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Reference
[1] Wahyudi A and Sutusna D 2021 Analisis Perikanan Tangkap Skala Kecil di TPI Pasir Studi Kasus: Nelayan KUB Mina Jaya Jurnal Penyuluhan Perikanan dan Kelautan 15 85-100.
[2] Sutjipto D O 2018 Dinamika Sosial dan Ekologi Perikanan Skala Kecil di Prigi Trenggalek Jurnal Perikanan dan Kelautan 8 114-125.
[3] Jara H J, Tam j, Reguero B G, Ganoza F, Castillo G, Romero C Y, Gevaudan M and Sanchez A A 2020 Current and future socio-ecological vulnerability and adaptation of artisanal fisheries communities in Peru, the case of Huaura province Marine Policy 119 1-15.
[4] Partelow S 2015 Key steps for operationalizing social-ecological system framework research in small-scale fisheries: A heuristic conceptual approach Marine Policy 51 507-511.
[5] BPS Kota Dumai 2018. Kota Dumai Dalam Angka 2018 (Dumai (ID): Badan Pusat Statistik Kota Dumai)
[6] Robinson OC 2014 Sampling in interview-based qualitative research: A theoretical and practical guide Qualitative Research in Psychology 111 25-41.
[7] Kim H, Sefcik J S and Bradway C 2016 Characteristics of Qualitative Descriptive Studies: A Systematic Review Research in Nursing & Health 401 23–42.
[8] Sugiyono 2017 Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, R&D. (Bandung (ID): Alfabeta)
[9] Omori K L, Hoening J M, Luehring M A and Baier-Lockhart K 2016 Effects of under estimating catch and effort on surplus production models Fish Research 183138–145.
[10] Béné C and Tewfik A 2001 Fishing effort allocation and fishermen's decision-making process in a multi-species small-scale fishery: analysis of the conch and lobster fishery in Turks and Caicos Islands Human Ecology 29 157- 186.
Sari I T 2010 Peran Pangkalan Pendaratan Ikan (PPI) Kota Dumai dalam Mendukung Aktivitas Penangkapan Ikan (Bogor: ID: IPB University) p 81.

Yusuf H N, Baihaqi B and Hufaidi H 2020 Dinamika Perikanan Pelagis Kecil dengan Pukat Cincin di Perairan Samudera Hindia Barat Sumatera Jurnal Litbang Perikanan Indonesia 26 109-123.

Battaglia P, Romeo T, Consoli P, Scotti G and Andaloro F 2010 Characterization of the artisanal fishery and its socio-economic aspects in the central Mediterranean Sea (Aeolian Islands, Italy) Fisheries Research 102 87-97.

Pradini U R, Yulinda E and Arief H 2017 Distribusi dan Margin Pemasaran Hasil Tangkapan Ikan di Bangliao Hasan Kelurahan Bagan Barat Kecamatan Bangko Kabupaten Rokan Hilir Berkala Perikanan Terubuk 45 87-97.

Matrutty, D D P, Matakupan H, Waileruny W and Tamela L 2019 Produktivitas jaring insang hanya berdasarkan waktu tangkap pagi dan sore di Teluk Ambon Dalam. Prosiding Seminar Kelautan dan Perikanan (Ambon: FPIK Unpatti) p9.

Garcia-de-la-Fuente L, Vazques E F and Carvajal M C R 2020 Sample selection bias in fisheries technical efficiency studies using stochastic frontiers; presence and correction for an artisanal fishery in Northwest Spain Ocean and Coastal Management 198 1-9.

Apriliani I M, Hamdani H and Rizal A 2020 Productivity of fishing gear on shrimp catching operation in Pangandaran Regency Albacore 4 141-148.

Wahyudi D P 2014 Analisis Persepsi Keberlanjutan Perikanan Tangkap Skala Kecil di Cisolok, Sukabumi, Jawa Barat (Bogor: ID: IPB University) 66 p.