Management of small-scale fisheries and their issues: Case study in Sibolga, North Sumatera, Indonesia

M Firdaus¹,², H M Huda¹, Mira¹, S H Suryawati¹, T Kurniawan¹, Y D Sari¹

¹Research Center for Marine and Fisheries Socio-Economics, Jalan Pasir Putih I Ancol Timur, Jakarta Utara, Indonesia
²Corresponding author: mr_firda@hotmail.com

Abstract. Small-scale fisheries dominate the fishing industry in Indonesia, and more than 90% of Indonesia’s fishing vessel is estimated to be less than 30 GT. Small-scale fisheries issues could vary by region in Indonesia, based on their characteristics, so the government requires different and effective fisheries development programs and initiatives. Sibolga, North Sumatera, is a fisheries centre in Indonesia where small-scale fishers and industrial fishing vessels co-exist in the same port. For instance, the issues and management strategies addressed have to be approached in several different ways to develop sustainability. The purpose of this research is to examine the management of small-scale fisheries and their issues in the study area. The study was carried out in 2019. Primary and secondary data were used for this analysis. The analysis of data used a qualitative approach. Social and structural aspects should be discussed in the management of small-scale fisheries. Regulations are expected to raise the economic rents of small-scale fishing activities and, on the other hand, to apply a resource tax to small-scale fishermen adapted to current social and institutional conditions.

1. Introduction
Indonesia has very significant fishery capacity and is expected to have an estimated fishing potential of 12.54 million tons based on Decree of the Indonesian Minister of Maritime Affairs and Fisheries (KepMen KP No. 50/KEPMEN-KP/2017). However, the capacity of this resource has not been optimally exploited. This situation is indistinguishable from the management of capture fisheries in Indonesia. The fishing conditions in Indonesia that enforce the common Property and the Open Access Scheme offer great potential for overfishing [1]. On the other hand, capture fisheries management have positive and a negative impact when it is not handled properly and sustainably [2]. The fishing industry in Indonesia is dominated by small-scale fishing, or as much as 94% by a vessel of less than 10 gross tons [3].

There are multiple kinds of meanings for small-scale fisheries, in the applicable regulations in Indonesia, small scale fisheries based on Law no. 45 of 2009 on adjustments to Law no. 31 of 2004, small-scale fishermen are defined as people whose livelihoods are fishing to meet their daily needs using a fishing vessel with a maximum size of 5 GT. In 2016, the legal definition of small fishers surfaced again through Law No.7/2016, where small fishermen are defined as fishermen who carry out fishing to meet their daily needs, both those who do not use fishing vessels and those who use fishing vessels of the same size, at most 10 GT. Meanwhile, in Government Regulation No.32 of 2019, small fishermen are defined as fishermen who catch fish for their daily needs, both those who do not use fishing vessels and those who use fishing vessels with a maximum size of 10 GT. Small-scale fisheries are also described as "the profession of final resort", with fisherfolk as "the worst of the poor " [4],

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however, small scale fisheries have a valuable addition and major role in terms of economic, social, employment and food supply [5-7].

Sibolga is one of the capture fisheries centres on the island of Sumatera or the western region of Indonesia, with an average capture fishery reaching 12.67% of the average capture fisheries of North Sumatera [8]. Sibolga is a region with a significantly larger fishing industry compared to other regions on the western coast of Sumatera. Capture fisheries situation in Sibolga is the same as national capture fisheries situation, which is driven by small-scale capture fisheries. The existence of small-scale fishers has undeniably had an economic impact, although it has not been optimal [3]. Capture fisheries in Sibolga shows that there are complex problems in the management of capture fisheries in this area, the existence of privately owned fish landings or what is referred to as “tangkahan” has left a gap in the function of the Sibolga Fishing Port (SFP) which is officially managed. By the government [10]. Tangkahan is a fish landing base that is managed by the private sector, both the activities and facilities therein are engaged in capture fisheries [9]. Tangkahan has a function as fish landing, marketing, the fulfillment of fishing operations and as a place for added anchoring and docking. In general, small scale fishers or fishermen with a vessel of less than ten gross tonnes are more affiliated with tangkahan than SFP.

The impact of existence has an impact on SFP. This effect is in the form of weakening of the catch landing activities that occur at SFP so that the recording of the number of fishers, the amount of production and other fishery activities in Sibolga becomes difficult to manage with authority [10]. After all reality, this issue is not the only one faced by fisheries managers in Sibolga. There are other problems. Based on this, this study aims to analyze small-scale capture fisheries and its issues in Sibolga so that it can be a recommendation for managers to realize capture fisheries development in the target area.

2. Material and methods

2.1. Study design

This study was carried out in Sibolga, North Sumatera Province, Indonesia. Sibolga and North Sumatera Province is the centre of captured fisheries in western Indonesia. A research survey was conducted in 2019. Primary data collection was carried out through interviews with small scale fishers, port managers and other key respondents using a questionnaire. Our study used two types of sampling techniques: purposive sampling and snowball. Purposive sampling was used where the number of fishers was small. Where no lists were available, snowball sampling was used where fishers were asked to identify their fellow fishermen who were then selected for the survey. Fifty-one fishermen were selected for this study. Additional relevant information also obtained from field observations and in-depth interviews with key informants. This study uses secondary data, such as scientific journals or publications, articles and reports.

2.2. Analysis data

Data were analyzed using the analysis of mixed methods using quantitative and qualitative methods. Profitability analysis and a feasibility study are conducted. The business feasibility analysis was conducted to determine the financial feasibility of investing in fishing businesses according to the vessel size and fishing gear. Data collected were organized into charts, tables, and graphs in Microsoft Excel. In this paper, the critical approaches to describe and assess the household of small scale welfare are from economic views (income), measured by using: (1) The ratio of income to regional minimum wage approach (RMW) when the ratio is < 1, then labor income is below RMW (inadequate) when the ratio = 1 means that labor income is equal to RMW (borderline) and when the ratio is > 1 means that income is higher than RMW (more than sufficient) [11].

3. Result and discussion

3.1. Performance of small scale fisheries in Sibolga

The fisheries sector is one of the driving forces for the economy in Sibolga that in 2017 the GRDP of Sibolga reached 4.64 trillion IDR, the fisheries sector contributed 21.39% of the GRDP. The total population of Sibolga City in 2018 is known to be 87,313 million, with total workers of 44,426 people.
Of the total workforce 12,508 people (28.15%) work and depend on fisheries for their livelihoods. Among them work as fishermen, loading and unloading workers in cisterns, fish and ice transportation drivers (trucks and rickshaws), fish and fish marketing actors, fish processing actors, docking workers, shop workers selling fishing tools, workers in cold storage and ice factories.

Small-scale fishers in Sibolga not only catch fish in the Sibolga Sea Region, even though their vessels are small, but some of them also catch fish outside the province, such as Padang, Aceh, Nias and Mandailing Natal. Based on the classification of fisheries management areas, the Sibolga region is part of the State Fisheries Management Area of the Republic of Indonesia (WPPNRI) 572. This area involves the seas of the Sunda Strait and the Indian Ocean west of Sumatra. Capture fisheries industry in Sibolga is dominated by small-scale fishermen (vessel <10 GT), or as much as 66% of the total vessel registered in Sibolga.

Table 1. Number of fishing vessels in Sibolga by the size in 2014-2018.

| Vessel Size | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------------|------|------|------|------|------|
| < 5 GT      | 25   | 210  | 224  | 222  | 225  |
| 5 - 10 GT   | 60   | 126  | 145  | 153  | 70   |
| 10 - 30 GT  | 151  | 88   | 102  | 110  | 78   |
| 30 - 50 GT  | 76   | 6    | 7    | 7    | 2    |
| 50 - 100 GT | 72   | 75   | 76   | 78   | 66   |
| > 100 GT    | 0    | 6    | 7    | 7    | 8    |
| **Total**   | 384  | 511  | 561  | 577  | 449  |

Source: [13]

In the period 2014 - 2018, fishery production in Sibolga decreased by 12,458.31 tons or 23% [13]. According to fishers, the factors that cause the decline in production include weather/climate conditions in the West Coast of North Sumatera and low productivity of fishers in capture fisheries activities, because most of the fishermen in Sibolga are small scale, fishermen, with traditional technology, so their fishing capacity is low. The types of fish caught landed in Sibolga City consist of various types of demersal fish, small and large pelagic fish, reef fish, and others. The types of fish include tuna (skipjack and yellowfin), mackerel, pomfret fish, grouper, yellowtail, snapper, mullet, cuttlefish, squid, and others.

The business performance of small scale fishers in Sibolga can be seen from the type of vessel and fishing gear. The difference in the use of the size of the vessel and the type of fishing gear used can give different results. Compared to the results of the profitability analysis shows that the fishing effort using the gillnet and hand line is not much different from the profit value, the profit value of the gillnet is smaller than the hand line. Fishing expenses using gillnet are greater because they use more fuel than hand line fishing. Handline fishers who are passive and do not move places when fishing is more efficient than gill net fishing gear. Fishers can catch themselves by using hand-line fishing gear, while for gillnet fishing gear the minimum is two people. In Table 2, it can be seen the magnitude of the business analysis on each fishing gear per trip and year.
Table 2. Profitability analysis of small scale fisheries in Sibolga, 2019.

| No. | Fishing Gears | Item          | Mean         | Max          | Min          |
|-----|---------------|---------------|--------------|--------------|--------------|
|     |               | Trip (USD/Trip) | Years (USD/Years) | Trip (USD/Trip) | Years (USD/Years) |
|     |               | 180           | 35,010.00    | 7,317.86    |
| 1   | Gill nets     | Assets        | 13,349.89    | 35,010.00    | 7,317.86    |
|     |               | Fix cost      | 0.54         | 97.57        | 2.38         |
|     |               | Variable cost | 1.08         | 193.82       | 2.57         |
|     |               | Revenue       | 4.95         | 891.79       | 6.27         |
|     |               | Profit        | 3.88         | 697.96       | 5.36         |
| 2   | Hand line     | Assets        | 10,091.45    | 12,828.57    | 7,147.14    |
|     |               | Fix cost      | 4.64         | 1,114.29     | 8.33         |
|     |               | Variable cost | 1.83         | 440.14       | 3.48         |
|     |               | Revenue       | 4.18         | 1,002.86     | 7.44         |
|     |               | Profit        | 4.68         | 1,122.79     | 7.44         |

Note: 1 USD = 14,000 IDR

The average number of trips per year with the gillnet fishing gear is 180 trips per year, while for hand-drawn fishing gear it is 240 trips per year. The average investment value for fishing business using gillnet fishing gear is higher than hand-line fishing gear. The biggest difference in investment costs is in the fishing gear used. Gillnet fishing gear reached more than 1,400 USD/unit, while for hand lines around 36 USD/unit. As for the type of vessel used, it is relatively almost the same in shape and construction. The revenue received is revenue for one vessel unit. This value does not reflect the value of income received by fishermen. The average number of crews in one small scale vessel unit is three people, consisting of the captain and two fishing crews.

Then the income earned by each crew based on the profit-sharing system for the vessel with gill net fishing gear for the captain is 50.36 USD/year and fishing crew 25.18 USD/year. Income for vessels with handline fishing gear for the captain 370.57 USD/year and fishing crew 185.3 USD/year. When compared with the regional minimum wage in 2019 for Sibolga of 2,372.86 USD/year, it can be concluded that the income received by small scale fishermen is still not feasible, even though this business is profitable. RMW is the minimum income received by every individual and as a benchmark for citizens' prosperity. RMW in Indonesia is determined based on the Ministry of Manpower Number circular B-M/308/HI.01.00/X/2019. RMW rates in thirty-four provinces in Indonesia concluded by the Governor in each Province and applied to all formal sectors. RMW can also be a benchmark to find out whether working on captured fisheries industry is better than in other occupations [11].

Table 3. Financial analysis for small scale fisheries in Sibolga, 2019.

| No. | Fishing Gears | Item          | Mean         | Max          | Min          |
|-----|---------------|---------------|--------------|--------------|--------------|
| 1   | Gill nets     | Assets (USD)  | 13,349.89    | 35,010.00    | 7,317.86    |
Based on the results of financial analysis with a period of 10 years and a factor discount value of 12%, it is known that the two businesses with different fishing gear are not feasible for fishers to do. Based on the IRR value, it is known that the business investment in hand-line fishing is considered more profitable than fishing using gillnet. This can be seen from the IRR value for hand-line fishing gear of 24% which is higher than the bank interest rate used in this business projection which is 12%, while for the IRR of fishing business with gillnet fishing gear it is 8% (Table 3). The average NPV value with a project period of 10 years shows that the fishing effort using hand-line fishing gear is estimated at 19,762.31 USD while for gillnet fishing gear it is USD 3,750.06.

3.2. Small scale fisheries management and their issues

The previous analysis results have shown that financially, the small scale fishing is unfeasible and have not been able to meet the decent living needs of fishers. Of course, this is a concern for maintaining small scale fishing in order to make fishers wealthy. One of the ways to enhance the performance of small scale fishing can be done through subsidies. Fishing subsidies are described as a public funds, indirectly or directly, from government authorities to the fisheries sector [14]. Government support for the fisheries sector can include non-fuel subsidies such as beneficial fisheries management subsidies, capacity-building subsidies (boat building, renovation and revitalisation) that can improve financial viability and strengthen international fisheries sustainability [15].

We suspect that around 80% of small-scale fishers in Sibolga do not land their catch at the official port (SFP), which the government manages but instead landed in a private port owned by civilians. At least one tangkahan can serve up to 40 small scale fisheries (<10 GT) with a total of up to 160 fishers involved [9]. Based on the research results, several things become the main attraction for small scale fishing because the owners of tangkahan provide services to fishermen, such as capital loans and an extensive marketing network. Each tangkahan provides services for marketing fish for local and inter-provincial destinations. However, unlike the official port, Tangkahan does not have a fuel and water station. However, they do provide fuel and water supply services at a higher price than ports. The price difference can reach 1,000-2,000 IDR/liter. However, tangkahan remains the main option for small fishers to land their catch.

The existence of tangkahan, has resulted in the function of fishing ports not being optimal. The production recorded at fishing ports is estimated at less than 5%, while those recorded in tangkahan reach more than 95% [16]. This, of course, has an impact on the low non-tax income of the fisheries sector received by fishery ports, which are managed for the government. The estimated value of retribution fees from capture fisheries activities in North Sumatera Province is 54,523.09 USD/year [17]. It is estimated that the value of retribution received by all Tangkahan in North Sumatera Province, is estimated to reach 1,090,461.80 USD/year [16]. Levies on fishery production, in the concept of a resource tax, are used as compensation for resource exploitation aimed at protecting the environment and encouraging economic growth [18].

There is a disparity between benefit and rent in fisheries and other natural resource-based industries. The case of fisheries in Norway, the US, and Canada, fisheries administrators, policymakers, and industries may be much more concerned in benefit, which is limited to seeing the overall profits of fishers, boats, and crews, thus seeing the opportunity cost of labor as profits rather than expense [19,20]. Rente is a concept that calculates net profit divided by the amount of catch production [2]. In this case, fisheries in Sibolga are expected to see this sector's economic value not
only from profits but also from the economic rent from these resources. Large economic rents will have a greater economic impact on all parties involved in this industry. One way to increase economic rent by the government is to reduce operational costs by controlling the distribution of fuel because the high cost mostly comes from the fuel portion [21]. The existence of small scale fisheries in fishing industry, especially in Sibolga and several other areas in Indonesia, is often not considered because of its contribution to low state taxes, even though in large numbers.

The sub-optimal role of fishing ports and the potential for loss of resource tax are the two main issues identified in this study on managing of small scale fishing in Sibolga. The government must be able to find a solution immediately. In this study, the frequency of problems that arise is related to the less optimal fishing ports' role compared to tangkahan, namely, efficiency and effectiveness of marketing. The nature of fishery products included in perishable food, so that fast marketing is needed so that the quality of the fish and the price remains good. Small fishers face problems in income uncertainty and a marketing system that is not optimal so that it has an impact on capital or meeting operational costs [22]. This problem makes small-scale fishers very dependent on tangkahan because it provides capital services. The role of fishing ports needs to be optimized in the effort to provide supplies at sea and the implementation of a comprehensive fish auction system so that small fishers have a bargaining position in the fisheries trade system and get cash directly.

4. Conclusion
Small-scale fishers dominate fishing industry in Sibolga. The small-scale fishing enterprise in Sibolga is profitable and but not feasible, with an average Net B/C value of 0.2. However, the fishing crew's income was not sufficient for the proper requirements because it was still below the minimum regional wage (RMW) value. The main problem for small scale fishing in Sibolga is related to the fish marketing system and the fulfillment of operational fishing costs. These two factors triggered the government's ineffective role of the official fishing port (Sibolga Fishing Port). One of the impacts is the low participation of small scale fishermen who land their fish catch in SFP so that the utilization tax on resources in non-tax revenue is low. Therefore, a strategy to optimize fishing ports' function is needed by adopting the marketing, social and institutional systems used by private ports "tangkahan" and adapted to the characteristics of small-scale fishing businesses.

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