Value Distribution across Fish Supply Chains: Blue Swimming Crab, Indonesia

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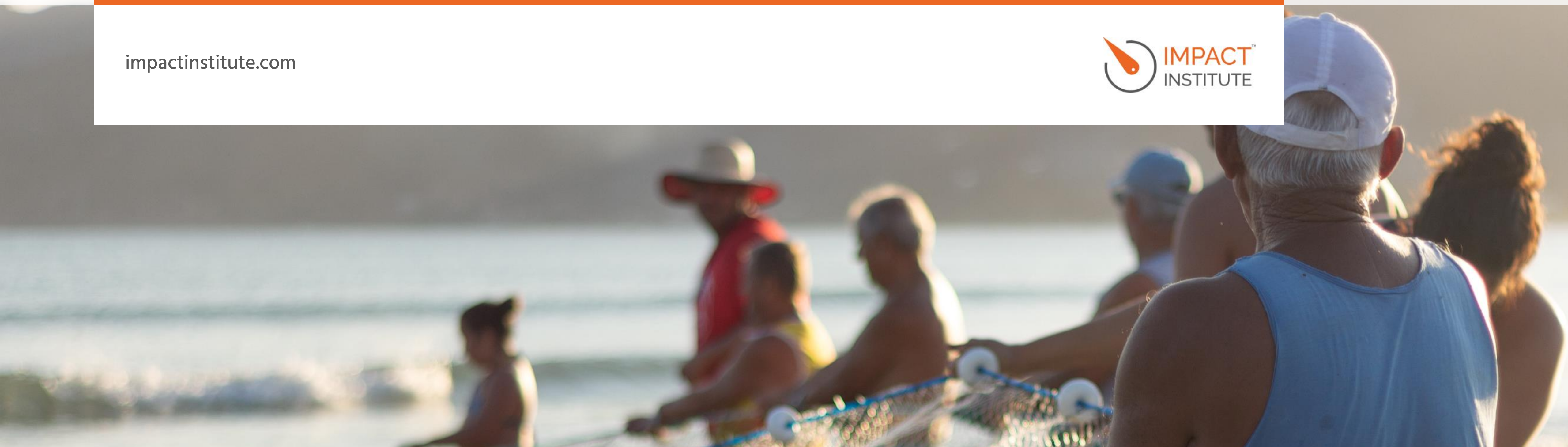


EXECUTIVE SUMMARY

Walton Family Foundation (WFF), founded in 1987, aims to build support for sustainable fishery practices to improve ocean health and to preserve coastal livelihoods. One of the focus areas in this aspect is to protect rivers and oceans and the communities they support. WFF has collaborated with Impact Institute to gain sufficient actionable information for decision-making and strategy development required to support and preserve fishery communities. The project has consisted of performing two value chain assessments on selected fish supply chains within the operational work of WFF. The selected value chains are the **blue swimming crab (BSC)** from Indonesia and the **mahi-mahi** (i.e., common dolphinfish) from Peru. The main research questions were:

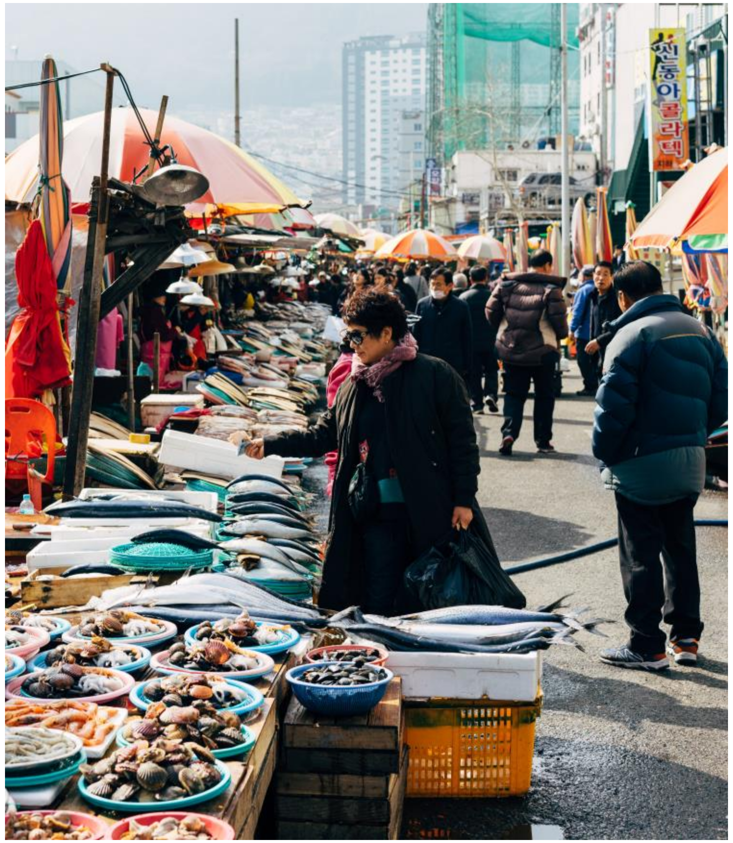
- How does the value of fish accrue throughout the supply chain?
- What is the fishers' share of the final product?

The goal of the analysis was threefold: (1) To identify the value distribution per supply chain step for the selected fisheries, (2) determine the presence of underearning faced by fishermen and (3) understand the role of sustainable fishing in the value distribution.

The Indonesian BSC supply chain presents a relatively unequal distribution of value along the steps. Fishers earn around 48% of a can of processed crab. Aggregators, namely collectors and mini-plants, accrue approximately 5%. Finally, processors accrue almost 47% of the value of a can. There is underearning present in the fishery, with an estimated 61% of BSC fishers earning below the national living income for a typical rural family. Lastly, future studies are recommended to include questions regarding sustainability since there is currently a lack of data in this regard.

This document summarizes the methodology, results and recommendations for the value distribution of BSC in Indonesia.

CONTENTS

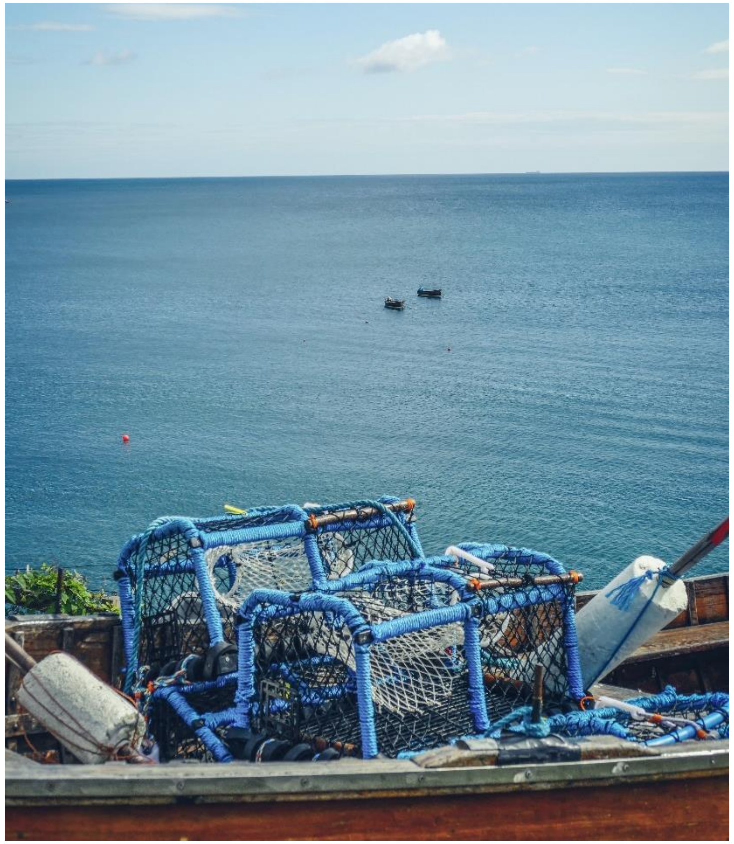


Introduction

01

INTRODUCTION OVERVIEW

The analysis is aimed at understanding how the value accrues along the supply chain of the Indonesian Blue Swimming Crab



WFF's Oceans team is leveraging the buying power of major seafood importers and engaging the supply chain in building support for sustainable fishery practices to improve ocean health and preserve coastal livelihoods.

WFF has collaborated with Impact Institute to gain sufficient actionable information for decision-making and strategy development required to support and preserve fishery communities. The assessment provides insight into how value accrues across specific fishery supply chains. The main research questions were:

1. How does the value of fish accrue through the supply chain?
2. What is the fishers' share of the final product?

This motivated the formulation of three main goals. First, to identify the value distribution per supply chain step for the selected fisheries. Second, to determine the presence of underearning faced by fishermen. Third, to understand the role of sustainable fishing in the value distribution of fish supply chains.

This document presents the results for the Indonesian Blue Swimming Crab (BSC). This fishery presented in 2019 a total export volume of 12,749 tons, worth an estimated $259 million.

This report contains an explanation of the methodology and approach, the main results for each formulated goal, as well insights and recommendations for equity improvement.

Methodology and Approach

02

METHODOLOGY AND APPROACH PROJECT ACTIVITIES

The assessment has completed 5 main activities, from scoping to reporting

Impact Institute has assessed the value distribution along the Blue Swimming Crab (BSC) supply chain in Indonesia. To do so, several activities have been conducted. This chapter will provide an in-depth explanation of the scope of the analysis, the data used and the type of models developed.

Activity 1: Scoping

The analysis started by scoping the boundaries of the project. Given data availability and feasibility, the first four steps of the value chain structure are in scope. A detailed overview of the dynamics of the BSC fishery is explained on the next page.

Activity 2: Data collection

The analysis has been based exclusively on secondary data given that no primary data was available. To get the most comprehensive overview possible of the entire BSC value chain in Indonesia, numerous reports shared by WFF have been analyzed. This has allowed Impact Institute to understand the dynamics of the fishery as well as to collect various required data points. Further, value chain data has been collected from other studies. These include sector reports, national statistics and academic studies. Yet, some required data points were still missing. These have been filled by making assumptions. A complete list of assumptions can be found in the Appendix.

Activity 3: Model building

Building upon the scoping decisions and the available data, a financial model has been built to quantify the value generated at each step of the value chain. Value has been captured as the profit earned.

Further, a separate model has been built to visualize the income distribution at the fisher level.

Activity 4: Analysis and Validation

For each goal of the project, an in-depth analysis has been performed. The analysis presents insights into the inequality present in the BSC fishery.

The model and analyses have been validated by multiple members from Impact Institute to ensure accuracy.

Activity 5: Reporting

The results of the analysis and the recommendations are collected in this report.

METHODOLOGY AND APPROACH 1. SCOPING (1/2)

The value chain structure of the Blue Swimming Crab in Indonesia has 8 main steps, in both national and international markets

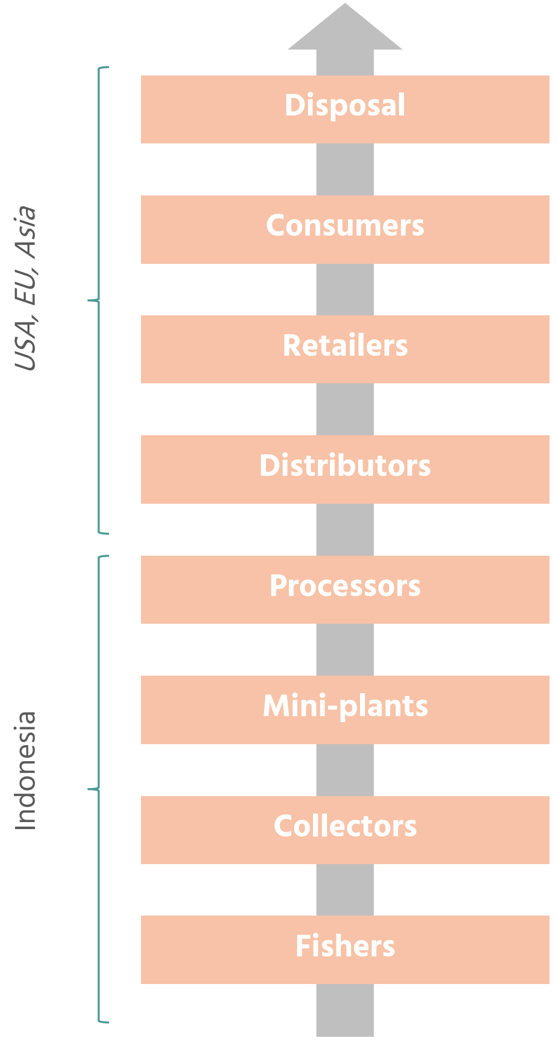
The first step in the value chain is at the harvesting level, where approximately 65,000 **fishermen** across Indonesia catch BSC using different fishing methods, such as fishing traps *(bubu)*, bottom gillnets *(kejer)* and mini bottom trawls *(arad)*. Fishermen can be daily fishers or multi-day fishers *(babangan)*, who perform long-term trips to the sea.

The next step in the value chain is the **collectors**, intermediary agents who finance the fisher's operations in order to collect their catch. The role of collectors can vary, since some fishers might boil the crab themselves. Also, collectors sometime own the mini-plant to which they supply. In general, collectors steam the catch before selling it to **mini-plants**, who are in charge of picking the meat out of the crab. There are more than 400 mini-plants distributed across the country. These are usually independent and locally-owned SMEs.

Mini-plants sell the picked BSC meat to **processing** facilities, where the crab is pasteurized and packed. The APRI is the Indonesia Blue Swimming Crab Processing Association consisting of 18 processor companies in charge of exporting crab meat. They represent over 90% of BSC production from Indonesia. The industry is trying to implement compliance mechanisms with the introduction of a voluntary Control Document to track the implementation of sustainability measures. They are faced with penalties if these are not met.

The NFI CC, National Fisheries Institute Crab Council, is the first international market actor in the supply chain. It represents 31 US **distributors** of packed crab meat, who import approximately 85% of packed BSC from Indonesia. Other importers are based in Asia and Europe.

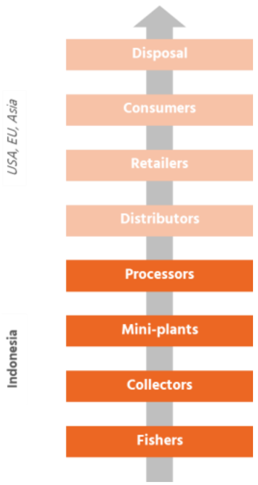
Finally, the product gets distributed to **retailers** and **consumers** in the importing country, closing the supply chain with its **disposal**.

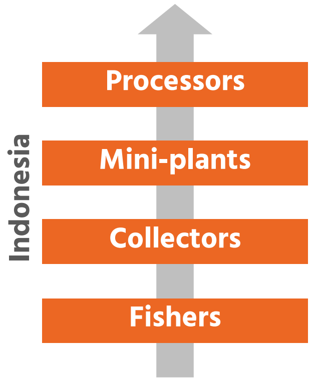


METHODOLOGY AND APPROACH 1. SCOPING (2/2)

The scope of the value chain assessment has been limited to the steps bound in the country of analysis

The analysis aims to understand how the value of crab accrues along the supply chain. To do so, the analysis is based on the **value chain steps that are geographically within Indonesia for the year 2019**. Hence, the scope of the value chain assessment considers the first four steps, as highlighted in dark orange in the following image:





However, several **scoping decisions** have been made within the structure of the value chain to perform the analysis. This refers mainly to the fishers' step, given the complex nature of the fishery.

First, multi-day fishers typically go out to the sea for 5 or more consecutive days. To preserve the crab, they have cooking facilities on board as well as ice and cold storage. Hence, they sell their catch directly to mini-plants. **This analysis focuses on daily fishers exclusively**, given that the practice of multi-day fishers is more complex and difficult to capture due to data availability and differences in the value chain structure.

Also, this study **does not consider the use of trawl** as fishing gear. This is because using trawl is forbidden in the fishery since 2015 and no data is available on their actual level of usage.

Provinces in scope are Lampung, West Java, East Java and Central Java. This scoping decision is based on previous studies and data availability.

Lastly, revenue from the BSC is the only source of income considered in this assessment. Hence, no other sources of income are included as revenue streams at the fisher level.

The Appendix includes a list of assumptions that justify the final scope at the fisher's level.

METHODOLOGY AND APPROACH 2. DATA COLLECTION

Secondary data collection has followed a data hierarchy to select the most fitting source for a specific data point

When sourcing secondary data, the goal is to use sources with a similar scope to the research being conducted.

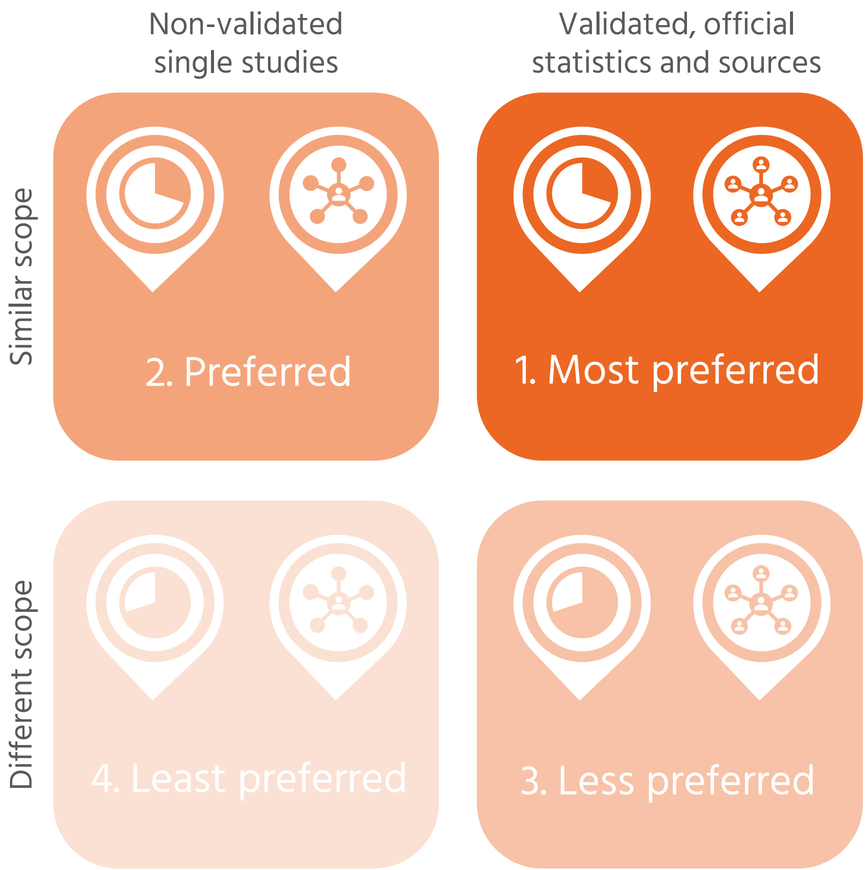
It can happen that, for a given data point, there is **no available data with a similar scope** to the research being conducted.

A **data hierarchy** provides the user with a ranking of data characteristics in order to decide which data point is best suited for the variable at hand. This can be visualized in the matrix to the right.

Examples of scope differences include:

Geographical scope

Time period



METHODOLOGY AND APPROACH 3. MODEL BUILDING (1/2)

A financial model has been developed to capture the value generated at each step of the value chain

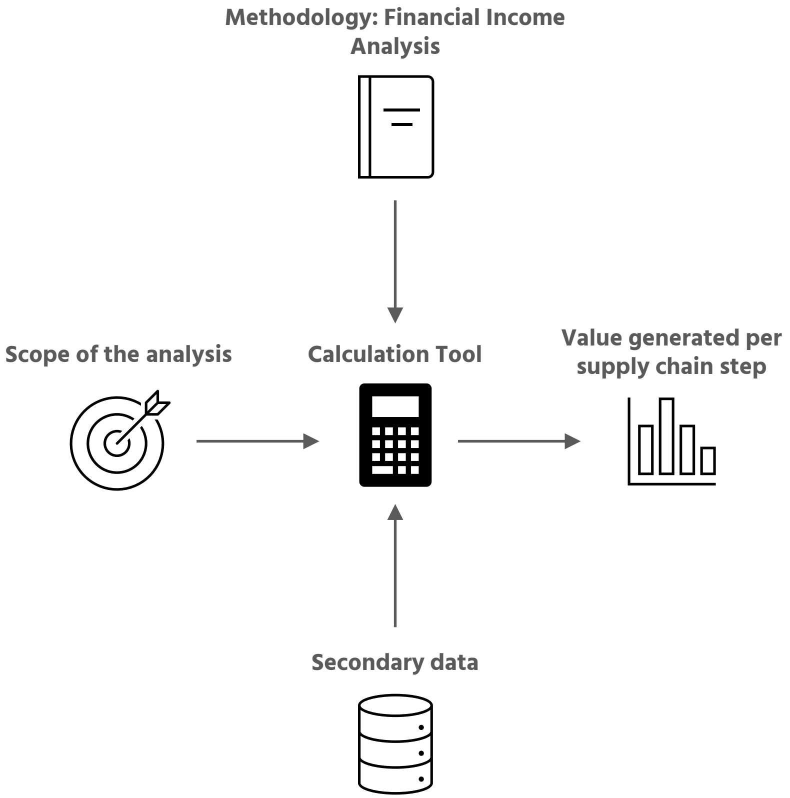
The model development has been based on a **financial analysis to determine the value generated at each step of the value chain**, from fishers to processors.

The focus has been set on the revenue and expense level of each player in the chain. The income analysis is intended to **determine the amount of profit obtained at each node** of the value chain. This amount of profit is the value generated. The basic equation used is Profit = Total Revenue – Total Cost, in which profit is obtained when Total Revenue > Total Cost.

For fishers, this analysis has been carried out separately between fishing gears used in the Blue Swimming Crab industry, bottom gillnets and traps. Further, the total sales price of Blue Swimming Crab in the year of analysis, 2019, is the total revenue of a fisherman. Hence, no other source of income has been included due to data availability. If data has allowed it, the analysis has distinguished between BSC seasonality.

The initial assessment consisted of calculating the value generated per value chain step. The output of this step was the profit earned per kg of crab specific to each step. For instance, $ / kg of live crab at the fisher level and $ / kg of picked meat at the mini-plant level. This has been **adjusted with a quantity ratio** to capture the proportion of the original crab in the final product. The final product is understood as the output of the processing value chain step, that is, processed and packaged Blue Swimming Crab. Finally, the results have been converted into a **standard can of BSC**.

The following image shows the main processes behind the model development:

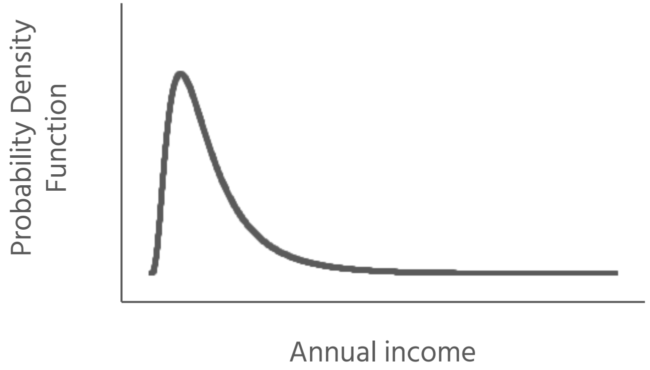


METHODOLOGY AND APPROACH 3. MODEL BUILDING (2/2)

A fisher income distribution has been used to estimate the underearning impact present in the BSC industry

To determine the presence and size of underearning, the **income distribution at the fisher level has been estimated**. This has been conducted with a tool that models the distribution of fisher income.

Income distributions are usually estimated using a common model: the **lognormal distribution** (Schield, 2018). This distribution describes the complexity of the financial situation of a given population by visualizing the income shares. The shape of the lognormal distribution is characterized by creating a **right-skewed curve**. This fits the income distribution given that the highest share of a given population earns little whilst only a minimum share earns a lot. So, the lognormal distribution highlights the income inequality as seen in the following graph:



This analysis serves to visualize the share of BSC fishers that earn below the average income and living income benchmarks. The average income used to provide the income distribution is the estimated value resulting from the financial model explained on the previous page. No studies were found on the living income benchmarks for Indonesia; hence, the cost-of-living data was taken from living wage studies as the best estimate.

There are several parameters that determine the shape of the log normal distribution. The most important parameter is the mean to median ratio. Impact Institute has tailored this methodology by combining large data sets of incomes and wages from various sources, including datasets from smallholder farmers as well as from the OECD. In particular, the average mean to median ratio applied in our income distribution assessments is 0.80. In essence, this ratio is an indicator of inequality and material well-being.

With this ratio, it is possible to provide an estimation of the median net income of fishers, given the average income that results from the financial model explained in the previous page. For more information on income distribution and mean to median ratio, please refer to the working paper by the Center for Global Development (2015).

METHODOLOGY AND APPROACH 4&5. ANALYSIS, VALIDATION & REPORTING

The developed model has been utilized and validated with results representing the basis for this report

The **analysis** has drawn upon the model built from secondary sources and expert input to create a detailed, thorough, and robust overview of the value distribution of the Indonesian Blue Swimming Crab fishery in 2019. Once the model has been developed, the data helps to illuminate where, why, and how value accumulates, as well as to what extent Blue Swimming Crab fishermen in Indonesia are able to earn a living income. The analysis has focused solely on the steps of the value chain occurring within Indonesia in 2019.

Once the analysis has been completed, the model and results undergo **multiple rounds of validation**, both internally with expert consultants at Impact Institute and externally with Indonesian Blue Swimming Crab fishery experts from WFF's partner organizations. These validation rounds serve to ensure that all data points are accurate, utilized correctly, and most importantly, make sense for the reality on the ground.

The final step has been to **develop the report**, with the purpose to clearly answer the research questions set out at the beginning of the process, as well as to achieve the three goals related to those research questions, as displayed to the right. WWF and Impact Institute are pleased to share the results.

Research questions

1. How does the value of fish accrue through the supply chain?
2. What is the fishers' share of the final product?

Goals

1. Identify the value distribution per supply chain step for the selected fisheries.
2. Determine the presence of underearning faced by fishermen.
3. Understand the role of sustainable fishing in the value distribution of fish supply chains.

Results

03

RESULTS INTRODUCTION

The results of the value chain assessment are presented per goal of the analysis

The following chapter portrays and discusses the results of the Indonesian Blue Swimming Crab supply chain assessment for the year 2019. As previously mentioned, the value chain steps in scope are bound to the operations happening in Indonesia: Fishers, Collectors, Mini-plants and Processors. Based on the research question, three main goals were tackled in the analysis:

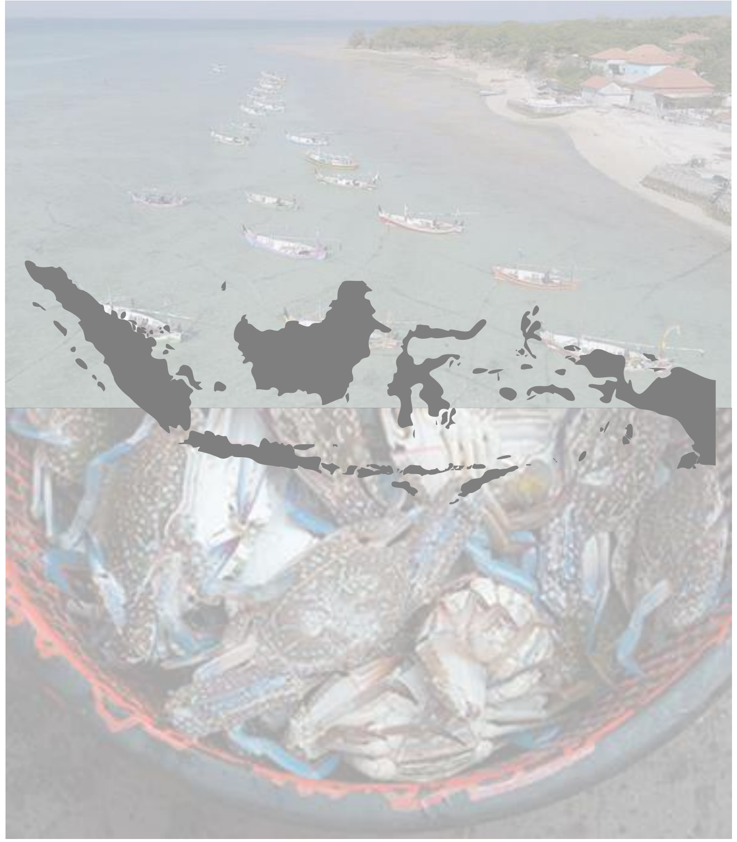
- **Goal 1**: To identify the value distribution per supply chain step for the selected fish supply chains;
- **Goal 2**: To determine the presence of underearning faced by fisherfolk; and,
- **Goal 3**: To understand the role of sustainable fishing in the value distribution of fish supply chains.

Goal 1 shows the results of the two main research questions:

1. How does the value of fish accrue throughout the supply chain?
2. What is the fisher's share of the final product?

Goal 2 shows the income distribution at the fisher level in order to visualize the degree of underearning present in the BSC industry.

Goal 3 explains what is needed in further studies to successfully complete the analysis.



RESULTS GOAL 1: VALUE DISTRIBUTION (1/6)

How does the value of fish accrue throughout the supply chain?

From the harvesting of Blue Swimming Crab to the pasteurization and packaging of crab meat in a can, the value of the crab varies as more processes are added to the supply chain. Taking as a final product a standard 425g can of BSC meat sold at the end market[1], **fishers earn $2.48 net per can**. Whilst aggregators earn almost 25 cents net per can, processors earn $2.41 per can.

This means that 48% of the value is retained at the fisher level, 5% at the aggregator level and the remaining 47% at the processor level. There are approximately 65,000 fishers at the harvesting level, around 400 mini-plants at the aggregator level and only 18 processors. This is important to take into consideration when interpreting these values, which are displayed per can of BSC.

As explained in the scoping section in page 9, the analysis only considers steps that occur within Indonesia. The distribution would be different if retailers where included.

Value Chain Step

Fishers	Aggregators		Processors
• Harvesting	• Boiling	• Peeling	• Pasteurizing & packing
2.48 $ / can of BSC	**0.24** $ / can of BSC		**2.41** $ / can of BSC
48%	**5%**		**47%**

[1]The end market is the final retailer in the international value chain (e.g.: Supermarkets in the USA). The average price at the end market of $17/can of BSC may be compared to an average 2019 export price of $22.65 per kg of final product.

RESULTS GOAL 1: VALUE DISTRIBUTION (2/6)

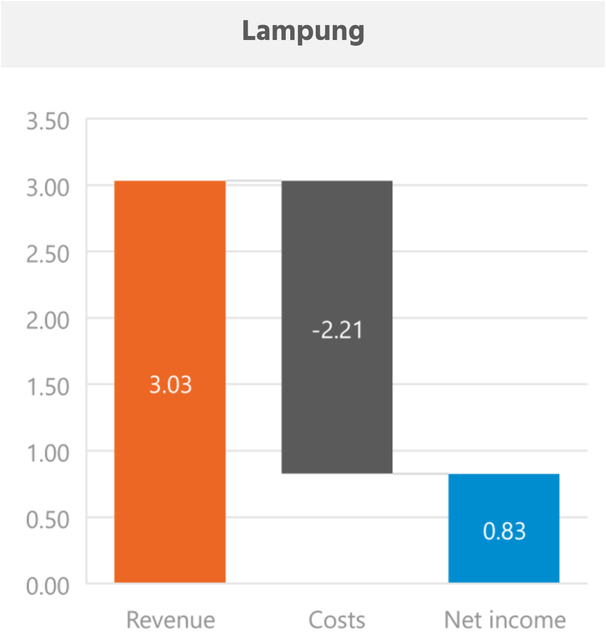
The net income breakdown at the fisher level is dependent on location, however, costs seem to be constant at around $2 per kg of live crab

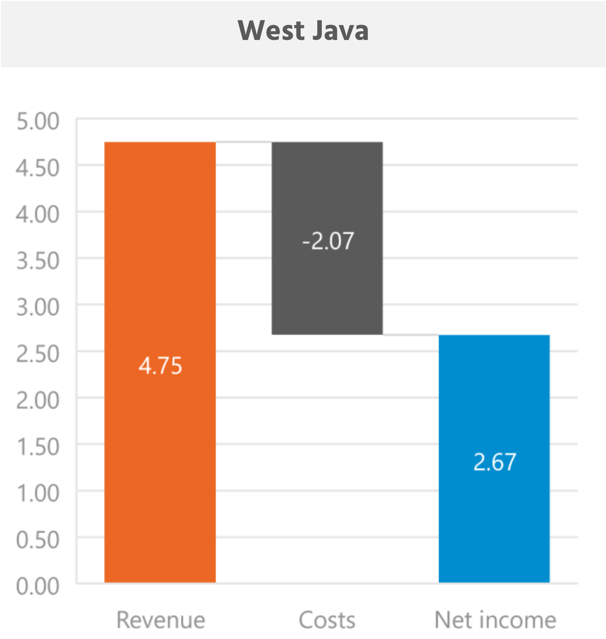
The graphs to the right show the **net income breakdown** for fishermen at Lampung and West Java. The breakdown includes both types of gear in scope, trap and gillnet.

The revenue is higher in West Java than in Lampung. This determines the resulting net income, since the amount of costs per kg of live crab that fishers amount to is similar between provinces. The next pages include an exploration on the differences in income between gears. This includes an explanation of possible drivers: differences in yield, time invested and cost structure.

The Appendix includes an overview of how the net income has been derived per province, due to data availability.

Net income breakdown per province and gear type at harvesting level, 2019.
Unit: $ / kg live crab





RESULTS GOAL 1: VALUE DISTRIBUTION (3/6)

Trap fishers consistently display higher annual net incomes than gillnet fishers

The yearly **average income for trap fishing is consistently higher across provinces**, with an average yearly income of $ 2,041, as compared to $ 1,726 for gillnet fishers. The assessment has been based on a distribution of gear use of 76% for trap and the remaining 24% for gillnet (Vivid Economics, 2014). Other shares between gears are stated as well. This might be dependent on location and culture. Yet, the source used did not make reference to any explanation for the difference in use of gear.

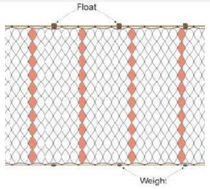
Nonetheless, the findings of this assessment show that trap fishers typically earn more than gillnet fishers, something which would be interesting to take into account for decision making on the ground. The next pages will explore different income drivers between fishing gears.

Legend

Trap

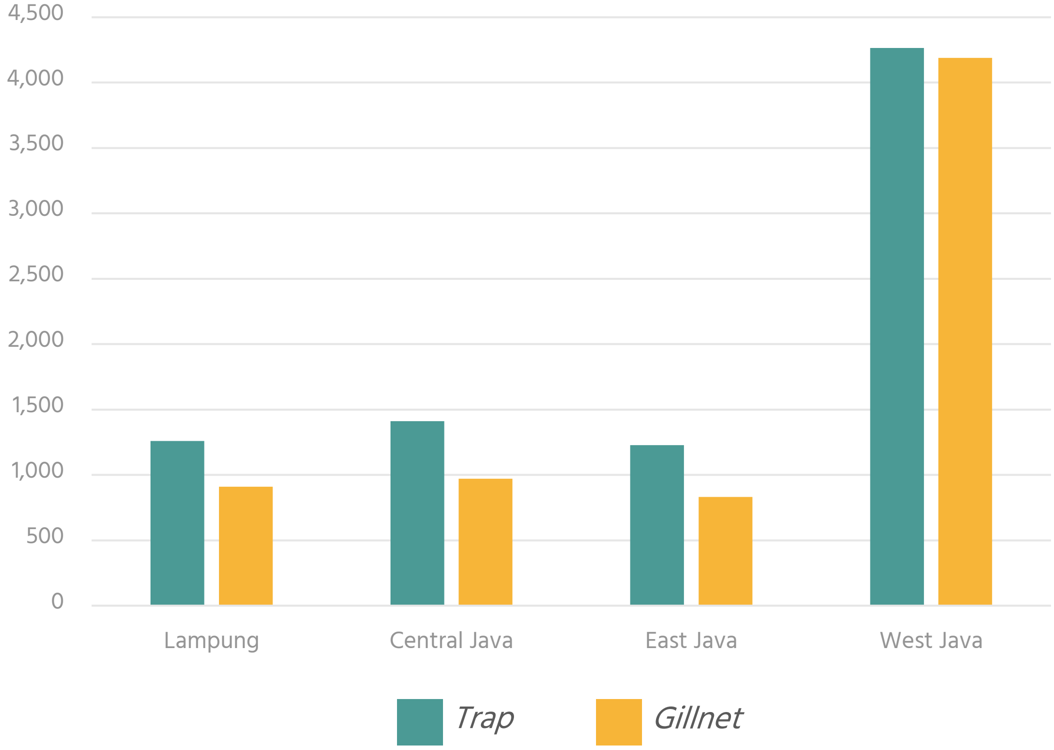
76%

Gillnet



24%

Net income per province and gear type, 2019.
Unit: $ / year



RESULTS GOAL 1: VALUE DISTRIBUTION (4/6)

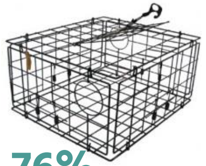
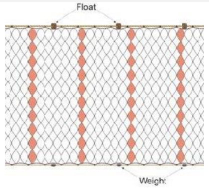
Exploration of the income differences behind fishing gears: yield and fishing time

The **yield of BSC caught using traps is higher** than that of using gillnets, as seen in the graph to the right. This is the case across all provinces. However, overall yield in Central and East Java is much lower than in Lampung and West Java. In particular, the average yield for trap fishers across provinces is 1,191 kg of live crab per year; whilst the average yield for gillnet fishers is 896 kg live crab per year.

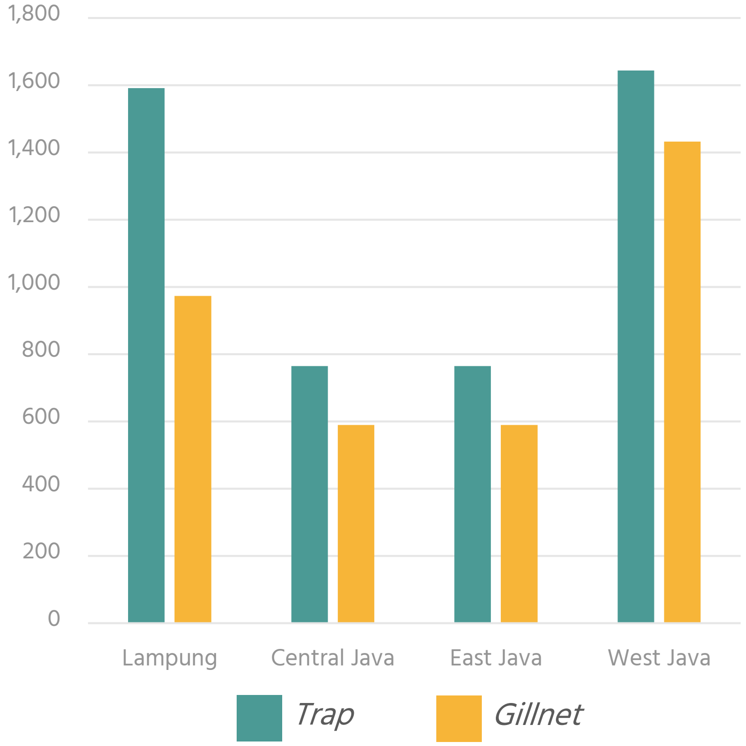
Trap fishers spend, on average, 324 more hours per year fishing than gillnet fishers. Further, **gillnets are easily broken due to entanglement with coral or other hard objects** at sea, leading to reduced time fishing during peak season.

Main statistics per gear type

Legend

	All provinces (average)	
Trap	**Yield**	**Fishing Time**
 76%	**1,191** kg live crab / year	**2,592** hours / year
Gillnet	**Yield**	**Fishing Time**
 24%	**896** kg live crab / year	**2,268** hours / year

Yearly yield per province and gear type, 2019. Unit: kg live crab / year



RESULTS GOAL 1: VALUE DISTRIBUTION (5/6)

Exploration of the income differences behind fishing gears: cost structure

Fixed costs included in the analysis are the **gear** (i.e., either trap or gillnet) and the **buckets**. **Variable costs** are based on the renting of **boats**, **fuel costs** and the use of **baits for fishers with traps**.

Fixed costs are higher for gillnets than for traps given that the price per gillnet is relatively high compared to the price per trap. Variable costs are three times higher for trap fishers than for gillnet fishers given the use of bait.

The graph to the right shows the net income per kilo of live crab. Trap fishers earn more in Central Java and East Java, whilst gillnet fishers earn more in Lampung and West Java. The outcomes for these clusters are likely due to proximity and similar fishery dynamics across both pairs of provinces.

Main statistics per gear type

Legend

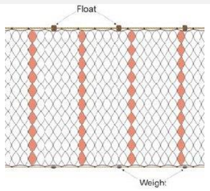
All provinces (average)

Trap

76%

Fixed costs	Variable costs
324	**1.28**
$ / year	$ / kg

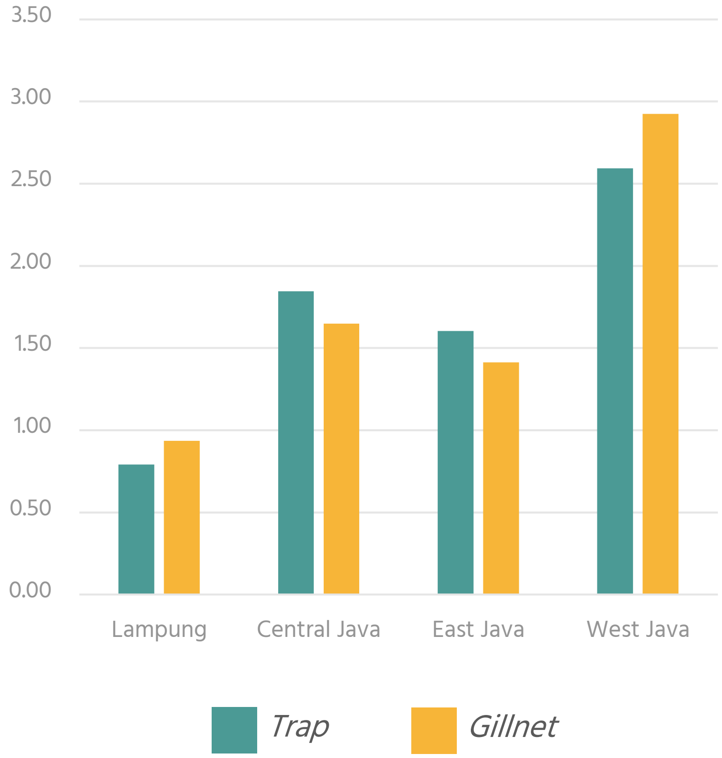
Gillnet



24%

Fixed costs	Variable costs
459	**0.43**
$ / year	$ / kg

Net income per province and gear type, 2019.
Unit: $ / kg live crab



RESULTS GOAL 1: VALUE DISTRIBUTION (6/6)

The net income breakdown at post-harvesting value chain steps shows that processors retain a higher margin as compared to aggregators

The aggregators are both the collectors and the mini-plants. Aggregators are represented in one step given that the role of collectors and mini-plants can sometimes be the same. This means that it may be the case that collectors are also mini-plant owners.

The costs at the collector level include the cost of produce, i.e., the crab they buy from fishers, and the cost of cooking. The costs at the mini-plant level include not only the picker fee & cost of ice, but also the cost of buying steamed crab from the collectors. This results in a net income for the **aggregators** of **$0.57 per kg of picked meat**. This is in line with results from other studies, where collectors make a profit between $0.2 and $0.8 per kg of (un)boiled crab (The World Bank, 2012).

This low profit margin should be interpreted with caution. Aggregators are independent actors in the chain and have established business relations with both the fishermen and the processing facilities. Hence, they have high control of the volume managed in the value chain. This means that aggregators, whilst making a low profit per kg of picket meat, have a sound economic positioning. This is due to the high volume of crab that they handle since many fishers bring their daily catch to one aggregator location.

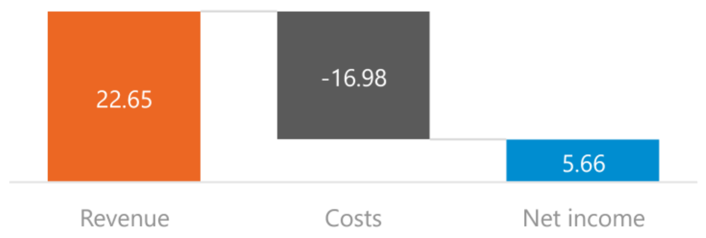
Finally, at the **processor** level, the value generated is **$ 5.66 per kg of final product**. The final product is the processed, pasteurized and packaged BSC. Costs at this level include cost of buying picked meat and an estimation for the cost of processing.

The average efficiency yield used is 29%[2]. This means that when the product reaches the processing facilities, it has lost 71% of its original volume.

Net income breakdown, 2019.

Aggregators (Collectors & Mini-plants)
Unit: $ / kg picked meat

Processors
Unit: $ / kg final product



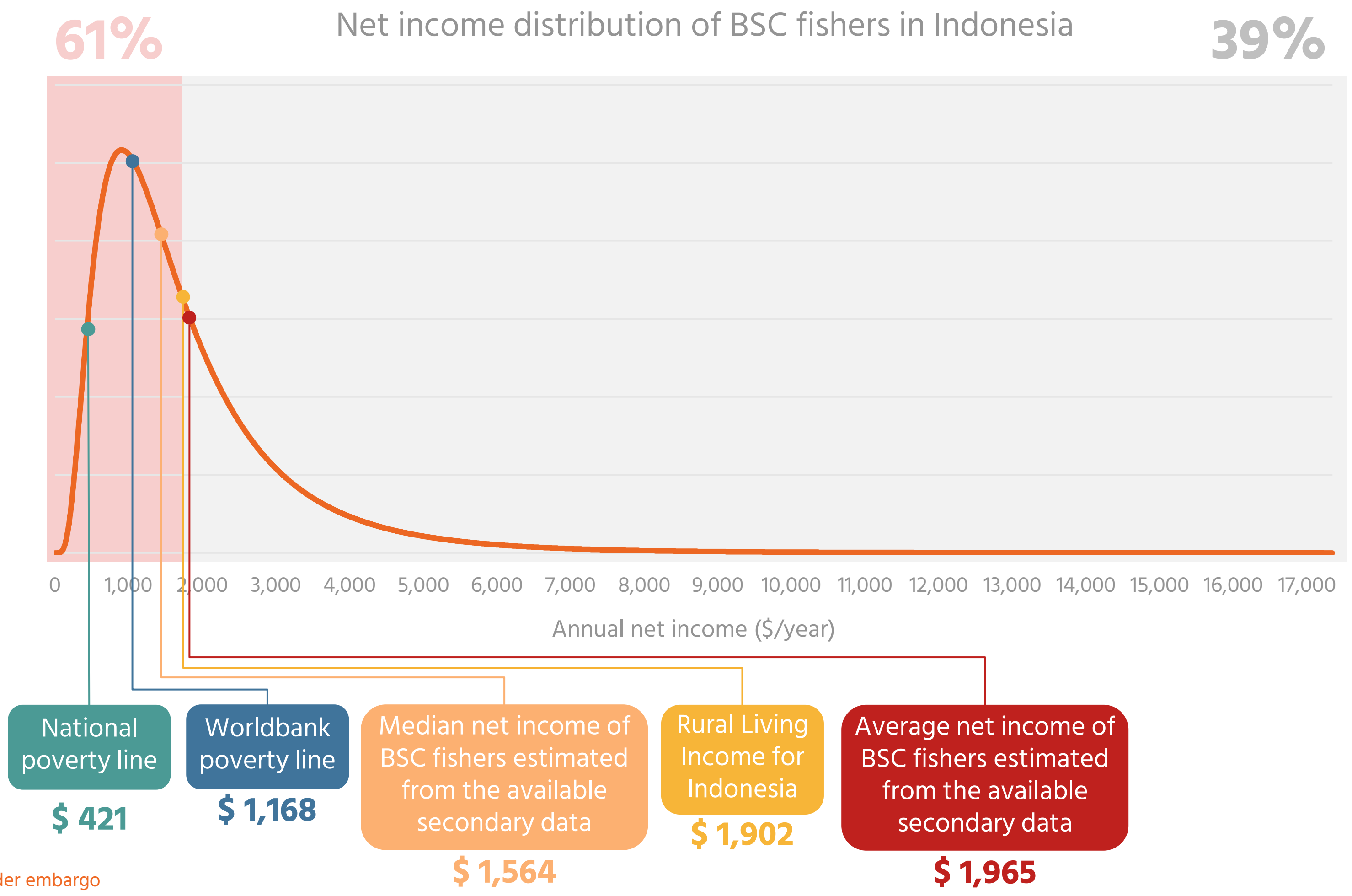
[2] The efficiency yield represents the utilized part of a fish, that is, the "cleaned" product after all processes have been applied. It is calculated by dividing the final weight of the product and the original weight of the fish.

RESULTS GOAL 2: PRESENCE OF UNDEREARNING

An estimated 61% of BSC fishers in Indonesia live below the living income for a rural family

The average net income of BSC fishers, estimated with the financial model developed for the purpose of this study, results in $1,965 per year. Based on the methodology applied in the net income distribution, the estimated median is $1,565 per year. Median values are more representative since the average is very likely skewed by a few large earners in the fishery.

The graph displayed here shows the net income distribution for BSC fishers. The average net income is above the living income for a rural family. The median income is above both the national and the Worldbank poverty line. However, it is 22% below the rural living income. In particular, an estimated **61%** of **BSC fishers in Indonesia earn below the living income** for a rural family. Hence, there is severe underearning in the fishery.



RESULTS GOAL 3: ROLE OF SUSTAINABLE FISHING

There is no data available on sustainable fishing practices, which highlights the complexity on the ground with regards to compliance of state and industry regulations

The lack of data availability on sustainable indicators has not allowed for the conducting of this analysis. In particular, no data has been found on by-catch fishing, gear abandonment or even compliance with government legislation. This relates to the prohibition of using trawl as a fishing gear, catching egg-bearing females or small crabs. Data has been found on the % of catch that are egg bearing or small, however, it is not very clear as to the degree to which this amount of crab is returned back to the sea. As seen in several data sources, mini-plants are less involved in the compliance of state or industry sustainability regulations, since it is quite common to find prohibited catch being picked and processed.

Insights into the fishers' income, which is one element of the scope of sustainable fishing, have been possible to portray, as discussed on the previous page.

To successfully analyze the role of sustainable fishing in the value distribution of the BSC supply chain, it is **recommended to include questions of sustainability in other BSC studies**. This will push for raising awareness in the industry regarding the lack of data in terms of sustainable harvest and monitoring of compliance.

Further, sustainability awareness seems to be lowered the further the agents involved in the supply chain are from the final market. APRI is heavily involved in pushing for system change with several compliance mechanisms. However, it seems that implementation at mini-plants is not only very low but also not of interest to their owners. Strengthening sustainability compliance at the first steps of the value chain is key to managing the sustainability level of the BSC industry.

Scope of sustainable fishing

(i) Fishing that occurs at a level at which fishing can continue indefinitely and the fish population can remain productive and healthy

(ii) Fishing that minimizes environmental impact through proper ecosystem management

(iii) Fishing that is managed effectively

(iv) Fishing that allows fishermen to earn living incomes or be paid living wages and human rights violations to be eliminated.

Discussion

04

DISCUSSION OVERVIEW

Fishers earn 48% of the value of a can of BSC, yet an estimated 61% of fishers live below the rural living income for Indonesia

Fishers earn 48% of the value of a standard can of processed Blue Swimming Crab. Similarly, aggregators and processors accrue 5% and 47% of the total value of a can, respectively. This does not imply that fishers are in the same financial situation as the processing facilities, or that aggregators are poorer than fishers. In fact, aggregators seem to usually be better-off than fishers. There are two important considerations here: volume and labor intensity.

Volume plays a significant role in determining value accrued. Volume refers to the quantity of crab that is managed at each node of the supply chain. BSC fishers catch a limited amount of crab per day, while aggregators collect the catch of all the fishers that they work with. While there are thousands of fishers, there are hundreds of aggregators and tens of processors. Number of actors per stakeholder group is a key consideration when interpretating the results of the assessment, which are presented per can of BSC and not per individual actor in the supply chain.

Further, time invested in fishery activities varies significantly per stakeholder group in the chain. This is related to **labor intensity**; a fisher needs to spend more labor hours per kilo of crab sold than an aggregator who buys and sells in bulk.

Despite a relatively high percentage value per kg, an estimated **61% of fishers earn below the rural living income** for Indonesia. In fact, the median annual net income of $1,564 is 22% below the living income, set at $1,902. Hence, there is indeed underearning in the fishery.

This implies that the living income gap experienced by BSC fishers is severe with an average income gap of $338 (based on the median income.)

Further analysis is needed to understand the drivers of the living income gap and to implement tailored programs to address this gap. Programs can include interventions that tackle fair pricing, sufficient yield and gear use. The following page includes several recommendations to tackle the underearning present in the industry.

DISCUSSION RECOMMENDATIONS (1/3)

Given the severe underearning present in the BSC fishery, several recommendations are suggested to close the living income gap (1/2)

1. **Towards a living income.** Fishermen, as an economic group, earn almost 48% of the value of a can of BSC accrued domestically, and yet there is significant underearning in the industry. Underearning might be a consequence of high costs or low yield. It may also be due to unsustainably low prices on global markets for fishermen to earn a return that affords them a decent livelihood.

- First, the implementation of programs aimed at providing fishermen access to finance would help in tackling the **cost** aspect mentioned above. An example of a bottom-up approach is the creation of a community savings cooperative where fishermen can contribute to group savings and take out loans. An example of this can be seen in remote coastal communities in the Philippines, where becoming a member of a fisher savings coop allows them to invest in their fishing operations, in education for their family or in their health. More importantly, it showcases the benefits of saving and using this money for investing in alternative businesses as well. Please see the bibliography for additional information on this program (Rare, 2018).

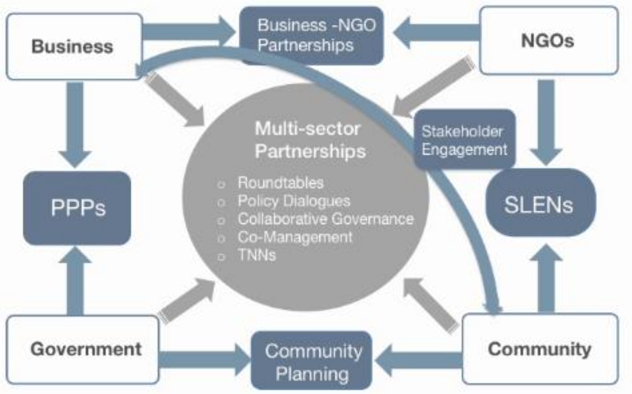
- Second, studies on the sustainable **stock** levels of BSC could be performed. This information is important to integrate in living income assessments to understand the stock status (i.e., declining, stable etc.) and, in turn, design alternative livelihood programs to ensure that fishermen are focusing on profitable business activities.

- Finally, on the **global market** side, a strategy to pay a fair and sustainable price at the harvesting level such as the Living Income Reference Price (LIRP) by Fairtrade could be promoted. The LIRP indicates the value a fisher should be paid in order to achieve a living income. Please see the bibliography for more information on the LIRP (Fairtrade, 2019). Overall, it is recommended to push APRI to include living income discussion in its pillars. This will expand APRI's current sustainability initiatives and will push for more transparency in the industry. Closing the living income gap is the first step towards an equitable distribution of value per individual in the supply chain.

DISCUSSION RECOMMENDATIONS (2/3)

Given the severe underearning present in the BSC fishery, several recommendations are suggested to close the living income gap (2/2)

2. **Chain-based development interventions**. It is recommended to engage the private sector in furthering economic development, employment and poverty reduction present in the BSC industry. Establishing linkages between fishers and lead firms is seen as a mechanism to improve relationships within the chain and to ensure compliance with state legislation. This helps to gain a better understanding of the issues faced by the fishermen and what they might need to alter current practices. In particular, tackling underearning and poverty faced by fishermen, as discussed in the previous page, requires collective action from all stakeholders in the value chain. Beyond ethical considerations of ensuring that producers earn a decent living beyond mere survival, there are economic incentives and benefits to promoting living incomes. Living income strengthens the stability and resilience of a supply chain by adhering to responsible purchasing practices at the beginning of the chain, the fishermen, without whom the rest of the value chain falls apart. The first step, however, is to improve access to reliable and comparable data to increase the visibility of poverty within the fishery – which is the foundation upon which an enabling environment for living income realization can be built.



Source: Gray B, et al. (2013).

DISCUSSION RECOMMENDATIONS (3/3)

Moreover, general recommendations are provided to help improve the data collection and analysis of the fishery as a whole

1. **Increasing collaboration, knowledge sharing and standardization.** One of the greatest challenges stakeholders in the Blue Swimming Crab value chain face is a lack of consistent, reliable, and comparable data. While great efforts and large strides have been made to rectify this situation through the creation of the APRI and through funding and research by external stakeholders such as WFF, the Gordon and Betty Moore Foundation, and the Sustainable Fisheries Partnership, there is still a large knowledge gap. Reports frequently address the situation on the ground using different vocabulary, differing definitions of value chain steps, and differing units. While this is understandable owing to the shifting reality on the ground, and the overlapping nature of several value chain steps (particularly that of collector and mini-plant), it makes it very challenging to collate data from reports and draw larger conclusions. It is therefore recommended that these stakeholders increase their collaboration and knowledge sharing partnerships and work together to create standard ways of viewing, monitoring, and discussing the value chain.

2. **Promoting traceability in the supply chain.** An analysis is only as good as its data - and data is only as good as the underlying collection process. The need for greater collaboration and standardization extends to the day-to-day monitoring and data collection processes - particularly in regard to variables like yield, hours worked, price per kilo, and the flexible nature of the supply chain. In order to improve this aspect of the fishery, there are numerous options available to improve traceability (the ability to fully trace products, from point of sale back to point of origin.) In the short term, these can be as simple and low-tech as increasing the level of reporting at each value chain step so that prices, yields, and quality are better documented. In the longer term, electronic catch documentation and traceability (eCDT) systems can be implemented such that data analysis can be instantaneous and with minimal human labor required.

Assumptions and Limitations

05

ASSUMPTIONS AND LIMITATIONS

The analysis has been conducted with various limitations in data collection and data accuracy. This has necessitated the making of assumptions for use of available data.

The data used to produce the value chain assessments has not included primary data collection. Hence, the focus on living income and expenses at the fisher's level has been limited by data availability. This has had multiple implications, as listed below.

First, strong assumptions have been made to maximize the usefulness of available data points and estimate missing values where needed. For instance, East Java and Central Java have been paired to fill in data gaps. This is due to proximity and similar fishery dynamics. Similarly, Lampung and West Java have been paired. This relates to not only yield values but also fishing trips per day and other similar indicators.

Second, many data points are relatively old, ranging from 2014-2019 in many cases. Consequently, they do not reflect the many ways that the COVID-19 pandemic affected all industries, particularly those with international value chains.

Further, given the lack of data in terms of sustainable fishing activities, this analysis has not been able to include the role of sustainable practices in the overall value distribution of the supply chain. As stated previously, it is recommended to stress the importance of collecting data in this regard to be able to conduct relevant analyses.

Detailed assumptions are listed in the Appendix.

No primary data availability

Lack of sustainable indicators

Appendix

- *Net income calculation overview*
- *Key assumptions*
- *References*

06

APPENDIX NET INCOME CALCULATION OVERVIEW

Different approaches have been taken to estimate the value generated at the fisher level depending on data accuracy and availability. The following table is an overview of the elements taken into consideration per province, gear type and season

Net income calculation overview								
Province	Lampung		Central Java		East Java		West Java	
Gear type / Time period	Trap	Gillnet	Trap	Gillnet	Trap	Gillnet	Trap	Gillnet
Average year			Data on annual net income. • Adjusted with yield, effort invested and working period.	Data on annual net income. • Adjusted with yield, illegal catch, effort invested and working period.	Data on annual net income. • Adjusted with yield and effort invested and working period.	*No data.* Estimated using % reduction in net income between gear types for other provinces.		
Seasonality (peak, medium and famine)	Revenue (selling price per season) Costs: • Fixed costs (i.e., gear) • Variable costs (i.e., boat, fuel and bait)	Revenue (selling price per season) Costs: • Fixed costs (i.e., gear) • Variable costs (i.e., boat and fuel)					Revenue (selling price per season) Costs: • Fixed costs (i.e., gear) • Variable costs (i.e., boat, fuel and bait)	Revenue (selling price per season) Costs: • Fixed costs (i.e., gear) • Variable costs (i.e., boat and fuel)

APPENDIX KEY ASSUMPTIONS FOR FISHERS (1/5)

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions			
Data indicator	Value chain step	Assumption	Rationale
Yield of BSC Province: East Java Gear type: Gillnet and Trap	Fishers	It is assumed that the yield for East Java is equal to that of Central Java.	There is only one data point for East Java's yield. The initial assessment is considered an outlier given its very low value. Proximity of East Java to Central Java justifies choice of province.
Number of working hours per trip Province: Central Java Gear type: Gillnet and Trap	Fishers	It is assumed that all provinces have the same number of working hours per trip. This data value is from 2017. It is also assumed it remains the same in 2019.	This data point is from Jepara Regency in Central Java. Given lack of data for other provinces, it is considered to be representative of all Indonesia.
Number of fishing trips per day Province: Central Java Gear type: Gillnet and Trap	Fishers	It is assumed that all provinces have the same number of fishing trips per day. This data value is from 2017. It is also assumed it remains the same in 2019.	This data point is from Jepara Regency in Central Java. Given lack of data for other provinces, it is considered to be representative of all Indonesia.
Number of fishing days a year per season Province: West Java Gear type: Gillnet and Trap	Fishers	It is assumed that all provinces have the same number of fishing days a year per season per gear type.	This data point is from West Java. Given lack of data for other provinces, it is considered to be representative of all Indonesia.

APPENDIX KEY ASSUMPTIONS FOR FISHERS (2/5)

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions			
Data indicator	Value chain step	Assumption	Rationale
Proportion of fishers using trap Province: Lampung, Central Java, East Java, West Java Gear type: Trap	Fishers	This data point is from the year 2014. It is assumed that the proportion remains the same in 2019.	Fishing practices and dynamics are expected to remain the same during this 5-year period.
Proportion of fishers using gillnet Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet	Fishers	Since the proportion of fishers using trap is known, it is assumed that the remaining proportion is that of fishers using gillnet.	This can be justified since scope of fishing gear of the analysis only includes gillnet and trap, and data availability is limited to fishers who use trap.
Proportion of fishers per province Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Fishers	It is assumed that there is an equal number of fishers per province.	Due to limited data availability, it is assumed that there is an equal proportion of fishers in the 4 provinces analyzed. This guarantees an equal value to the data found per province.
Local consumption of BSC Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Fishers	It is assumed that all BSC catch moves through the supply chain. Hence, fishers do not keep BSC catch for own consumption.	This can be justified by the fact that no data on local BSC consumption from the fishers' catch has been found and it is not a common local food.

APPENDIX KEY ASSUMPTIONS FOR FISHERS (3/5)

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions			
Data indicator	**Value chain step**	**Assumption**	**Rationale**
% of yearly catch per season Province: Lampung Gear type: Gillnet and Trap	Fishers	The share of catch per season in Lampung is the same as the share from West Java.	This is needed to incorporate a more granular level of data for Lampung. Revenue data is provided per season. However, yield is provided as an average. To estimate the yield per season for Lampung, the reported yearly catch has been used to estimate the proportion of catch per season following West Java's distribution.
% reduction in net income between gear types Province: East Java Gear type: Gillnet and Trap	Fishers	To estimate the net income of gillnet fishers in East Java, it is assumed the % net income reduction between gear types is the same as the % reduction for Central Java.	This is because no required data points to estimate the value generated have been found for gillnet fishers from East Java.

APPENDIX KEY ASSUMPTIONS FOR FISHERS (4/5)

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions			
Data indicator	Value chain step	Assumption	Rationale
Costs Province: West Java Gear type: Gillnet	Fishers	The fixed costs at fisher level are assumed to be based on gillnet pieces and buckets. The variable costs are assumed to be based on the boat rental and fuel. Data values are from West Java. It is also assumed that it is representative of Lampung.	This is the best estimate of costs at the fisher level using gillnet due to data availability. Further, proximity of Lampung to West Java justifies choice of province.
Costs Province: West Java Gear type: Trap	Fishers	The fixed costs at fisher level are assumed to be based on trap pieces and buckets. The variable costs are assumed to be based on the boat rental, fuel and use of baits. Data values are from West Java. t is also assumed that it is representative of Lampung.	This is the best estimate of costs at the fisher level using trap due to data availability. Further, proximity of Lampung to West Java justifies choice of province.

APPENDIX KEY ASSUMPTIONS FOR FISHERS (5/5)

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions			
Data indicator	Value chain step	Assumption	Rationale
Weight of live BSC Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Fishers	The weight of a live Blue Swimming Crab is assumed to be between 80 and 160 g across all provinces. In particular, the weight incorporated in the model is 145 g. The weight does not affect directly the final distribution of value given that the financial model applies quantity ratios using % of yield loss throughout the process, from live catch to pasteurization.	The weight of a live Blue Swimming Crab varies between sex of the crab and catching location. The reason why the final weight does not directly affect the value distribution throughout the supply chain is because the quantity ratios applied are based on the % of yield loss between processes. Hence, the relative relation between steps remains the same, regardless of the original weight applied.
Debt cycle Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Fishers	It is assumed that fishers are trapped in a debt cycle with collectors.	This has been sourced from other reports as well as confirmed with input from experts in the fishery. Collectors not only finance fishing operations but also schooling or housing related costs. Hence, costs have been included at the fisher level to account for non-fishing expenses covered by collectors. This is a conservative measure.

APPENDIX KEY ASSUMPTIONS FOR COLLECTORS

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions			
Data indicator	Value chain step	Assumption	Rationale
Selling price Province: Lampung Gear type: Gillnet and Trap	Collectors	The selling price is based on values from Lampung. It is assumed that this is representative across provinces.	This is because there is no data on selling price in other provinces.
Cost of cooking BSC Province: East Java Gear type: Gillnet and Trap	Collectors	The cost of cooking is based on values from East Java. It is assumed that this is representative across provinces.	This is because there is no data on cost of cooking in other provinces.
Costs Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Collectors	It is assumed that the costs at the collector level are based on the cost of steaming and the cost of produce (i.e., live crab from the fishers).	No other data points on costs have been found.

APPENDIX KEY ASSUMPTIONS FOR MINI-PLANTS

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions for Mini-plants			
Data indicator	Value chain step	Assumption	Rationale
Selling price Province: Lampung Gear type: Gillnet and Trap	Mini-plants	The selling price has been provided within a range. It is assumed that during the high season, the selling price is on the lower range provided; during the medium season, the selling price is on the average range; during the famine season, the selling price is on the higher range. Further, the selling price is based on values from Lampung. It is assumed that this is representative across provinces.	Each season has different prices representing market dynamics of the fishery. Further, no data on selling price is available in other provinces.
Cost of processing BSC Province: East Java Gear type: Gillnet and Trap	Mini-plants	The value is the cost of processing BSC at East Java. It is assumed to be representative of all provinces.	This is due to lack of data.
Costs Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Mini-plants	It is assumed that the costs at the mini-plant level are based on the cost of processing (i.e., picker fee and ice) and the cost of produce (i.e., steamed crab from the collectors).	No other data points on costs have been found.

APPENDIX KEY ASSUMPTIONS FOR PROCESSORS (1/2)

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions for Processors			
Data indicator	Value chain step	Assumption	Rationale
Maximum markup % Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Processors	It is assumed that the maximum markup percentage of processors is 25%. With this assumption, it is possible to estimate the cost of processing BSC.	No data on cost of processing has been found. By reversing the logic of this assumption, it is possible to estimate the cost of processing incurred.
Costs Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Processors	It is assumed that the cost for processors is the cost of produce from the mini-plants and the estimated cost of processing.	No other data points on costs have been found.
Average yield after pasteurization and processing Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Processors	It is assumed that the percentage of yield at the processing level with respect to the average weight of a crab is the same percentage as in the mini-plant level.	This is because the meat that is picked at the mini-plants is then received, checked for quality, and sorted before storing into cans. They are then pasteurized to preserve the quality. Hence, no yield of meat is lost in between.

APPENDIX KEY ASSUMPTIONS FOR PROCESSORS (2/2)

The following table summarizes the key assumptions taken to successfully complete the project based on the available data

Key Assumptions for Processors			
Data indicator	Value chain step	Assumption	Rationale
Quantity ratios Province: Lampung, Central Java, East Java, West Java Gear type: Gillnet and Trap	Processors	It is assumed that there is a 100% efficient processing and management of BSC at the processing facilities.	This is because the percentages of yield with respect to the average weight of a crab used are based on the maximum values provided by the source. Hence, there is no percentage loss in the calculations of quantity ratios.

APPENDIX REFERENCES

The following is a list of references consulted to perform this analysis

References

Blue Green Advisors (2022). “2021 Baseline State of the Fishery: Blue Swimming Crab Fishery”.

Bioflux (2019). “Financial analysis in the exploitation of blue swimming crab *Portunus pelagicus* in Banten Bay, West Java, Indonesia”.

Birdsall, N. & Meyer, C. J. (2015). The Median is the Message: A Good Enough Measure of Material Wellbeing and Shared Development Progress. Global Policy.

Fairtrade (2019). “Living Income Reference Price model”.

Global Marine Commodities (2020). “Gender Analysis and Mainstreaming in the Indonesian Tuna Pole and Line and Blue Swimming Crab Fishery Improvement Projects”.

Gray, B. & Sites, J.P. (2013). *Sustainability through Partnerships: Capitalizing on Collaboration*. Network for Business Sustainability. Retrieved from: nbs.net/knowledge.

Harbor Seafood (2017). “Jepara Regency Blue Swimming Crab Gillnet Fishery Improvement Plan Assessment”.

MNAG (2015). “Indonesian Blue Swimming Crab FIP”.

Pathak, N. et al. (2019). “Pre-Processing Yields of Blue Swimming Crabs Collected From Different Crab Collection Points in South-East Coast of India”.

Rare. (2018). “To save for the future, Filipino fishers bank on each other”.

Schield, M (2018). Statistical Literacy and the Lognormal Distribution. *Section on Statistical Education*.

Starling Resources (2019). “Blue Swimming Crab Sustainable Fisheries Initiative”.

The World Bank (2012). “Evaluation of New Fishery Performance Indicators (FIPs): A case study of the Blue Swimming Crab Fisheries in Indonesia and Philippines”.

Vivid Economics (2014). “Towards Investment in Sustainable Fisheries: Financing the Transition of Blue Swimming Crab in Indonesia”.

Wage Indicator Foundation (2016). “Living wages in Indonesia”.

Address: Haarlemmerplein 2, 1013 HS, Amsterdam
Site: **www.impactinstitute.com**
Facebook: /impactinstitutecom
Twitter: impact_inst

Tel.: +31 202 403 440
Mail: info@impactinstitute.com