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# Setting Up Traceability Tools for the Indonesian Blue Swimming Crab Fishery: A Case Study in Southeast Sulawesi

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Additional information is available at the end of the chapter

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## Abstract

The Indonesian blue swimming crab fishery developed rapidly during the 1990s to become an important source of income for coastal communities. The blue swimming crab (BSC) in 2015 is the third highest export commodity in Indonesia, primarily to USA markets. Southeast (SE) Sulawesi is a relatively minor area for blue swimming crab production (approximately 1200–2000 mt per annum), in which only a subset of Asosiasi Pengelolaan Rajungan Indonesia (APRI) members are active, and it may be a conducive region in which to conduct a pilot activity to form a fisheries management structure that demonstrates the benefits that can be achieved via collaboration. The control document (CD) is a traceability and documentation process to be implemented by all of the segments of the supply chain (collectors/cooking stations, miniplants, and processors) in order to promote compliance to new Ministry and Marine Affairs (MMAF) regulations and generate the records and documents of the supply chain application and verification of the new regulations. The self-recorded logbook by the fishermen and miniplant, as the point in the supply chain, could help with a meaningful and long-term solution to the fishery management in Southeast Sulawesi. This is the first trial of CD in Indonesia and could be a good model for BSC fishery in other regions in Indonesia.

**Keywords:** Rajungan, control document, traceability, seafood, Indonesia

## 1. Introduction

The coastal waters of Indonesia are a biodiversity repository of global importance. Coastal waters, and the ecosystems they contain, are also essential to the health and subsistence of coastal Indonesian communities. Indonesia's fisheries are open access, and in combination with increasing populations, increased demand, and increased access to international seafood markets, this has resulted in overfishing of coastal and offshore fisheries. Since the 1980s, overfishing in Indonesia has led to serial depletion of coastal resources, and some fishing communities have started using fishing techniques that damage habitats. Overfishing started in the west of the Indonesian archipelago, moved to the east, and from shallow coastal to deeper offshore waters. Usually, overfishing first affects the larger species, which means that coastal waters are now nearly depleted of large piscivorous fish [1, 2]. Overfishing in coastal waters is now considered one of the main threats to marine biodiversity in Indonesia. Because fish stocks have been depleted, fishing families are now struggling to survive as they experience a decline in their food security and income level. As each local resource declines, fishing communities are forced to find yet another resource, either by traveling further afield in the hope of finding less depleted resources or by adopting more effective, but generally more expensive and often destructive fishing techniques.

USAID-Indonesia Marine and Climate Support (IMACS) Project is assisting Ministry and Marine Affairs (MMAF) and local fishery agencies (DKP) to strengthen fisheries management and to abate overfishing [Asosiasi Pengelolaan Rajungan Indonesia (APRI) 2015]. A means to do this is to put in place systems that enable local management on a fishery-by-fishery basis, as opposed to centralized management of a large area that comprises various fisheries. At a local level, stakeholder groups need to be formed to take a role in fishery management. Such groups must include fishers, traders, plant owners, and regulators (government officials), and the group must have the support of stock assessment experts. Furthermore, a monitoring system must be put in place to provide data for a basic stock assessment and to inform harvest control rules.

Through support of the National Fisheries Institute (NFI) Crab Council of US importers, the Indonesian Blue Swimming Crab Association or Asosiasi Pengelolaan Rajungan Indonesia (APRI) has been driving the blue swimming crab (BSC) sustainability initiative in Indonesia since 2007. APRI is an industry trade association comprised of blue swimming crab (*Portunidae: Portunus pelagicus*) processors and exporters. The fishery directly employs more than 65,000 fishermen and 130,000 women working in miniplants and factories. The BSC fisheries indirectly impact thousands of others from miniplant owners, gear manufacturers, middlemen, ice vendors, and fisher communities. APRI members campaign sustainable crab harvest to the supply chain through protecting immature stocks and allowing crab to grow to mature size, collaborating with Universities, fishery scientists, and eNGOs, supporting the MMAF to develop a National Fishery Management Framework, and working closely with fishers' community to establish community-based fishery management (CBFM).

The Indonesian BSC fishery can be categorized as coastal and small scale, which developed rapidly during the 1990s to become an important source of income for coastal communities.

Over the last decade, approximately 20,000 mt per annum of BSC has been exported, primarily to USA markets, which are now demanding that the product's sustainability be certified. However, since 2008, government and industry production figures show that landings, and the average size of BSCs being caught, have been declining. This trend is following trends in region where BSC fisheries developed earlier and where catches have now declined to very low levels due to overfishing and might be also overfished. The trends in the Indonesian BSC fishery are already threatening the profitability and sustainability of the fishery, which is effectively controlled by a small, well-organized group of processing companies that have effectively structured themselves into an industry association (APRI), and who are growing increasingly interested and active in regard to making their fishery sustainable.

The BSC species of Indonesia as well as in South-East Asia region is *P. pelagicus* (Portunidae) and one among of this species complex known previously are: *P. armatus* of Australia, *P. reticulatus* at western Andaman Sea and *P. segnis* at western Indian Ocean [3]. This species is likely those and some of portunid species, which has high productivity, rapid growth rates (i.e., [4–8]), and low intrinsic vulnerability to fishing by using fuzzy logic expert system criteria [9]. International experience shows that due to their high productivity, rapid growth rates, and low intrinsic vulnerability to fishing, depleted BSC stocks can recover quickly by maintaining and restoring both immature size crabs and breeding population in the stock. The biological characteristics of BSC, the coherent organized nature of the industry, and its reliance on sustainability conscious export markets make the BSC fishery strategic for beginning the process of developing models for the collaborative management of coastal fisheries.

Southeast (SE) Sulawesi is an important pilot area for the IMACS project in that approximately 1200–2000 mt per annum of blue swimming crab are caught. Meetings between APRI and IMACS suggest that because SE Sulawesi is a relatively minor area for BSC production, in which only a subset of APRI members are active, it may be a conducive region in which to conduct a pilot activity to form a fisheries management structure that demonstrates the benefits that can be achieved via collaboration. The province is in the center of the Coral Triangle, and successful activities undertaken in the province can be replicated to other provinces and districts.

The livelihoods of coastal fishers and the integrity of the coastal ecosystems go hand in hand. In principle, Indonesia's coastal fisheries are open access. This means that visiting fishers can nullify any successes in stock recovery that resident fishers may have achieved through improved management [10]. In the situation of the blue swimming crab fishery, however, a large part of the sector is organized in a producer's organization (APRI). At least 80% of Indonesia's BSC grow through APRI processors before product go to market. Through this organization, it is possible to control a large part of the fishery, and this means that control can be exerted on fishing behavior and on participation in the fishery. For this reason, a stakeholder group comprising the BSC sector of SE Sulawesi is in a good position to implement effective management in partnership with local government.

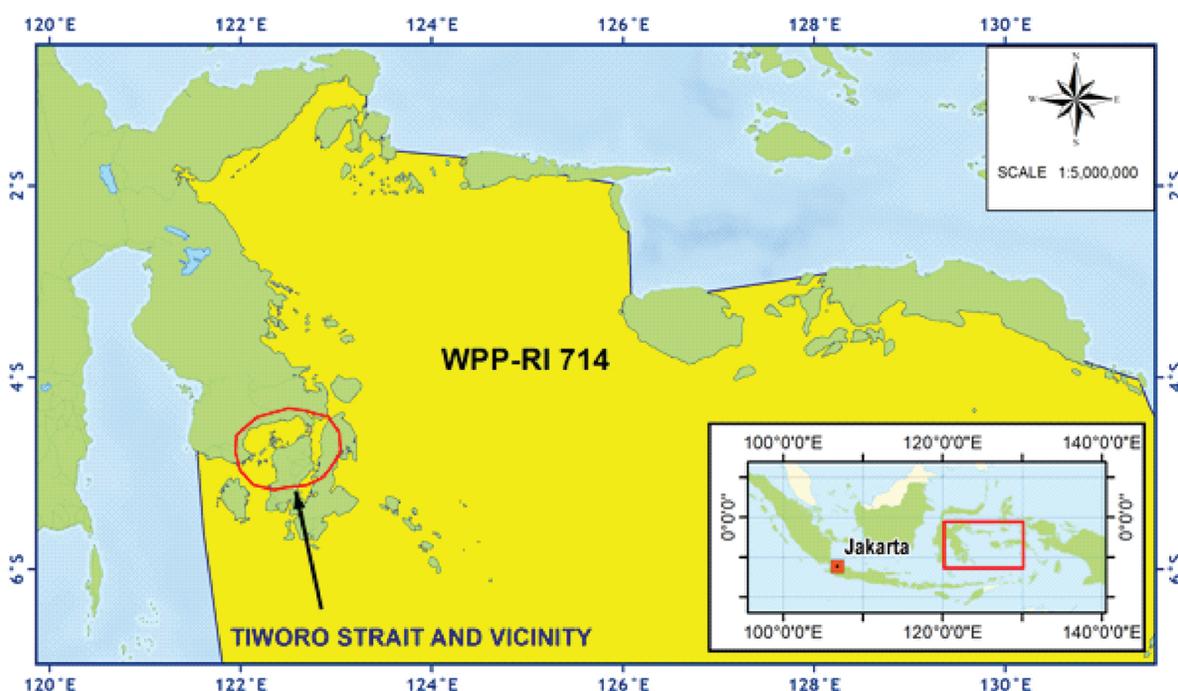
The objective of the study was to describing the BSC fishery and the fishery improvement project (FIP) in Southeast Sulawesi, obtaining biological data from landing information at fishermen and miniplants, and was to expand to incorporate catch and effort data derived from

fishing vessels. The key point of this project is on the fishermen and the miniplant, where the first chain of the supply, which could be a critical point to control and to trace the BSC. This study was initially focused on self-reporting of catch by fishery stakeholders, establishing a foundation for auditable control documentation and a robust traceability system.

## 2. Materials and methods

### 2.1. Study site

Geographical area of main BSC fisheries in SE Sulawesi is Tiworo strait and vicinity. This area is located at western Laut Banda (Banda Sea), part of Fisheries Management Area (FMA) of Indonesia (WPP-RI 714) and FAO Fishing Area 71, western and central Pacific (**Figure 1**).



**Figure 1.** Boundary area of BSC fisheries management in Tiworo strait and vicinity of Southeast Sulawesi (red line), Fisheries Management Area (FMA 714) of Indonesia (yellow area).

### 2.2. BSC fishery in Southeast Sulawesi and registration system

The BSC fishery was studied based on references and field observations at the local government and direct information from fishermen. The information includes fishermen, miniplants, fishing gear, number of fishing gear, fishing ground, boat (size and length). APRI initiated logbook data collection for both fishers and miniplants. The registered vessel using a unique vessel identifier (UVI) number that tagged onto the boat, for example, APRI-IMACS-001. The registration system is initially following the Kartu Nelayan (Fishermen Card) implemented by the Ministry of Marine Affairs and Fisheries. However, most fishermen do not have their KTP

(Indonesian ID). So, we registered the fishermen based on their miniplants. The owners of the miniplant list their fishermen, and then, fishermen were asked their availability for their participation during data trial collection. This process was conducted before, during and after training for logbook. Each fisherman was asking about their profile including where they sell their catch, boat type and size, number of fishing gear.

### **2.3. Logbook system**

The fishermen filled the logbook independently or assisted by enumerator at each site. Depending on the area, fishermen usually sell their catch to supplier or directly to miniplants. At each miniplant, we also give a logbook. We have identified from the beginning the fishermen with their supplier or miniplant. Fishery logbooks detailed including vessel UVI, gear type, gear volume, soak time, landing port, target specie volume, primary and secondary species, liters of gas used, and fishing effort cost. Miniplant logbooks detailed include Fisher UVI, gear type, volume of raw material received, crabs with egg-bearing females, and crabs at minimum legal size (MLS). The data from each fishermen and miniplant were collected by enumerators and those data were sent to APRI enumerator managers.

### **2.4. Fishermen perception**

Pre- and post-tests were conducted before and after training, as a basis for evaluation. The question includes the following: catch record and fishing gears in 3–5 years, the basic knowledge of blue swimming crab biology, the awareness of ministerial decree, the catch composition (number of berried female), and the needs of management for BSC.

### **2.5. Consequence analysis of the BSC stock**

Implementation of UVI numbers for vessels, fisher logbooks, and miniplant logbooks are the building blocks by which blue swimming crab fisheries can have a transparent and auditable control document (CD) system. Data collection program by incorporating catch and effort data derived from fishing vessels. Lastly information derived from fisher logbooks will contribute to assessing fishery impacts to retained, by-catch, and ETP species, as well as ecosystems and habitats using Marine Stewardship Council (MSCs) risk-based framework (RBF) methodology [16]. Consequence analysis (CA) was used to score data-deficiency for stock status outcome. Consequence of the fishing activity on the most vulnerable subcomponent was determined by the stakeholder input during the workshop, using quantitative and qualitative biological indicator data.

## **3. Results and discussion**

### **3.1. BSC fishery in Southeast Sulawesi**

Crab harvesters in Southeast Sulawesi using boats of 12 m length, 0.7 m of width and 0.3–0.5 m of height. Some fishermen do not own a boat and a boat can be used by two different fishermen.

Meanwhile, the exact number of fishermen is uncertain, but is approximately 3500. The number of boats involved in the SE Sulawesi BSC fisheries in 2013 was 2311 among which 1239 non-powered <1 GT boats, 964 small boats with outboard engine, and 108 powered <5 GT boats (Data Management Commission 2014 in APRI and USAID-IMACS 2014) [13–15].

The BSC is mostly caught with trap and bottom gillnet. The fishing gear used is depending of fishing ground characteristics, but according to stakeholders met during the site visit, trap is the fishing gear the most used for both shallow and deep water (<10 m and >10 m depth, respectively). Meanwhile, gillnet is commonly used for crab fishing at deep water. The BSC is also a retained species in other fisheries such as those using trawl, trammel nets, and seine nets (APRI and USAID-IMACS 2014). The traps used are mostly collapsible or folding traps, round or square form and depending of the locality, with a size of 30–40 cm × 30 cm × 20 cm and mesh size nets of 1 inch. The trap limit is the capacity of the boat. One fisher carries about 100–200 traps connected to a main line, with an average of 150 traps/boat/harvester (IMACS 2013 in APRI and USAID-IMACS 2014). Traps are baited with fish pieces and are usually soaked overnight. Bottom gillnets used are monofilament of 100 m length and 80 cm height per-set, with mesh size of 3.5–4.5 inches. There is no limit of the number of gillnets used, but a fisherman usually soaks 5–20 sets of nets. Soaking time is typically 11–13 h.

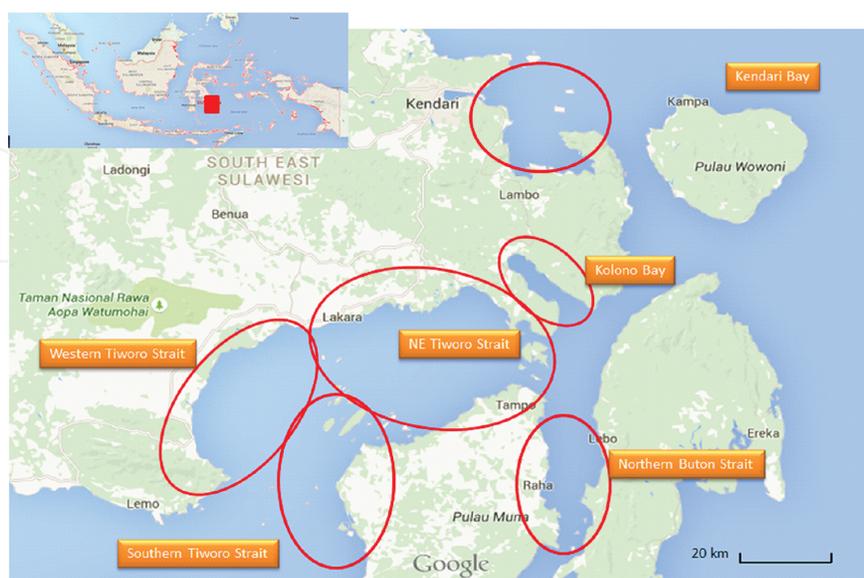
No.	Subfishing area	Fishing base	Subdistrict	District/city
1	Eastern Kendari Bay	Bungkutoko village	East Kendari	Kendari City
2	Kolono Bay	Puupi	Kolono	Konawe Selatan
3	Northeast (NE) Tiworo strait			
	a. Lahia Bay	Pamandati and Polewali village	Lainea	Konawe Selatan
	b. Renda island and Tampo waters	Renda island and Tampo	Napabalano	Muna
4	Southern Tiworo strait			
	a. Maginti, Gala and Pajala waters	Pajala and Gala island	Maginti	Muna Barat
	b. Bangko waters	Bangko island	Tiworo Selatan	Muna Barat
5	Northern Buton strait	Raha	Raha	Raha
6	Western Tiworo strait	Kasipute	–	Bombana

**Table 1.** Subfishing area, fishing base, subdistrict and district jurisdiction in Southeast Sulawesi.

The fishing areas are located in coastal waters of the Tiworo strait and vicinity. Based on the fisher base and landing based of caught crabs, there is several subfishing fishing areas at Tiworo strait and vicinity (**Table 1** and **Figure 2**).

Management arrangement of Southeast BSC fisheries is under regulation of Ministry and Marine Affairs (MMAF) of Indonesia. The regulation, such as minimum legal size (MLS) of crab, is 100 mm (10 cm) carapace width and prohibit to catch berried female (Minister Decree No. 1, year 2015), which is effectively applied in January 2016. During January–December 2015, it is prohibit catching individual BSC below 55 g (Minister Circular Letter No. 18, year 2015).

The BSC is also prohibiting to catching Under Minister Decree No. 2, year 2015, also restricted to catch by trawl.



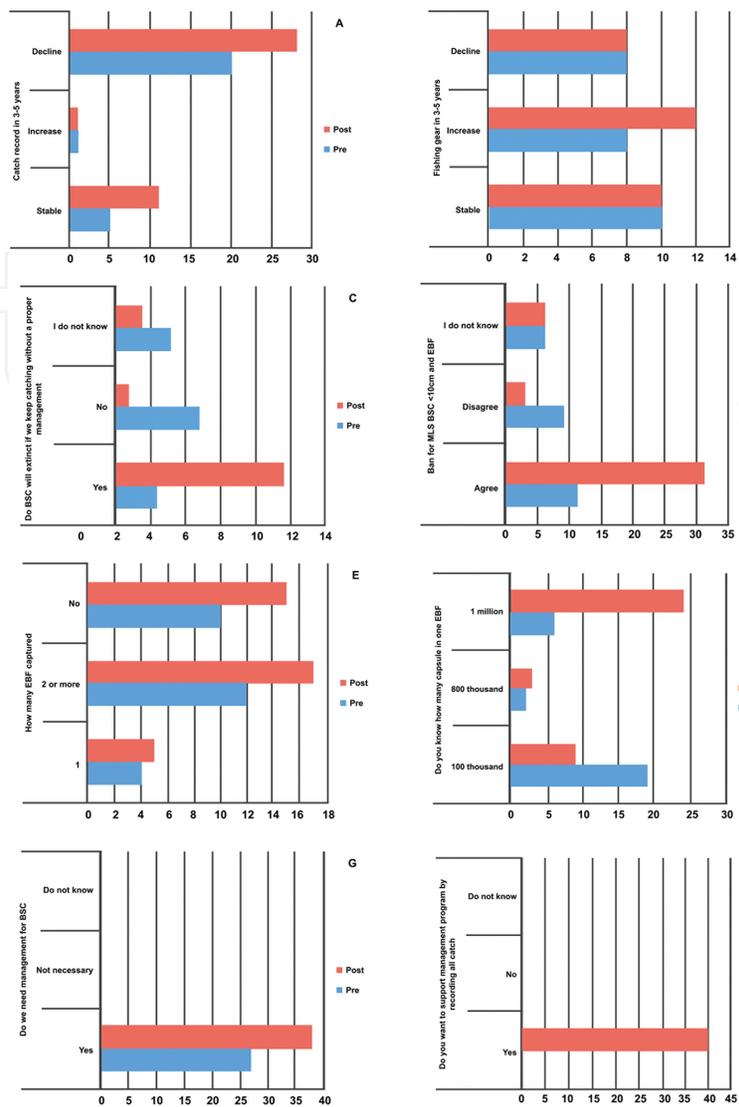
**Figure 2.** Subunit of fishing area at Tiworo strait and vicinity of Southeast Sulawesi.

### 3.2. Logbooks and unique vessel identifier (UVI), and training

APRI initiated logbook data collection for both fishers and miniplants, as well as compile a vessel registry of 208 participants using a unique vessel identifier (UVI) number that tagged onto the boat. APRI, with the assistance of Survival Fisheries Partnership (SFP), Haluoleo University (UHO), and DKP Kendari conducted a training program for miniplant logbooks, fisher logbooks, and UVI numbers. A total of 208 vessels were registered with UVI numbers, the correlating fishers working on those vessels were trained to fill-in logbooks. A total of 12 miniplants were trained to fill-in miniplant logbooks at their receiving centers (**Table 2**). Fishers and miniplants were trained during the same event. In all, there were five training sessions across the province.

Location	Fishers #	Miniplant #
Pajala and Pulau Gala, Muna	34	3
Raha/Tampo, Muna	41	2
Pulau Bangko, Muna	26	2
Pamandati, Konawe Selatan	38	1
Bungkutoko, Kendari	27	2
Kasipute, Bombana	41	2

**Table 2.** Training on control document conducted at each location in SE Sulawesi in a period of May–July 2015.



**Figure 3.** Pre- and post-evaluation with questions: (a) the condition of catch record in 3–5 years, (b) the number of fishing gear in 3–5 years, (c) do blue swimming crab will extinct if we keep catching without a proper management, (d) knowledge on ban for MLS BSC under 10 cm and EBF, (e) how many egg-berried-female captured, (f) how many capsule or eggs from one egg-berried-female, (g) do we need management for blue swimming crab in SE Sulawesi, and (h) their support of IFISH program in SE Sulawesi.

The training objectives were to (1) record raw material going through the supply chain as a basis for the control document, (2) investigate catch composition with regard to ecosystem impacts, and (3) train fishermen and miniplant on how to fill in the logbook itself. The training was organized to achieve the training objectives. The training includes theory on the importance of blue swimming crab management through data collection to see the impact to the ecosystem and also to see catch composition, and the dynamics of BSC as well. Fishermen and miniplant owner were giving the materials by experts, in order to give the understanding why we need management on the BSC. They were asking their support to participate on the IFISH program, and they were taught on how to fill the logbook. From data that will be collected, that is time departed to and back from fishing area, type and number of gear that

used and gasoline consumption per trip per day. From the data, we can analyze how the business status. It will be formulated and find solution whether need conservation area to protect BSC from distinction.

Pre- and post-tests were conducted before and after training, as a basis for evaluation (Figure 3). Based on the test, most fishermen said their catch within 3–5 years was declining; even some of them have increased their fishing gear number. They have changing their mind after the training about the extinction of BSC with over exploitation. Most fishermen agree with the current regulation on minimum landing size and egg berried female. The test also shows their lack of knowledge on the impact of catching of egg-berried female, and how many potential crab will be lost if they are caught.

The fishermen and miniplants owner are ready and support the management of blue swimming crab in SE Sulawesi and are willing to participate in the IFISH program. Over all, the training seems change the perception of the fishermen.

### 3.3. Consequence analysis of the BSC stock

As a result of data documentation by fishermen and miniplants, the consequence analysis (CA) was used to score data deficiency for stock status outcome. Consequence of the fishing activity on the most vulnerable subcomponent was determined by the stakeholder input during the workshop, using quantitative and qualitative biological indicator data (Table 3) [17].

Principle 1: stock status outcome	Scoring element	Consequence subcomponent	Consequence score
Tiworo strait and vicinity blue swimming crab fisheries	<i>Portunus pelagicus</i>	Population size	60
		Reproductive capacity	60
		Age/size/sex structure	60
		Geographic range	

Principle 1: stock status outcome	Scoring element
Rationale for most vulnerable subcomponent	Population size as well as reproductive capacity and age/size structure was considered almost equal vulnerable subcomponent based on the impact of exploitation pattern and biomass
Rationale for consequence score	<ul style="list-style-type: none"> <li>Information on fleet structure, fishing area and exploitation rate indicated that the stock is fully exploited. According to USAID-IMACS (2015), the BSC catch per-unit of effort (CPUE) in Tiworo strait tends to decrease and its stock status was “overfished.” However, trend in exploitation rate, biomass, and recruitment indicates that fishing is not adversely damaged recruitment in long time. As the fishery is defined as fully developed and fully capacity, it cannot conclude that its impact on stock size is minimal as well as it is not having an impact on life history and population dynamic parameter</li> </ul>

Principle 1: stock status outcome	Scoring element
	<ul style="list-style-type: none"> <li>• The BSC stock is intensively fished (ca. 80% of the estimated biomass). Available evidence suggests that there may be a detectable change in reproductive capacity as the BSC are caught in their first year of growth. The minimum landing size (MLS) of 10 cm CW that will be implemented for this fishery also allow for catching individuals in their first year of growth and the BSC at this size is still &lt;10% SPR in Tiworo strait. A retained BSC is defined as one that is retained by traps having an escape vent approximately 3.5 × 5.0 cm at each side or entangled by gillnet having mesh size &gt;4 inch. Even though the BSC of this size are in their first year of growth and will became a reproductive period and spawned at least once before being caught. Moreover, caught berried female shall be reduced. The harvest strategy ensures that long-term recruitment dynamics is not adversely damaged by fishing</li> <li>• Size frequency distribution of the species is available, showing that recruitment is not being adversely damaged. However, level of catch and fleet structure do not enable a qualitative assessment to determine that the impact of population dynamics is minimal</li> </ul> <p>Indicators used are as follows:</p> <ul style="list-style-type: none"> <li>• There are two main fleet structures in all fishing area: traps and gillnet, while another fleet is minitrawl that operate at western Tiworo strait. The trap fleets have an access to most shallow waters (&lt;7 m depth) and few fleets used traps at deeper, contrastingly to gillnet fleets. In addition, fishing area where the minitrawl operates, there were almost no above two fleets operates in these areas. Thus, all of fleets have full access to the stock at almost the entire BSC habitat</li> <li>• The stock biomass remaining only 0.2 biomass MSY and implementation of minimum landing size of 10 cm CW for existing stock remaining SPR &lt;10% (USAID-IMACS 2015)</li> <li>• Prohibited to catch crabs at size &lt;10 cm CW was &gt;10% as well as berried female were still neglected by the fisher</li> </ul> <p>Exploitation rate:</p> <ul style="list-style-type: none"> <li>• Management aims to stock rebuilding proposed by USAID-IMACS team, such as (a) reducing fishing effort gradually; (b) reducing fishing effort dramatically about 50% of f-msy; (c) moratorium for at least 1 year, (4) implementing minimum landing size (MLS), and etc</li> <li>• Identification of nursery habitat for implemented another management measure in sufficient season or wide (close season during peak recruitment or nursery habitat protection)</li> <li>• Fishing by minitrawl must be stopped to reduce fishing effort and damaged to habitat, which is guided by the Minister of Marine Affair and Fishery Decree No. 2, year 2015</li> <li>• Data collection of the BSC catch per-unit of effort (CPUE) and stock assessment need to be made durable in order to monitor changes in the stock status over time and improved fisher mindful against unreported fishing</li> </ul> <p>Fishing area and seasonality:</p>

Principle 1: stock status outcome	Scoring element
	<ul style="list-style-type: none"> <li>Detail distribution information of traps and gillnet fleet's fishing effort is collect on a routine seasonal basis (representative of crab fishing season), including the number of traps and gillnet per-boat as well as gillnet length and number gillnet set per-boat</li> </ul> <p>Overall approaches to scoring the BSC stock/biology unit:</p> <p>The BSC biological unit was defined as Tiworo strait and vicinity. Therefore, PI 1.1.1 was scored by considering the BSC in the area of Tiworo strait as single stock, including Kolono Bay and Buton strait. The BSC stock in eastern Kendari Bay seems to be spill-over of Tiworo strait stock. However, this approach was considered appropriate to the spawning biology and larval dispersal of the BSC</p>

**Table 3.** Consequence analysis score and justification.

Based on available data and information collected from the field and the RBF workshop, the fully RBF assessment could not be conducted and not feasible yet, this report act as pre-assessment RBF. High productivity and low intrinsic vulnerability to fishing of the BSC seem to be not guaranteeing on stock rebuilding and might relate to overcapacity, offspring survival, and recruitment succeeds, as well as the BSC habitat quality. The current study recommends continuing: (1) recording of the BSC CPUE data and incorporating to non-targeted species for both number of individual and weight, where non-targeted catches are recorded at species level and family level in some cases; (2) recording daily, monthly, and annually catches BSC for each fishery; (3) mapping spatial-temporal fishing ground and spatial-temporal community structure at the BSC fishing area; (4) mapping vulnerable habitat, the high potential BSC nursery habitat, and its environmental quality status; and (5) stock rebuilding could be by integrated management, that is, reducing fishing effort and ban minitrawl fishery, increasing the BSC reproduction capacity, protect the high potential and sufficient wide area of the BSC nursery habitat.

### 3.4. APRI's role on control document and audit system

Asosiasi Pengelolaan Rajungan Indonesia (APRI) is an industry trade association comprised of blue swimming crab processors and exporters. The fishery directly employs more than 65,000 fishermen and 130,000 women working in miniplants and factories. Blue swimming crab fisheries indirectly impact thousands of others from miniplant owners, gear manufacturers, middlemen, ice vendors, and fisher communities. Through support of the NFI Crab Council (US importers), APRI has been driving the sustainability initiative for blue swimming crab fisheries in Indonesia since 2007. The overarching goal of APRI's sustainability efforts is to operate their fisheries on par with the MSC standard. Through initiating a fishery improvement project (FIP), APRI has supported cross-sectorial roundtable to address fishery management, fishery research, and stock assessment data collection. APRI advocates fishery policies based on good science so that crab resources remain productive and the fishery viable in the future. APRI collaborates with NGO's, Universities, fishery scientists, and the Ministry of

Marine Affairs and Fisheries (MMAF). Key to their strategy has been to develop a national fishery management framework and then working closely with fisher community stakeholders to establish. APRI's members cover more than 80% of the export volume and could be a beneficial for controlling the fishery.

The BSC fishery industry is happening in Southeast Sulawesi for a long time; however, lack of knowledge observed in the fishermen, in terms of the biology of the crabs. From the training, we observe that they do not know about the importance on why we need to manage the crabs. The trends in the Indonesian blue swimming crab fishery are already threatening the profitability and sustainability of the fishery, which is effectively controlled by a small, well-organized group of processing companies that have effectively structured themselves into an industry association (APRI), and who are growing increasingly interested and active in regard to making their fishery sustainable.

Since early 2015, APRI together with NFI Crab Council and SFP have been crafting and trialing a control document (CD) system. In order to strengthen compliance among producers and facilitate the supply chain's accountability, traceability, and verification, the CD gives buyers new tools to use with their suppliers to verify that the products being traded are from legitimate producers operating in legal fisheries and that the gear employed and the captures landed are compliant with local and international regulations. The control document specifies that not only does a particular shipment/product bought need to be legal within national regulations, it further requires that the entire product the supplier handles, for all customers, is legal also. The CD comprises three components that ensure its successful application: (a) a letter of warranty or private contract that requires legal trading of fish products along the entire commercial chain; (b) a list of control points that conform to the full regulatory and legal framework relevant to the fish products marketed; and (c) a guide to a third-party audit mechanism, which lists the main control check points, from producer to retailer, and identifies recognized and reputable independent auditing bodies. CDs are adopted on a voluntary basis by those producers, traders, and/or suppliers that wish to ensure a sustainable supply of marine products to responsible consumers all over the world, while combating IUU effectively and supporting livelihoods in producer countries. The supply chain participating in the process needs to agree on the penalties framework, including full and potentially permanent exclusion from the supply chain for violators of the CD stipulations (e.g., suppliers can be delisted due to failure or refusal of an audit and denied contracts until compliance is verified at their cost). The CD is a traceability and documentation process to be implemented by all of the segments of the supply chain (collectors/cooking stations, miniplants, and processors) in order to promote compliance to new MMAF regulations and generate the records and documents of the supply chain application and verification of the new regulations [11, 12].

#### **4. Conclusion**

The BSC fishery industry is happening in Southeast Sulawesi for a long time; however, lack of knowledge observed in the fishermen, in terms of the biology of the crabs. From the training,

we observed that they have lack of information about the importance on why we need to manage the crabs. The key point of this industry is on the fishermen and the miniplant, where the first chain of the supply, which could be a critical point to control and to trace the BSC. This study was the first effort in Indonesia that initially focuses on self-reporting of catch by fishery stakeholders, establishing a foundation for auditable control documentation and a robust traceability system. The self-recorded logbook by the fishermen and miniplant, as the point in the supply chain, could help with a meaningful and long-term solution to the fishery management in Southeast Sulawesi. The control document can support the implementation of Ministerial Decree on minimum landing size and ban of specific fishing gear. The study in SE Sulawesi could be a good model for BSC fishery in other region in Indonesia.

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## References

- [1] Madduppa HH, von Juterzenka K, Syakir M, Kochzius M. 2014. Socio-economy of marine ornamental fishery and its impact on the population structure of the clown anemonefish *Amphiprion ocellaris* and its host anemones in Spermonde Archipelago, Indonesia. *Ocean & Coastal Management*, 100: 41–50. doi:10.1016/j.ocecoaman.2014.07.013

- [2] Madduppa H, Subhan B, Suparyani E, Siregar AM, Arafat D, Tarigan SA, Alimuddin DK, Rahmawati F, Bramandito A. 2013. Dynamics of fish diversity across an environmental gradient in the Seribu Islands reefs off Jakarta. *Biodiversitas*, 14(1): 17–24. doi: 10.13057/biodiv/d140103
- [3] Lai JCY, Ng PKL, Davie PJF. 2010. A revision of the *Portunus pelagicus* (Linnaeus, 1758) species complex (Crustacea: Brachyura: Portunidae), with the recognition of four species. *The Raffles Bulletin of Zoology* 58(2): 199–237.
- [4] de Lestang S, Hall NG, Potter IC. 2003. Reproductive biology of the blue swimming crab (*Portunus pelagicus*, Decapoda: Portunidae) in five bodies of water on the west coast of Australia. *Fishery Bulletin* 101(4): 745–757.
- [5] Ernawati T. 2013. Dinamika populasi dan pengkajian stok sumberdaya rajungan (*Portunus pelagicus* Linnaeus) di perairan Kabupaten Pati dan sekitarnya [Population dynamic and stock assessment of the blue swimming crab (*Portunus pelagicus* Linnaeus) in coastal waters of Pati and adjacent area]. Magister thesis. Bogor (ID): Graduate School of Bogor Agricultural University (IPB). 79p.
- [6] Kangas MI. 2000. Synopsis of the biology and exploitation of the blue swimmer crab, *Portunus pelagicus* Linnaeus, in Western Australia. Fisheries Western Australia, Perth, Western Australia. *Fisheries Research Report* No. 121.
- [7] Kunsook C. 2011. Stock assessment and movement pattern for sustainable management of blue swimming crab, *Portunus pelagicus* (Linnaeus, 1758): Case study in Kung Krabaen Bay, Chanthaburi Province, Thailand [Dissertation]. Bangkok (TH): Faculty of Science, Chulalongkorn University. 166p.
- [8] Zairion. 2015. Pengelolaan berkelanjutan perikanan rajungan (*Portunus pelagicus*) di Lampung Timur [Sustainable management of the blue swimming crab (*Portunus pelagicus*) fisheries in East Lampung]. PhD Dissertation. Graduate School of Bogor Agricultural University (IPB). 236p.
- [9] Cheung WL. 2007. Vulnerability of marine fishes to fishing: from global overview to the northern South China Sea. PhD Dissertation. The Faculty of Graduate Studies, The University of British Columbia. 354p.
- [10] Hamid A. 2015. Habitat, biologi reproduksi dan dinamika populasi rajungan (*Portunus pelagicus* Linnaeus, 1758) sebagai dasar pengelolaan di Teluk Lasongko, Sulawesi Tenggara [Habitat, reproductive biology and population dynamic of the blue swimming crab (*Portunus pelagicus* Linnaeus 1758) as a basic of its management at Lasongko Bay, Southeast Sulawesi]. PhD Dissertation. Graduate School of Bogor Agricultural University (IPB). 160p.
- [11] MMAF [Ministry of Marine Affairs and Fisheries]. 2015. Ministerial Decree of Marine Affairs and Fisheries Republic Indonesia No.1 Minimum Landing Size for Blue Swimming Crab, Mud Crab, and Lobster year 2015.

- [12] MMAF [Ministry of Marine Affairs and Fisheries]. 2015. Ministerial Decree of Marine Affairs and Fisheries Republic Indonesia No. 2 ban operation for specific fishing gear year 2015.
- [13] APRI and USAID-IMACS. 2013. Marine Stewardship Council Pre-Assessment Report for the Asosiasi Pengelolaan Rajungan Indonesia (APRI) Tiworo Strait, Southeast Sulawesi Blue Swimming Crab Trap and Gillnet Fisheries.
- [14] MSC [Marine Stewardship Council]. 2014. MSC Fisheries Certification Requirements and Guidance, Version 2.0, 1st October, 2014.
- [15] MSC [Marine Stewardship Council]. 2014. MSC Fisheries Standard and Guidance v2.0 (Extracted from Annexes SA, SB, SC and SD of the Fisheries Certification Requirements v2.0), Version 2.0, 1st October, 2014.
- [16] MSC [Marine Stewardship Council]. 2010. Fisheries Assessment Methodology and Guidance to Certification Bodies, Including Default Assessment Tree and Risk-Based Framework, Version 2.1, 1st May, 2010.
- [17] Patrick W.S., P, Spencer, O. Ormseth, J. Cope, J. Field, D. Kobayashi, T, Gedamke, E. Cortés, K. Bigelow, W. Overholtz, J. Link, and P. Lawson. 2009. Use of productivity and susceptibility indices to determine stock vulnerability, with example applications to six U.S. Fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-101, 90p.

