



# Characteristics of artisanal fisheries in Rembang Regency, Indonesia

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**Abstract.** This study analyzed the characteristics of artisanal capture fisheries in Rembang Regency. The survey involved 90 artisanal fishermen who used fishing gears including gill net, '*bubu*' (trap) and longline. In-depth interviews were conducted with 5 extension staffs. The characteristics of artisanal fisheries in Rembang Regency were analyzed using qualitative and quantitative approaches. The cost:revenue (CR) ratio analysis assessed the profitability of artisanal fisheries in Rembang Regency. The results showed that the residential neighborhoods of artisanal fishermen were densely populated and had poor sanitation even though most of their houses had tile floors, cement walls and roof tile. Most fishermen had low to middle education background. Their average monthly family expenditure was IDR 1.44 million, 53.1% of which was allocated for food. The potential for social conflict in the neighborhoods was rather low, and '*musyawarah*' or deliberation has been the mechanism in resolving conflicts. Abundant fish resource is considered the most important factor in the management of artisanal fisheries among fishermen. The CR ratio value for capture fisheries using gillnet was 0.71, while for traps was 0.58 and for longline was 0.28.

**Key Words:** artisanal fisheries, CR ratio, Rembang Regency, social characteristics.

**Introduction.** Artisanal fishery businesses need government assistance, including artisanal fisheries in Rembang Regency, Indonesia. Artisanal fishery is characterized by the utilization of simple technology, fishing ground close to the fishing base (one-day fishing) and low capital. The productivity of artisanal fisheries is often relatively low. In developing and under developing countries, artisanal fisheries provide employment opportunities, support food security, economic growth and contribute to poverty alleviation (Oliveira et al 2016; Ahmed et al 2021). According to Béné et al (2007), high population growth and inadequate government support to the development of artisanal fisheries put artisanal fisheries business actors in difficult situation. The demand for the government to give greater support for the development of artisanal fisheries in the world is rising. Many countries have started to realize that they should not solely focus on developing large-scale fisheries (Vincent et al 2007). With the decline in global stock of fish resources, artisanal fisheries business actors are vulnerable to loss.

The fisheries sector is a major economic contributor to Rembang Regency (Wijayanto et al 2021). Fisheries, agriculture and forestry sectors make the highest proportion to the gross regional domestic product (GRDP) of Rembang Regency by 25.02% (BPS-Statistics of Rembang Regency 2020). Rembang Regency has several fishing bases, including Coastal Fishing Port (CFP) of Tasikagung, Fish Landing Place (FLP) of Tunggulsari, FLP of Tanjungsari, FLP of Pasar Banggi, FLP of Pangkalan, FLP of Pandangan, FLP of Karang Lincak, FLP of Karanganyar, and FLP of Sarang. Some of these fishing ports have become fishing bases for artisanal fisheries, except for the CFP of Tasikagung which is the base for purse seine and cantrang vessels with a fishing operation duration of more than 2 months per trip (Wijayanto et al 2019; Wijayanto et al 2020a; Wijayanto et al 2021). Some coastal villages in Rembang Regency are not supported by adequate fishing base facilities. Therefore, the development of artisanal fisheries should be prioritized by Rembang Regency government.

Despite its low productivity, artisanal fisheries have a strategic role in the economic development in Rembang Regency. To develop this sector, it is necessary to examine information regarding the characteristics of business actors and their opinions. Unfortunately, data on artisanal fisheries in developing and underdeveloped countries are usually limited (Oliveira et al 2016). This study analyzed the characteristics of fishing business actors in Rembang Regency to optimize the economic development of Rembang Regency.

## Material and Method

**Setting.** This research was conducted in Rembang Regency (Figure 1) at 111°00' to 111°30' East longitude and 06°30' to 07°00' South latitude (BPS-Statistics of Rembang Regency 2020). The survey was conducted in coastal villages where artisanal fishermen live. Surveillance was conducted from March to April 2021.



Figure 1. Research location.

**Data collection method.** Interviews were conducted with 90 artisanal fishermen. Observations were carried out on coastal fishing settlements and fishing bases for artisanal fishermen. We also conducted in-depth interviews with five extension staffs to follow up the results of the survey.

**Data analysis.** Analysis of the characteristics of artisanal fisheries in Rembang Regency was carried out using qualitative and quantitative approaches. The collected data was processed thematically using Microsoft Excel. The cost:revenue (CR) ratio analysis was conducted to assess the level of profit of artisanal fisheries in Rembang Regency. The CR ratio is the opposite of the revenue:cost (RC) ratio. If the value of the CR ratio is less than one, then the artisanal fishery business under study is profitable. The CR ratio formula follows this equation (Batchimeg 2017; Wijayanto et al 2019):

$$\text{CR ratio} = \text{total cost} / \text{total revenue} \quad (1)$$

Note: revenues and costs in this research were converted to IDR per trip.

**Results.** Most of the world's artisanal fisheries are in the tropic areas, especially in developing and underdeveloped countries. This has made data on artisanal fisheries limited as research funding allocated to such countries is low (Oliveira et al 2016).

**Social characteristics.** The environment where traditional fishermen live in Rembang Regency was densely populated, with narrow roads, poor water channels, and slum settlements. Waste management in residential areas was often improper (Figure 2a). Some residents still throw trash to the sea or burn it. Fish catching, fish processing, fish trading and services related to fishery business (including transportation, and provision of supplies) are the main economic sources for the majority of the population living in the coastal area of Rembang Regency. Facilities used by traditional fishermen and their wives to process fish are shown in Figures 2b, 2c and 2d. Slum settlements with dense population were not only found in Rembang Regency, but also in other coastal areas of Indonesia and other countries in Asia and Africa, including Bangladesh, India, Pakistan, the Philippines, Kenya and Ghana (Ballesteros 2010; Marx et al 2013; Darmiwati 2016; Michiani & Asano 2019).

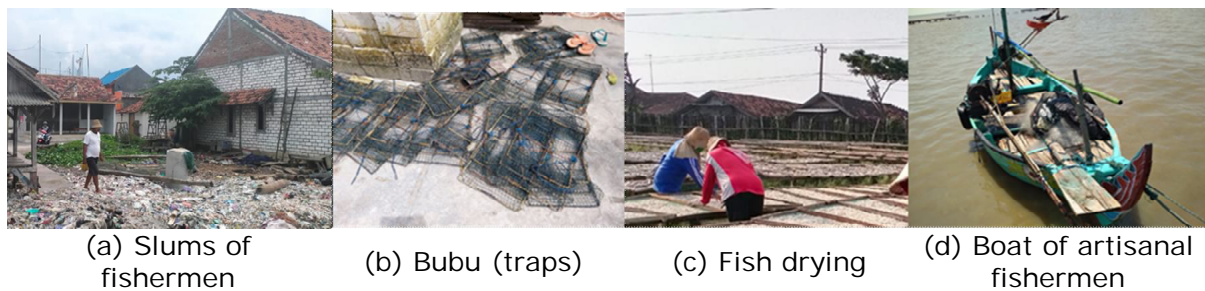


Figure 2. Artisanal fishermen settlement environment and artisanal fishing facilities.

Despite living in a slum area, the fishermen's family houses mostly use tiled floors, cement walls and tiled roofs (Figure 3). Poor residential plan has created slum settlements.

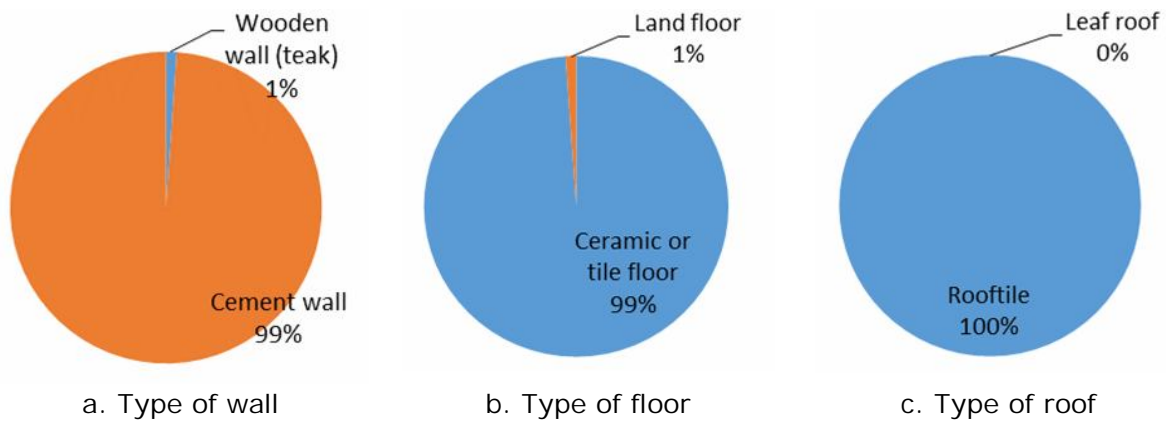


Figure 3. Characteristics of respondents' houses.

The artisanal fishermen of Rembang Regency have predominantly lower to middle education (Figure 4) which affects their mindset and ability to adapt to technology. In general, the average education level has increased since the government has made serious attempts in developing the education level and increasing population's awareness of the importance of education for the future of children.

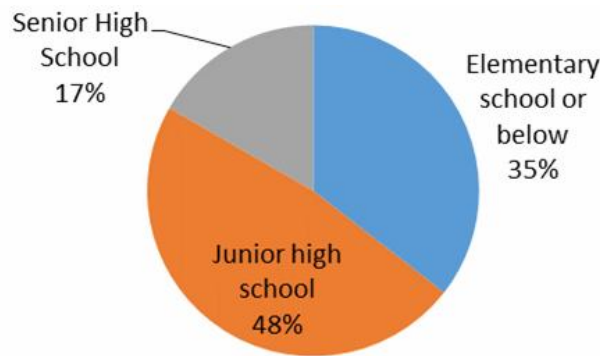


Figure 4. Respondents' education background.

The average number of family members of artisanal fisherman families in Rembang Regency is four persons, meaning that most of them have 2 children (Table 1). The Government of Indonesia has been running a family planning program since 1957, and the program has been successful in controlling the population growth. The average expenditure of a fisherman's family is IDR 1.44 million/month with the average proportion for food expenditure of 53.1%. Population expenditure tends to be positively influenced by family income. This condition reflects that the purchasing power of artisanal fishermen's families is relatively low. Meanwhile, the minimum wage for formal sector workers in Rembang Regency in 2021 is IDR 1,861,000 per month. Artisanal fishers in Rembang Regency are micro and small-scale business actors, while fishermen who work on fishing vessels as crew members are non-formal sector workers. Fishermen crew are not paid monthly, but they are paid based on profit sharing and have minimal social security facilities, including not having a pension fund.

Table 1  
Characteristics of respondents' families

Categories	Min	Average	Max
Number of family members	2	4	8
Family expenditure (IDR per million per month)	1.00	1.44	6.0
Family expenditure for food (%)	40.0%	53.1%	70.0%
Family expenditure for non-food (%)	30.0%	46.9%	60.0%

Respondents rated the intensity of conflict in their area relatively low (Figure 5). Such conducive conditions is a social capital that supports the development of artisanal fisheries in Rembang Regency. Some conflicts occurred due to conflicts of interest in operating the fishing gear, such as mini trawls that crashed and damaged the gillnet, trap and longline. Conflicts were mostly amicably resolved in deliberation (*musyawarah*). Deliberation is a form of local wisdom that prioritizes discussion to reach mutually beneficial solutions.

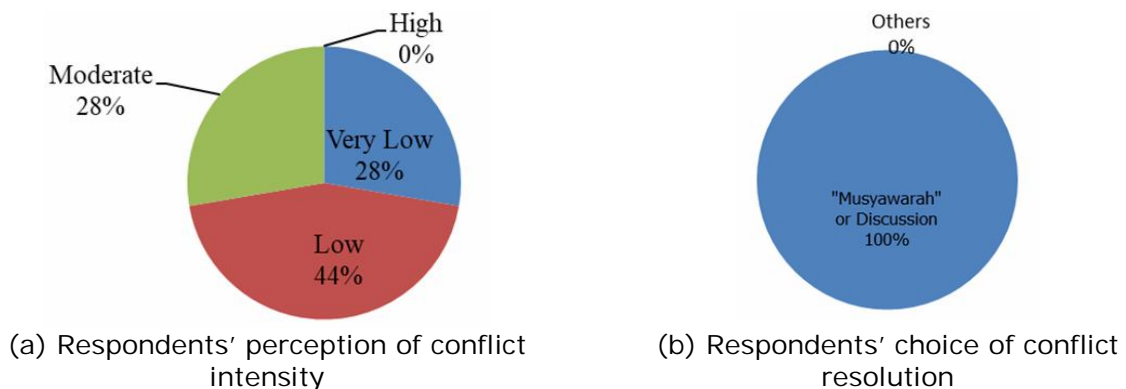


Figure 5. Potential conflicts and resolution.

The tradition of '*gotong royong*' or communal work is still being preserved by artisanal fishermen in Rembang Regency. *Gotong royong* refers to communal work and helping each other for common social interest and to help those in need. In addition, artisanal fishermen have strong respect to village heads, religious leaders, ship owners and skippers of vessel (social, spiritual and economic reason).

**Views on artisanal fisheries development.** The fisheries system in Rembang Regency was rather complicated due to multi-species, multi-gears problems and conflicts of interest in the utilization of coastal areas (Wijayanto et al 2020a; Wijayanto et al 2020b). The results of survey on respondents' perceptions regarding the most important factors in the development of artisanal fisheries are shown in Table 2. Fish resource abundance has been considered the most important factor in fisheries development. It implies that artisanal fishermen strongly depend on natural resources. In empowering fishermen, the consideration of preserving fish resources can be the key to getting support from artisanal fishermen.

Table 2

Perceived factors influencing artisanal fishery development

<i>Rank</i>	<i>Factors</i>	<i>Score</i>
1	Fish resource abundance	1.06
2	Availability and conditions (physical and service) of the fish market	3.31
3	Condition of fishery supporting infrastructure (roads, electricity, clean water, etc.)	4.13
4	Demand of fishery products by the community and industry	4.32
5	Fisheries business capital	5.38
6	Availability and conditions (physical and service) of fishing ports and fish auction places	5.99
7	Quality of service of fishery cooperatives	6.50
8	The ability and skills of fishery business actors	7.06
9	Fishery technology	7.86
10	Government policy and legal support	9.32
11	Political support	10.69

Artisanal fishermen in Rembang Regency agreed to the regulation on the prohibition of the use of 'cantrang' or Danish seine (opinion of 86.7% of respondents). 'Cantrang' is a modified Danish seine with trawling-like operation. Respondents (staff of extension) also explained that the use of non-ecofriendly fishing gear is a major threat to artisanal fisheries because it causes damages the aquatic ecosystems. Meanwhile, 13.3% of the respondents expressed neutral opinion because they perceived that the fishing areas of artisanal and Danish seine are different. In addition, some artisanal fishermen also become crew members of Danish seine, especially during difficult fishing situation. Respondents who agreed with the prohibition of Danish seine believed that it takes too many fish and damages coral reefs which are disadvantageous to artisanal fishermen themselves.

**Financial analysis.** The results of the financial analysis for artisanal fisheries business are presented in Table 3. The CR value of the artisanal fisheries business ratio ranged between 0.28 to 0.71 (profitable). The choice of fishing gear by artisanal fishermen was influenced by their habits. Some fishermen also used multi gear which allow them to be more flexible in adjusting their target fish according to the fishing season.

Operational costs are higher than asset depreciation and asset maintenance. Fuel cost has the highest proportion to the total cost. Problems in fuel distribution can be disadvantageous to artisanal fishermen. In the case of the Danish seine in Rembang Regency, the profit-sharing, fuel and fishermen consumption (food and beverage) have the largest proportion in the composition of the cost of Danish seine fishing (Wijayanto et al 2019).

Table 3

## Artisanal fisheries financial analysis

Average	Type of tool and material	Gill net	'Bubu' (trap)	Longline
Investment	Vessel	25,238,095	26,487,500	23.625.000
	Machine	6,183,333	5,995,000	5.500.000
	Fishing gear	12,947,619	9,927,500	1.862.500
Asset depreciation (IDR per year)	Vessel	2,523,810	2,648,750	2.362.500
	Machine	1,236,667	1,199,000	1.100.000
	Fishing gear	12,947,619	9,927,500	1.862.500
Maintenance cost (IDR per year)	Vessel	945,238	778,500	718.750
	Machine	464,048	393,000	587.500
	Fishing gear	5,495,548	2,355,000	450.000
Operational cost (IDR per trip)	Fuel	37,179	29,531	55.500
	Consumption	21,122	26,800	32.000
Operational cost (IDR per year)	Fuel	10,633,242	8,623,125	15.373.500
	Consumption	6,040,878	7,825,600	8.864.000
Total cost (IDR per year)		40.287.048	33,750,475	31,318,750
Total revenue (IDR per year)		56.292.063	58,214,603	112,314,844
RC ratio		1.40	1.72	3.59
CR ratio		0.71	0.58	0.28
Trip		286	292	278

**Discussion.** Most of the small-scale fishermen in developing countries, including in Indonesia are facing poverty and food insecurity. Overexploitation of natural resources, lack of alternative sources of employment, rapid population growth, migration of people to coastal areas, environmental pollution and conflicts of interest in coastal areas add to the complexity of problems in the development of artisanal fisheries and they are problems that need to be addressed (Béné et al 2007). Nonetheless, artisanal fisheries are a major contributor to seafood in the world. Artisanal fisheries also contribute to employment opportunities, food security, and poverty alleviation in underdeveloped and developing countries (Murshed-e-Jahan et al 2014; Purcell et al 2014; Ishengoma 2016; Pathmanandakumar 2017; Kurohman et al 2020). Therefore, fisheries stakeholders in the world should not ignore the development of artisanal fisheries, including the government of Rembang Regency.

In developed countries, artisanal fisheries are very well managed. On the other hand, in underdeveloped countries, artisanal fisheries are rather poorly managed (Kurohman et al 2020; Ahmed et al 2021; Nicolosi et al 2021; Wijayanto et al 2021). In fact, artisanal fisheries business actors are more concerned about the preservation of fish resources around their homes because they are dependent to the geographical area around them (Okeke-Ogbuafor & Gray 2021). Fishery development in Rembang Regency should consider all aspects of fish resources. The results of the study conducted by Wijayanto et al (2021) showed that Rembang Regency needs prioritize 17 leading fish commodities, including shortfin scad *Decapterus macrosoma* (the largest production) and black pomfret *Parastromateus niger* (the most expensive commodity).

In the development of artisanal fisheries, the empowerment of small-scale fishermen plays a crucial role. The empowerment can be carried out by improving fishermen's knowledge and increasing access to capital and markets (Béné et al 2007). Women also play positive contribution to the socio-economic conditions of fishermen's households. Unfortunately, female fishermen were often unpaid. They mostly take care of fish trading activities (Liontakis et al 2020). According to Crona et al (2020), co-management is still not widely practiced in the management of artisanal fisheries in the world even though it has long been recommended by researchers. Whereas co-management can be applied to achieve the sustainable development goals (SDGs), including the importance of gender equality and resource conservation. Therefore, artisanal fisheries development, industrial scale fisheries and water conservation should

be balanced. According to Kapembwa et al (2021), co-management can improve the artisanal fisheries management, yet stakeholders' ability to manage artisanal fisheries is the key to its success. Without adequate capabilities, the implementation of co-management can fail, including ineffective authority, group cohesion, and leadership. According to Vincent et al (2007), one of the successful implementations of co-management is data report to stakeholders which allows knowledge transfer.

Wijayanto et al (2021) mentioned some strategies can support the fisheries development in Rembang Regency including strengthening fisheries institutions, monitoring fish resources, developing human resources, developing fishing ports, developing fish processing industries, attracting investors, research, development public ports and industrial estates, management of coastal ecosystems, construction of toll roads and railways, and promotions. Duggan & Kochen (2016) also noticed that certification is a challenge for artisanal fishery business actors in Indonesia, especially related to export quality products. Furthermore, Nicolosi et al (2021) pointed out the need for synergistic actions in artisanal fisheries and industrial fisheries in promoting products from artisanal fisheries. Ahmed et al (2021) also urged the need for synergy between the government, fishery cooperatives, NGOs, and other related parties to support artisanal fishermen for stronger business sustainability. The combination of management strategy carried out by the government (top-down) and a bottom-up (communitarian) can fit for the management of artisanal fisheries because each approach has advantages and disadvantages (Okeke-Ogbuafor & Gray 2021).

**Conclusions.** The results showed that the residential neighborhoods of artisanal fishermen in Rembang Regency were densely populated with poor sanitation despite their house had tile floors, cement walls and proper roofs. Artisanal fishermen in the area possessed lower to middle education level. The average family expenditure was IDR 1.44 million per month with 53.1% allocation for food necessities. The potential for social conflict in artisanal fishermen was rather low and 'musyawarah' (deliberation) has been a preferred attempt for conflict resolution. Fishermen also stated that the abundance of fish resources is considered the most important factor in the management of artisanal fisheries. The CR ratio for capture fisheries using gillnet was 0.71, while for traps ('bubu') was 0.58 and for longline was 0.28.

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

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