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# Understanding the socio-ecological system of small-scale octopus fisheries in North Minahasa to achieve sustainable certification

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**Abstract.** This study aims to comprehend the challenges and opportunities to implement certification in the small-scale octopus fisheries in North Minahasa through the Socio-ecological System (SES). The background of this research is because Indonesian octopus has a potential for export. However, octopus was listed under concern due to unsustainable fisheries practices. In addition, the export activity must be accompanied by an eco-label certification scheme such as Marine Stewardship Council (MSC) and Fair Trade (FT). This study used a qualitative case study by online interviews with stakeholders such as fishers, middlemen, exporters, and the government-non government organization. The result was that local actors started to become aware of the octopus improvement program through cooperation with an NGO in a program called Rumah Boboca; hence, it is not ready to implement certification. The recommendation is to support improvement with an octopus national management plan (RPP) and a basic Fishery Improvement Project (FIP).

## 1. Introduction

The increasing global population has pushed the demand to exploit fish stock lead unsustainable fisheries practices. Millions of fishers depend on seafood as a source of income and subsistence. It also represents a significant economic sector for the world economy [1]. A majority of people from developing countries such as Southeast Asia rely on fish as a primary source of protein. Indonesia is one of the countries in Southeast Asia that play a crucial role in seafood production; however, it has been threatened by illegal, unregulated, and unreported (IUU) fishing [2].

This research focused on small-scale octopus fisheries in North Sulawesi, Indonesia. Octopus fisheries take place in coral reef habitats. In North Sulawesi, octopus is harvested from the small-scale industry; even now, some fishers utilize boats without engines. Many traditional fishers in North Sulawesi considered octopus as a critical livelihood and valuable for export products [3].

In comparison to tuna or shrimp, octopus is not prioritized by Indonesia for sustainable fishing and export, yet there is room for improvement. Thus, the productivity of octopus is still high, which puts Indonesia as the top octopus exporter [4]. Therefore, another issue came when Indonesia's octopus products were listed in the red (or to avoid) categories due to concerns about stock status and high fishing mortality [5]. It means that octopus production in Indonesia is not yet considered sustainable.

Furthermore, the demand for octopuses in the world has increased. The export target is the European Union (EU), the United States (US). Most importantly, they also have demand for more sustainable fisheries products. It must be proven by an eco-label certificate scheme [6]. The objectives of eco-label certification are to promote better fisheries management and ensure seafood products safe to be consumed. Additionally, eco-label products strive to raise consumer awareness of selecting sustainable seafood products. [6].



In many cases, the small-scale fisheries are often more sustainable. However, because they are located in rural areas, unfamiliar with fisheries management, unreported data, and inadequate infrastructure, they have become disadvantaged to be certified [7]. It leaves a problem to improve sustainable trade from small-scale fisheries in developing countries. It becomes ironic due to most of the seafood supply worldwide is provided by developing countries. These facts demonstrate that small-scale fisheries are not sufficiently covered by the certification scheme.

This study aimed to understand the possibility of implementing certification in the small-scale octopus fisheries case in North Sulawesi. As stated, the current export status of octopuses from Indonesia is under the red list, meaning octopus fishing and trading practices are not considered sustainable. It will also examine the debate over whether eco-label is inclusive for small-scale fisheries. It was analyzed through the socio-ecological framework because of the social system's connections between human and environment. The research questions are: (1) how do current octopus fisheries practices in North Minahasa fit into certification programs? and (2) how do the governance actors perceive the implementation of certification programs in North Minahasa?

## 2. Material and Methods

SES is an ecological system linked with and affected by one or more social systems [8]. SES contain units that interact independently and may affect each other, called the subsystem [8]. SES is a term that can be used in many fields, including environmental and social sciences, economics, and humanities [9]. SES has been frequently used to pinpoint elements influencing the management of natural resources. Connecting social and ecological systems made this framework complex but can be adaptive for many social-science cases. [10]. SES is a system with various factors, including population and globalization, as well as political-technological changes [9]. This research focused on the social side of SES: governance system (organization, rules, and monitoring processes) and users (socioeconomic attributes, location, norms).

This study used a qualitative case study approach. The qualitative study allows researcher to obtain descriptive information related to particular topics, such as certification implementation in different fisheries cases [11]. The case gave insight into actors' practices, such as daily fishing and trading activities [12]. It is matched with the aim of the research question to investigate and comprehend the advantages and disadvantages of implementing eco-label in small-scale fisheries.

This research was conducted in the study area of Gangga Satu village, North Minahasa, Sulawesi. Gangga Satu village was chosen as the research site because the village will be the pilot project for an octopus improvement program. This research was done between September 2021 and December 2021. The key actors interviewed include the governments, non-government organizations (NGOs), fishers, middlemen/women, and exporters.

The data was collected through online interviews because the researcher could not travel to the study area during the pandemic of Covid-19. The interviews were held to gain data regarding daily fishing and trading activities and the role of governance in supporting local actors. Local actors were asked about their knowledge of certification and daily practices. Meanwhile, the government and nongovernment organizations were interviewed regarding their role in empowering local actors and their opinion on certification.

In addition, the scientific literature has been studied to answer the research question and certification issue. The literature review helped provide research on the certification and socio-ecological topic. Literature review is also valuable for familiarizing the discussion regarding the implementation of certification in small-scale fisheries cases.

## 3. Result

### 3.1 Octopus fisheries scheme in North Minahasa

The fishing activity starts in 5 o'clock the morning and end in the 3 o'clock in the afternoon. The fishers can make four to six trips in a week. The fishing ground location is close to fishers' home with approximately one hour trip. Fishing activity requires traditional small boat that fits one or two people.

The gears are specific only for octopus fishing activity consist of *pocong*, *sambi* and *ketang*. *Pocong* is a bait that looks like small octopus. *Sambi* is a hook-like instrument that been used for catch. *Ketang* is a bait that looks like a crab as a main food of the octopus. These gears are used simultaneously; *pocong* is used to lure the octopus from its shelter, *sambi* is used to catch it.

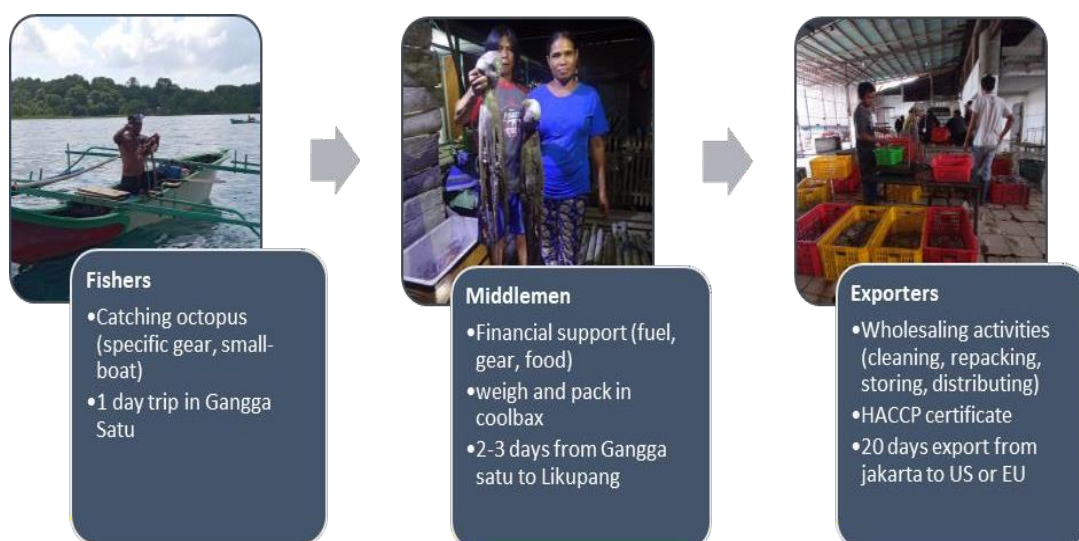
The middlemen usually provide fuel, gear, and food in addition to cash support. After the middlemen collected and purchased the octopus, they weighed and packed it in a coolbox with ice to maintain octopus' quality. The total weight for sending octopus to exporters must reach 1 ton. The fishers sell octopus from Gangga Satu to the middlemen or suppliers in Likupang before reaching the fishing industry in Bitung. The process of trading activities from fishers to the company takes 2-3 days.

The octopus size affects how much it price. Less than 1 kg is called "alus", and greater than 1kg is called "size". At the time this research was conducted, the price of *alus* was IDR 10.000, and the price of *size* is 5.000 per kg. Because of no electricity in Gangga Satu, middlemen are enabled to use freezer, instead they only used ice and coolbox. Freezer is important because it is essential to maintain the quality of octopus.

Almost all octopuses are sold for export, but the rejected one is given back to the fishers for either consumed or sold locally. Most of the time, the rejected item is returned due to its poor quality. After receiving the octopus from the middlemen and suppliers, the fishing industry checked the quality and cleaned it before put it in a freezer at a temperature of  $-40^{\circ}\text{C}$  for 24 hours. After that, it must be repackaged approximately 10-15 tons and kept in cold storage at  $-30^{\circ}\text{C}$ .

Before the export process, the octopus must be sent to Jakarta from Bitung, the basis of cold storage in North Sulawesi. Octopus is transported by shipment, also known as river container. Before the shipment, the octopus was sent and repackaged in Jakarta to fulfil the export quota. The octopus has been sent to the US or EU, depending on the demand and deal with the buyer. It takes approximately 20 days of the export process from Jakarta to the buyers abroad.

There are approximately five fishing industries that conduct octopus export in Bitung. Some of them were inactive due to the covid-19 pandemic and shortage supply, leaving only one that could be contacted. According to our exporter informant, fundamental requirement from the buyer is sterile workers and production room. To comply with the requirement, factories must own a HACCP (Hazard Analysis and Critical Control Points) certificate. Meanwhile, the other requirement, such as eco-label certification, must be fulfilled based on the agreement. Figure 1 below illustrates the small-scale octopus fishery system in North Minahasa.



**Figure 1.** Illustration of small-scale octopus flow in North Minahasa

### *3.2 Governance role in supporting sustainable octopus fisheries*

There are at least three stakeholders that have concerns about octopus sustainability: Yayasan Pesisir Lestari in collaboration with YAPEKA (YPL-YAPEKA), Sustainable Fish Partnership (SFP), and the (local/district/national) government itself. They have planned and worked together to promote octopus fisheries improvement based on community development and transition towards more sustainable octopus fisheries.

YPL-YAPEKA focused on community-based octopus management. It consists of mapping social-economical profile and understanding the fishing and trading process. Furthermore, they created a report to the community and the government to finalize the temporary closure concept through the focus discussion group. Choosing North Minahasa as a research location became the preliminary idea for implementing Fishery Improvement Project (FIP).

YPL stated that the transition program to FIP started by collaboration with the national government. YPL-YAPEKA completing data collection and stock indicators. This was followed by establishing a specific team from the NGOs and government to create an octopus management plan (RPP), which will later cover the future octopus improvement plan. Currently, the RPP for octopuses is incomplete because the octopus is not the main priority species.

SFP focuses on mobilizing the supply chain, which means receiving export requests from the buyer. According to them, at least seven buyers/companies from the US and EU want to export octopus within the certification or FIP. In addition, SFP stated that a relationship between supply (market) and demand (commodity) is essential, thus, it can be seen by examining the supply chain in North Minahasa. It served as the starting point for the government's discussion of designating octopus management plan.

In addition, SFP has worked with a crab association called Indonesian Blue Swimming Crab Association (APRI). It consists of the stakeholder involved in crab business, namely fishers, middlemen. SFP assists the APRI organization in enhancing the communication platform, especially for decision making. The crab organization now can have space in the national level forum for organizing regulation or other issues related to crab fisheries management. The lesson that can be implemented in the octopus cases is crucial to assemble an organization of octopus association management at the national level, similar to APRI.

Moreover, the provincial and district government strongly emphasize strengthening local actors, such as providing KUSUKA cards for fishers database. The fisheries sector development is heading towards the marine protected area, traceability, and certification. The provincial government is ready to collaborate with NGOs and other actors, especially for fishers' capacity building.

### *3.3 Challenges and opportunities to implement certification*

The first challenge can be found during the interview with local actors: fishers and middlemen. Both stated that they did not understand the concept of certification. It is understandable because they have not been introduced to certification yet. Similar to the fishers and middlemen, the exporters said that the certification for export is only HACCP. It is a standard for sanitation and hygiene, which is not a sustainable certification. Nonetheless, certification is a business-to-business process, which means there is a request from the buyer in the EU and US. Certification request from the buyer will made exporters comply with certification.

Second, another NGO called Masyarakat dan Perikanan Indonesia (MDPI) mentioned that one of certification issues is rigorous standards. MDPI has several experiences working in a certification case, especially with tuna stakeholders in Maluku. They said that the standard is always increase in order to cope up with fisheries sustainability. It is important to create an octopus management plan authorized by the government. On top of that, there is also an annual certification review, aside from expensive and time-consuming process.

Third, YPL stated that the transition process to certification is complex. Prior to starting the certification process, it is imperative to increase capacity building through FIP. To lead FIP, the local community must have an active approach. In line with this statement, SFP said organizing FIP over a long term is one of that the challenge in certification process. Currently, there is no organization for octopus management in the national level, which further motivates the need for it to be established.

On the other hand, researcher found that several reasons can be the opportunity to implement certification in the future. First, the local actors are strongly willing to learn about the certification process. For instance, middlemen wish to learn more about certification before deciding to participate in certification process, as well as middlewomen who want to join any capacity-building training. In addition, the exporters' informant also stated that they want to join the training. They are willing to initiate partnerships with local and national governments for socialization and information about certification to support their export market. In other words, the local actors are willing to receive any training and knowledge transfer related to certifications

Second, the cooperation between NGOs, local actors (YPL-YAPEKA), and industry (SFP) is also essential for the supply-demand of octopus export. YPL-YAPEKA is more focused on supply sides, which accompanied local actors to become more aware of environmental issues and enhanced their capacity. Meanwhile, the SFP focuses on demand sides from buyers worldwide. The connection between supply and demand is crucial to implement certification.

Finally, the reason for the certification opportunity is the government's role. They welcome cooperation or willing to give permission regarding certification training or knowledge sharing, especially during the interview; the provincial government is concerned about the sustainable development in fisheries, such as certification and traceability. The support from government actors to the NGO and local actors is fundamental to accelerating octopus improvement program.

In addition, there was an activity called Rumah Boboca (the house of octopus). The activity is described as temporary closure of octopus fishing activities in Minahasa Utara. It was initiated directly by the local people in Minahasa Utara with assistance from NGOs to maintain octopus stock. Previously, they saw the trend of octopus's weight and quantity decreasing. Thus, they design a focus group discussion to decide the time of temporary closure. Finally, the NGOs created guidelines and regulations for temporary closure.

The temporary closure activity started with data collection and tracking supply chain of octopus from fishers to middlemen. The data that has been collected regarding octopus is weight, sex, and fishing ground as well as the catch per unit effort (CPUE) data. NGOs collaborated on data collection and analysis to recommend the plan temporary closure. Meanwhile, the local government assists in monitoring and sanctioning. It was a positive reflection of the co-management action to improve sustainable methods of fishing octopus and give education-empowerment to local actors.

## 4. Discussion

### 4.1 Certification requirements

Three initiatives, namely MSC, FIP, and FT, might be taken into consideration to further enhance octopus fisheries in North Minahasa. The first one, MSC, is a third-party certification scheme that evaluate fisheries sustainability [14]. There are three principles (stock status, environmental impact, and fisheries management), including 28 performance indicators to be certified sustainable fisheries by MSC [14]. In addition, there are three levels of scoring in MSC: (1) best practices = >80; (2) minimum requirement = 60-79; (3) fail = (<60). It is assessed using the performance indicators' combined score. The overall score must be at least 60 in order to receive MSC certification [14].

Secondly, FIP is a platform that requires stakeholders' cooperation to address complex fisheries issues and ensure sustainability [15]. It is also a transition program before entering the MSC standard. There are two types of FIP, basic and comprehensive. Basic FIP enhances on answering and one key aspect of fisheries improvement. Meanwhile, the comprehensive FIP concentrates on several complex fisheries issues as well as fulfill the MSC standard [15]. Both basic and comprehensive FIP require a verification progress annually, which must be updated on the FIP website. It can take approximately five years to complete FIP requirements. The score of FIP is rated by score A-E, based on the report given on the website, and it is openly accessible [16].

Finally, FT point out social issues in fisheries management. The objective of FT is to empower the fisheries actor to develop and attain an environmental sustainability level consistent with MSC [17]. The

Fair-Trade Capture Fisheries Standard (FTCFS) program has six different indicators to be fulfilled, including (1) structural requirements; (2) empowerment & community development; (3) fundamental human rights; (4) wages, working conditions & access to services; (5) resource management; and (6) trade. In addition, the first FTCFS program in the world was done in Indonesia, specifically on Maluku Island [17].

Starting with Basic FIP will be more feasible compare with other two certification initiatives mentioned above. Basic FIP emphases on attaining particular objectives, such as stock status or longterm management objectives. In addition, basic FIP also requires active involvement, management administration, and clear objectives. The success of certification depends on support from key stakeholders, comprehend fisheries data, budgeting, and the long-term plan [7].

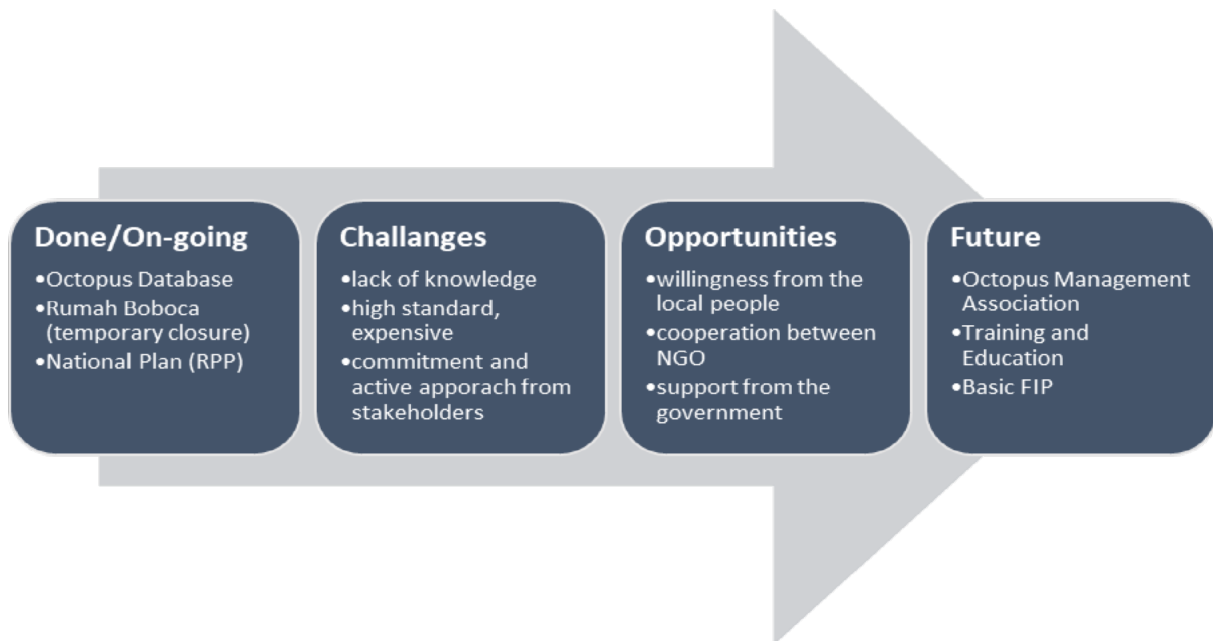
#### 4.2 Further consideration

The first project of temporary closure was done by an NGO called Blue Ventures 2004 in Madagascar [19]. The objective of the temporary closure activity is to increase the stock of octopus naturally. The characteristics of the octopus are high fecundity, a relatively short life cycle, and fast body weight growth. The characteristic shows that octopus is not vulnerable to fishing activities. Migration behavior and continuous exploitation activities are the behavior that makes octopus vulnerable to overfishing [19]. The biological nature of this octopus is interesting enough to be managed with a temporary closure model. It is expected that the octopus can respond to temporary closure activities in a short time [20].

In addition to the purpose of ecological preservation, temporary closure activities are also beneficial for improving the economy of coastal communities. Research in Senegal and Tanzania regarding temporary closure of other octopus fisheries shows that even in less than two months, this activity can increase octopus productivity which is directly proportional to economic growth for fishermen [18].

Selecting Gangga Satu as study location is a solid choice because they have improved capacity building through *Rumah Boboca*. It will not be difficult to explain the certification concept to the actors that lived in Gangga Satu because at least they have been involved in improvement activities such as temporary closure. There was also a discussion over how rigorous the certification process for small-scale fishermen. Reflecting on this research, we concur that implementing certification in small fisheries is challenging, yet we have seen that step-by-step improvement is more important than forcing eco-label certification. It is showed by the North Minahasa actors involved in temporary closure activities, and they can see the benefit of conservation for the future generation. Moreover, the transition to FIP can organize octopus fisheries to a better improvement and open a broad export market.

Nevertheless, implementing certification for octopus fisheries will be challenging and premature. Researchers think certification can occur later after the data collecting is complete, and the national government is aware of creating octopus national management plan (RPP). In other words, the process is still a long way from certification but near to the plan for creating FIP. This research is not adequate to fully explain the concept of certification to small-scale actors, consequently, more study and information regarding technical issues of certification are required. Figure 2 below concludes all activities that have been done, future progress, as well as challenges and opportunities in implementing FIP/certification.



**Figure 2.** Research conclusion, challenges, and opportunities

## 5. Conclusion

Certification is a complex process that appears premature. It seems more feasible to start with a basic FIP and octopus management strategy in the national level, after that continue to certification program. In addition, the local actors are still unfamiliar with the eco-label certification. Some local actors are keen to learn about certification and even want to join in the training or capacity building that comes with it.

To organize small-scale actors and promote improvement programs, the support of NGOs and the government is crucial. It can be seen from the Rumah Boboca initiative that helps the small-scale octopus practices lead to improvement and sustainable attitudes. Coordination between NGOs and government can help small-scale fisheries actor to understand better fisheries management before starting certification program.

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