Applicability of Adaptive Co-Management within Indonesian Small-Scale Fisheries.

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Small-Scale Fisheries (SSF) governance has historically excluded small-scale fishers from participating in decision-making processes, negatively influencing millions of livelihoods. Governance of SSF is complex due to interactions between users and the environment, both with varying influence on the system. Indonesia is of particular importance for SSF governance due to its archipelagic structure, fishing culture and the direct link between economic viability and SSF. Indonesian SSF provide livelihood, nutrition, and economic security to millions of fishers. Indonesian SSF however face, illegal and unreported fishing practices, fishing location disputes, pollution, poor living conditions, declining fish stocks and extreme volatile weather conditions. Effective governance strategies for SSF that can adapt to dynamic conditions within Indonesian SSF are critically needed. This thesis aims to explore the strength of adaptive co-management indictors present within Indonesian SSF, and how current governance of SSF can be transitioned, aiding in the transition of these fisheries from vulnerability to viability. Adaptive co-management is a governance approach that combines co-management and adaptive management, while integrating the practices of learn-by-doing, social memory and social networks into governance proceedings. This thesis indicates that adaptive co-management is an effective governance approach for complex social-ecological systems such as SSF. With adaptive co-management providing an avenue to facilitate vulnerable to viable SSF transitions. Long-term institutional support, effective capital building and social capital, were the strongest indicators of adaptive co-management, marking these critical for future development in SSF.

Keywords: Social-Ecological System, Governance, Adaptive Co-Management, Sustainability, Small-Scale Fisheries.

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Dedication

I dedicate this thesis to my friends and family, along with the small-scale fishers of Indonesian small-scale fisheries.

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List of Abbreviations

ACM Adaptive Co-Management.

IUU Illegal, Unreported and Unregulated Fishing Practices.

SSF Small-Scale Fisheries.

SES Social-Ecological System(s).

V2V Vulnerable to Viable.

Chapter 1 Introduction

1.1 Problem and Background

Small-Scale Fisheries (SSF) are vital for sustaining livelihoods and the economic prosperity of millions of fishers globally. SSF, however, have historically, and continue to be, excluded from decision-making processes in SSF governance (Berkes, 2005; Berkes, 2007; FAO, 2023; Winter et al., 2023). Despite heavy economic contributions to developing nation economies SSF are excluded from decision-making processes within this sector (Berkes, 2005; Berkes, 2007; Issacs, 2013; Sowman et al., 2014; Winter et al., 2023). SSF are not the same as large-scale fisheries and have their own contextual definitions. SSF use minimal technology, fish in local waters, sell fish locally or consume their catch, have boats less than 12 meters in length, and have a total boat weight of less than 5 GT (gigatons) (Bakiu et al., 2018; FAO, 2015; Mozumder et al., 2020). SSF additionally, provide avenues for poverty alleviation and food security for vulnerable communities (Barnes-Mauthe et al., 2013; FAO, 2020). Understanding SSF governance is critical as SSF can address various United Nations Sustainable Development Goals (SDGs) including, SDG #1 – No Poverty, SDG #2 – Zero Hunger, SDG #5 – Gender Equality, SDG #10 – Reduced Inequalities, SDG #11 – Sustainable Cities and Communities, and SDG #14 – Life Below Water (United Nations, 2015, https://sdgs.un.org/goals). Finding governance tools for SSF is therefore critical, not only for the sustainability of SSF, but for the facilitation of vulnerability to viability transitions for fishers.

Governance within SSF has historically been top-down and centralized. These command-and-control governance approaches have kept small-scale fishers in a state of vulnerability, as

they are unable to voice their perspectives on governance decisions (Berkes, 2005; Berkes, 2007; Trimble & Ostrom, 2015; Winter et al., 2023). Top-down governance works on a hierarchical level of communication, with higher levels of governance not collaborating with lower levels of governance, reducing communication (Berkes & Nayak, 2018). Due to the exclusion from decision-making processes in top-down governance, SSF have seen increased competition, a decline in marine fish catch and overall exploitation (Berkes, 2005; Mozumder et al., 2020). SSF are being kept in a state of vulnerability, as their opinions, values, and beliefs are not considered in governance decision-making processes.

Bottom-up governance approaches within SSF have been scarcely implemented. . Governance approaches including Community-Based Management (CBM) (Berkes, 2005; Gurney et al., 2016; Leopold et al., 2013; Thompson et al., 2003; Wiber et al., 2004), co-management (Alexander et al., 2015; Carr & Heyman, 2012; d'Armengol et al., 2018; Jentoft, 2005; Kushardanto et al., 2022), and adaptive co-management (Folke et al., 2005; Berkes, 2007; Armitage et al., 2009) are emerging bottom-up governance approaches for SSF, but still fail to adequately address the livelihood needs of fishers. A new governance approach, adaptive co-management, has emerged out of co-management governance to aid in understanding dynamic social-ecological systems (Armitage et al., 2007; Armitage et al., 2009; Berkes, 2007; Folke et al., 2005). Understanding how adaptive co-management can influence the governance of SSF is vital in order to aid in the facilitation of these communities from vulnerability to viability.

The vulnerable to viable transitions that occur within SSF should be understood as a continual process and not static. Dias et al., (2023), defines vulnerability as the lack of community resilience and capacity to absorb and overcome dynamic events influenced by social, economic and environmental drivers. Viability, however, is defined by Dias et al., (2023) and Nayak & Berkes, (2019), as the transformation of vulnerable communities into viable communities, through increasing capacity to navigate and adapt to changing conditions, through the integration of social capital and networks between users. Understanding how adaptive co-management can facilitate vulnerable to viable transitions within SSF can increase the understanding of these transitions.

Adaptive co-management is a governance approach for social-ecological systems governance that offers an avenue to facilitate vulnerable to viable transitions. Adaptive co-management is a governance approach implemented within social-ecological systems that relies on the knowledge of local users, institutional linkages, social capital and networks and learn-by-doing approaches, to build the systems adaptive capacity and resiliency to uncertainty (Armitage, 2007; Armitage et al., 2009; Armitage et al., 2007; Berkes, 2007; Plummer et al., 2013; Folke et al., 2005). Adaptive co-management has emerged as a governance tool for social-ecological systems through existing co-management and adaptive management literature (Armitage et al., 2007; Armitage et al., 2009; Folke et al., 2005). Adaptive co-management is a form of governance that requires social capital, social networks at vertical and horizontal scales and learn-by-doing approaches to inform and facilitate governance (Armitage et al., 2009; Armitage, 2007; Folke et al., 2005; Plummer et al., 2013). Adaptive

co-management applicability within the context of SSF needs to be further examined to determine how it can facilitate viable governance processes within fisheries.

1.2 Importance of Problem for Indonesian SSF

Understanding the adaptive co-management applicability within Indonesian SSF is vital. Indonesia is an important study site for this thesis research because they are the largest archipelagic country in the world, with over fifty percent of the population's animal consumption coming from fish products (Warren & Steenbergen, 2021). There are over six million fishers in Indonesia that are directly reliant on the production of SSF, with over 90% of total fisheries production in Indonesia coming directly from SSF (Warren & Steenbergen, 2021; FAO, 2024). Indonesian fisheries governance is critical as Indonesia is the second largest global contributor of aquatic fish species and since 1961 fish consumption within Indonesia has increased over thirty percent (FAO, 2024). Despite incredible importance of SSF in Indonesia there are calls for increased governance viability.

SSF within Indonesia have received little governance attention. The Indonesian population of small-scale fishers are under immense stress of SSF collapse (Warren & Steenbergen, 2021; FAO, 2024). Calling for sustainable and viable SSF governance strategies that can mange the complexity of Indonesian SSF. Halima et al., (2019), notes that within Indonesia SSF require specific governance approaches due to the complexity of relationships of regulations, rules and norms intersecting these fisheries. Additionally, Warren & Steenbergen, (2021), state that more attention is required on the governance of the small-scale fishing sector in Indonesia.

Increasing the governance attention provided to SSF within Indonesia can aid in facilitating the transition of SSF from vulnerability to viability.

Within Indonesia governance structures, relationships and entities take varies forms. Tambak Bulusan and Purwoejo have sticky relationships with governance structures and processes within SSF. Fishers have noted difficulties in receiving capital from admin requests and proposals. Additionally, within these SSF although governance of the SSF is done collaboratively with fishers, they have little control over the management and enforcement of fisheries rules, boundaries, and decision-making processes. Fishery leaders are legitimized by federal level government officials, but the heads of fishery and fish port enforcement agencies are appointed directly from government officials, not the fishers themselves. Finding effective governance strategies that can improve the relationships, process and management of SSF within Indonesia is critical for viable communities.

1.3 Gaps in Literature

Based on a thorough review of the SSF governance literature, various gaps and areas for development were discovered. This thesis research generates knowledge and ideas on literature gaps within adaptive co-management and SSF governance, contributing to improved SSF governance, increased awareness of vulnerable to viable transitions within SSF and provides a dynamic understanding of SSF.

The gaps in literature to be addressed within this thesis are as follows. Armitage, (2007), indicates difficulties in increasing the adaptive capacity of social-ecological systems in commons spaces, where individual livelihoods are interconnected with system outcomes.

Nayak, (2014), notes that classifying SSF as social-ecological systems aids in understanding the dynamic social and environmental interactions intersecting these systems. Berkes, (2011), explains that SSF within social-ecological systems requires effective governance strategies and increased understanding of these strategies is needed. Halima et al., (2019), indicates that SSF within Indonesia require increased knowledge on governance processes as fisheries are difficult to regulate and have, their own rules and norms. Warren & Steenbergen, (2021), identify increased research needs within SSF in Indonesia to understand the complex relationships of governance that intersect them. Lastly, Dias et al., (2023), notes that there is an increased need to understand vulnerable to viable transitions within SSF and what is influencing them. These gaps were answered through the objectives of this thesis research.

1.4 Purpose Statement

The purpose of this thesis is to understand the applicability of adaptive co-management within Indonesian SSF, while determining how adaptive co-management can facilitate vulnerable to viable transitions. Adaptive co-management is defined by Armitage, (2007), Berkes, (2007); Plummer et al., (2013), and Folke et al., (2005), as a governance approach for social-ecological systems integrating ecological knowledge of users, institutional linkages, social capital, social networks, and learn-by-doing approaches, to understand the dynamic change intersecting the systems, building adaptive capacity and resilience (Armitage, 2007; Armitage et al., 2009; Armitage et al., 2007; Berkes, 2007; Plummer et al., 2013; Folke et al., 2005). Multiple data collection methods were employed to understand the objectives of this

thesis, including qualitative observations, household surveys, semi-structured interviews and qualitative illustrations (see Chapter 2 – 2.3. Data Collection).

1.5 Thesis Objectives

This thesis research has three main objectives that are answered in the following subsequent content chapters. Below is an overview of the objectives that this thesis research will aim to understand by the end of this paper.

1) The first objective of this thesis is to identify the economic, social and environmental characteristics intersecting SSF in Indonesia, and determine the most influential characteristics.
2) The second objective of this thesis is to understand the adaptive co-management indicators present within SSF in Indonesia, determining if adaptive co-management can be transitioned to as a form of SSF governance.
3) The third objective of this thesis is to determine how the adaptive co-management indicators can facilitate or not, the vulnerability to viability transitions within Indonesia SSF.

1.6 Thesis Road Map

The purpose of this thesis is to understand the applicability of adaptive co-management within Indonesian SSF, while determining how adaptive co-management can facilitate vulnerable to viable transitions. The following section (Chapter 2) of this thesis will provide an overview of the research methods, methodology and data analysis procedures. Chapter 3 will classify SSF in Indonesia as social-ecological systems, bring increased attention to the

characteristics influencing the governance of SSF in Indonesia, and identify pathways to viability for Indonesia SSF. Chapter 4 will identify adaptive co-management indicators intersecting SSF in Indonesia, bring increased attention to the governance of SSF within Indonesia, and identify the evolutional ability of current SSF governance within Indonesian. Chapter 5 will provide an understanding of the adaptive co-management indicators ability to facilitate or not, vulnerable to viable transitions within Indonesian SSF. Following Chapter 5, Chapter 6 will provide a summary of the objectives, results, contributions, and a set of recommendations for Indonesian SSF governance moving forward. The thesis will be concluded with a reference list and subsequent appendix pages.

Chapter 2 Research Methodology and Methods

2.1 Research Design

This research takes the form of a qualitative case study analysis of the SSF in Indonesia. A case study was utilized as the structure for this thesis as adaptive co-management indicators were tested within two small-scale fishing communities to determine their context specific relationships with these indicators. A case study as defined by Creswell & Creswell, (2023), is when the researchers develop a comprehensive understanding of the problem in relation to the study site, where cases are coupled with time and setting specific characteristics, while data is collected over a sustained duration. A qualitative design was utilized for this thesis as data collected and the overall structure of the study follows a qualitative format, employing open ended questions, observations and illustrations (Creswell & Creswell, 2023). Additionally, this research worked inductively, by establishing common themes and working between data, and deductively, by examining the data and determining if more data was required to support the themes (Creswell & Creswell, 2023). This qualitative approach to research allows for a comprehensive understanding of the key themes, ideas, and findings of adaptive co-management dynamics intersecting SSF within Indonesia.

This thesis conducts research from a pragmatic worldview. Pragmatism is defined by Creswell & Creswell, (2023), as understanding the world as independent and interconnected with the mind, while having the freedom of choice to determine the methodological structure of research. Pragmatic research has historically been conducted within social, historical and political contexts, where problems have deep connections to the livelihoods of individuals

(Creswell & Creswell, 2023). A pragmatic worldview for this research is justified as the research takes place within the social, historical and traditional context of small-scale fishers, while employing qualitative forms of data collection.

2.2 Data Collection

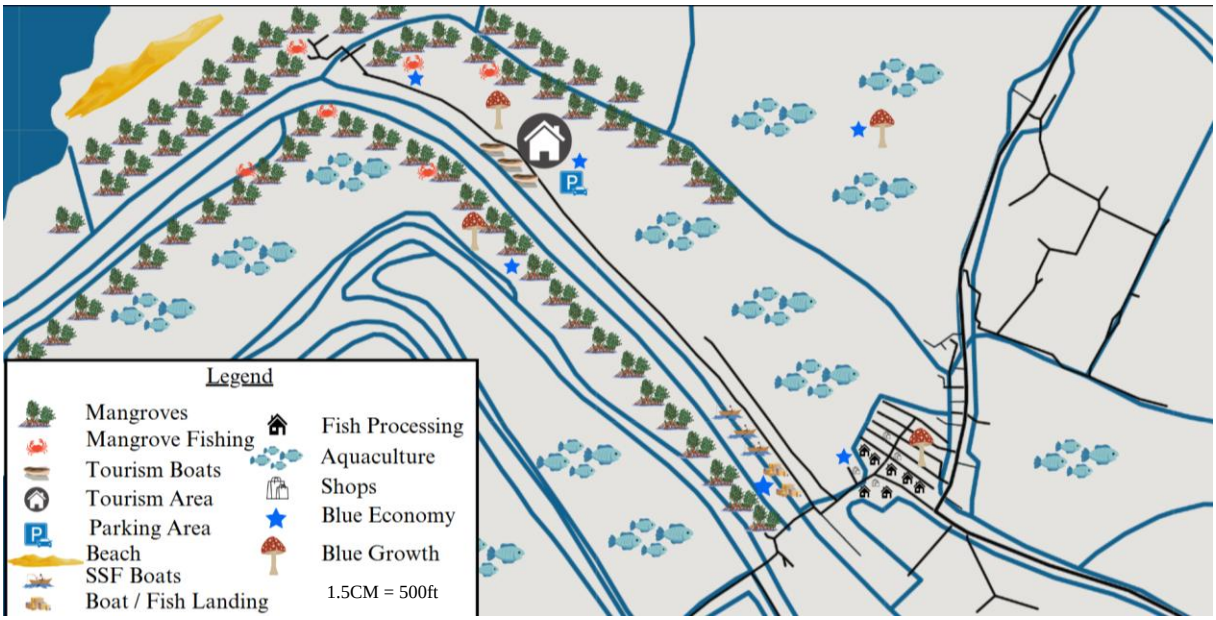
Multiple qualitative data collection strategies were employed to understand the applicability of adaptive co-management within SSF in the Demak Regency of Indonesia. Qualitative observations and illustrations, household surveys and semi-structured interviews were utilized within this thesis research.

Qualitative observations were utilized within this thesis research. Qualitative observations as defined by Creswell & Creswell, (2023), are the field notes completed by researchers in the field during data collection regarding behaviour and interactions of participants under study. Observations were utilized within the first content chapter of this thesis to understand the social, economic, and environmental dynamics intersecting the SSF of study. Observations within Tambak Bulusan and Purwoejo indicated what observed social, environmental and economic dynamics could be seen intersecting each SSF. These observations were coupled with semi-structured interviews to create qualitative illustrations of Tambak Bulusan and Purwoejo. These illustrations mapped the social, economic and environmental dynamics influencing each fishing community.

Illustrations were utilized within this thesis research to visualize the social, economic and environmental dynamics operating within and influencing the SSF of study. These illustrations are a combination of first-hand qualitative observations and semi-structured

interviews that were employed within each SSF. Figure 1 represents the combined observational and semi-structured interview data from Tambak Bulusan, representing the social, economic and environmental dynamics intersecting the SSF.

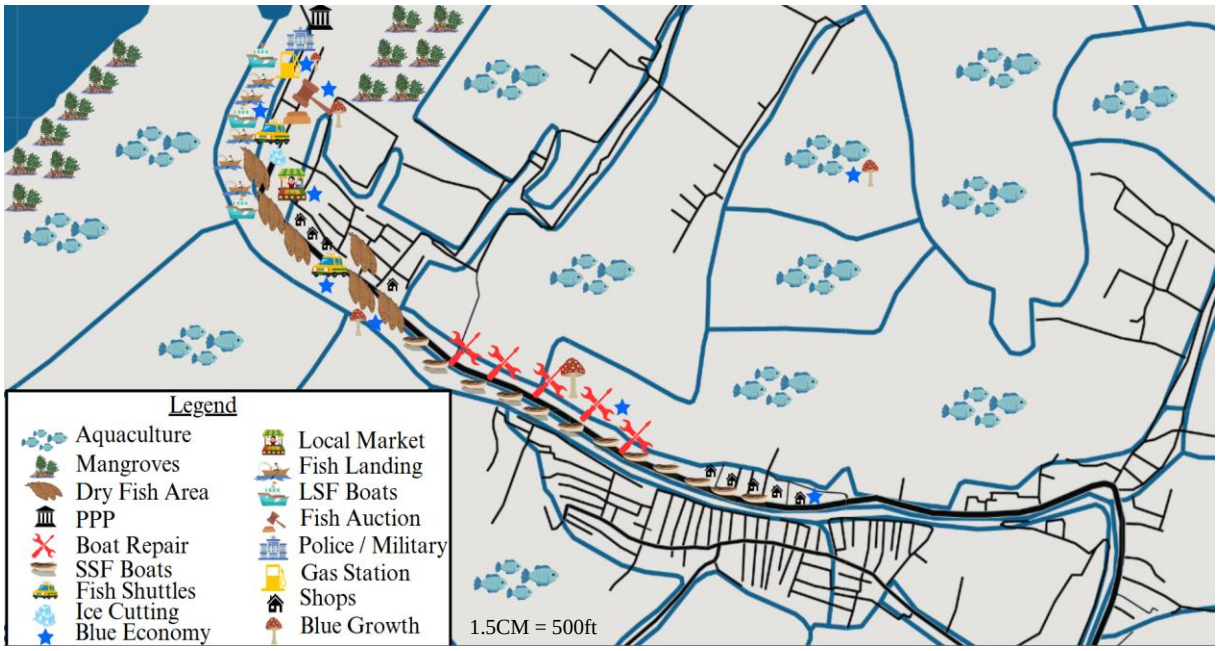
Figure 1: Illustrative Survey of Economic, Social and Environmental Dynamics Intersecting the SSF of Tambak Bulusan, Demak, Indonesia.



(Primary Observation & Semi-Structured Interview Data, 2024).

Figure 2 represents the combined observational and semi-structured interview data from Purwoejo, representing the social, economic and environmental dynamics intersecting this SSF.

Figure 2: Illustrative Survey of Economic, Social and Environmental Dynamics Intersecting the SSF of Purwoejo, Morodemak, Demak, Indonesia.



(Primary Observation & Semi-Structured Interview Data, 2024).

These illustrations (Figure 1 & 2), coupled with observational and interview data were used to answer the objective of the first content chapter.

Next, small-scale fisher household surveys were utilized to determine the objective for content chapters two and three. Qualitative surveys are defined by Jansen, (2010), as surveys that determine the diversity of the central phenomenon of study within a specific population, while establishing critical themes intersecting the population under study. Small-scale fisher household surveys were employed to determine the small-scale fisher perceptions of the adaptive co-management dynamics intersecting and influencing their community and fishery.

Household surveys with small-scale fishers tested 10 adaptive co-management indicators cited for successful adaptive co-management within social-ecological systems (see Table 2.1).

Table 2.1: Ten Adaptive Co-Management Indictors for Successful Adaptive Co-Management in Social-Ecological Systems.

Indicator	Works Evolved From
Well-Defined Resource System.	Armitage et al., 2007; Armitage et al., 2009; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Ostrom, 1990; Ostrom, 1994.
Community Collectivity.	Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Pomeroy et al., 2001; Ostrom, 1990; Ostrom, 2007.
Clear Property Rights.	Armitage et al., 2007; Armitage et al., 2009; Ostrom 1990; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Pomeroy et al., 2001; Ostrom, 2007.
Access to Adaptable Management Portfolio.	Armitage et al., 2007; Armitage et al., 2009; Berkes, 2007; Berkes, 2009; Folke et al., 2005.
Institutional Support.	Armitage et al., 2007; Armitage et al., 2009; Berkes, 2007; Berkes, 2009; Pomeroy, 1993.
Capital Building.	Armitage et al., 2007; Armitage et al., 2009; Berkes, 2009; Berkes, 2007; Pomeroy et al.,

	2001; Islam et al, 2023; Ostrom, 2007; Folke et al., 2005.
Leadership.	Armitage et al., 2007; Armitage et al., 2009; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Pomeroy et al., 2001; Berkes, 2007.
Community Participation.	Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Ostrom, 1990; Pomeroy et al., 2001.
Delegation of Authority.	Pomeroy, 1993; Susilowati and Budiati, 2003; Pomeroy and Williams, 1994; Pomeroy et al., 2001; Berkes, 2007; Armitage et al., 2009.
Community Empowerment.	Pomeroy et al., 2001; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003.

(Adapted from: Armitage et al., 2007; Armitage et al., 2009; Berkes, 2009; Berkes, 2007; Folke et al., 2005; Islam et al, 2023; Ostrom, 1990; Ostrom, 1994; Ostrom, 2007; Pomeroy et al., 2001; Pomeroy and Williams, 1994; Pomeroy, 1993; Susilowati and Budiati, 2003).

The ten adaptive co-management indicators in Table 2.1 were derived and compiled from the existing literature of adaptive co-management (Armitage et al., 2007; Armitage et al., 2009; Folke et al., 2005; Berkes, 2007), co-management (Pomeroy and Williams, 1994; Pomeroy et al., 2001; Pomeroy, 1993; Susilowati and Budiati, 2003; Berkes, 2009), common pool resource design principles (Ostrom, 1990; Ostrom, 1994), and social-ecological systems theory (Ostrom, 2007). Table 2.2 below outlines the systematic process of how the 10 adaptive

co-management indicators (see Table 2.1) were formulated and adopted from existing social-ecological systems governance literature. Table 2.2 identifies the step in the process, what the process was for each step and the articles discovered during in processing step.

Table 2.2: Outline of Process in Determining the 10 Adaptive Co-Management Indicators being utilized for Small-Scale Fisher Household Surveys.

Step.	Processes.	Articles Discovered.
1	I began with a reading list of current governance styles for social-ecological systems. This list was discovered from articles in various databases including Scopus, UW Library, and Google Scholar. From this initial set of articles, I secondary sourced additional articles from these articles that related and included the key words for this research (see Table 5).	Armitage et al., (2009); Ostrom, (2007); and Folke et al., (2005).
2	After secondary sourcing of articles from the original set of articles, this process was continued with all articles found from the secondary sourcing process. This was done until saturation was believed to be achieved.	Armitage et al., (2007); Berkes, (2007) and Berkes, (2009).
3	After secondary sourcing reached saturation a preliminary set of adaptive co-management indicators were created. These adaptive co-management indicators were created and presented to scholars within Indonesia.	Armitage et al., (2009); Ostrom, (2007); Armitage et al., (2007); Berkes, (2007); Berkes, (2009). and Folke et al., (2005).
4	After this preliminary set of adaptive co-management indicators was presented, further articles were explored with specific context and relation to the field of co-management and governance of Indonesian SSF.	Pomeroy and Williams, (1994), and Susilowati and Budiati, (2003).
5	After these new articles were read, secondary sourcing and a search of Scopus, Google Scholar and the UW Library was conducted to find other relevant articles (see Table 5 for inclusion criteria).	Pomeroy, (1993); Pomeroy et al., (2001); Islam et al., (2023).
6	Once saturation was met with the final round of article discovery, a final set of adaptive co-management indicators needed for successful adaptive co-management were created. These indicators were then tested and discussed with Indonesian professionals before proceeding with data collection.	Pomeroy and Williams, (1994); Susilowati & Budiati, (2003); Pomeroy, (1993); Pomeroy et al., (2001); Islam et al., (2023); Armitage et al., (2009); Ostrom, (2007); Armitage et al., (2007); Berkes, (2007); Berkes, (2009). and Folke et al., (2005).

(Lister, 2025).

Within the third and sixth steps of the above systematic process outlined in Table 2.2 saturation of articles is mentioned. Saturation as defined by Creswell & Creswell, (2023) is the ceasing of data collection due to the fact that sufficient forms and amounts of data have been collected relating to the overall theme of the research – adaptive co-management.

Table 2.3 below indicates the criteria that was used to determine what articles, books and journals to include within the selection of adaptive co-management indicators tested for household surveys.

Table 2.3: Criteria to be included in 10 Adaptive Co-Management Indicators for Successful Governance.

Number	Criteria.
1	Articles must focus on and contain the keywords of adaptive co-management, co-management, or adaptive management. Articles must also include social-ecological systems and small-scale fisheries (SSF). Additionally, articles that had links to adaptive co-management and Indonesia were included.
2	Articles must be accessible via the University of Waterloo Institutional access, Scopus, and/or Google Scholar.
3	Articles must be in Word, PDF or Book file formats, no other formats were included.
4	Articles with historical context of fisheries governance were included. Any articles included within the selection of adaptive co-management indicators to test in household surveys must be within the past 30-35 years, up until 1990.

(Lister, 2025).

Therefore, based on this extensive review of social-ecological system governance literature the 10 adaptive co-management indicators in Table 2.1 were created as the 10 most influential indicators at determining effective adaptive co-management within social-ecological systems. Small-scale fisher household surveys were utilized to answer the objectives of content chapter two and three.

After household surveys were completed with small-scale fishers within the SSF of study, semi-structured interviews with fishery and institutional leaders were conducted. Semi-structured interviews as defined by Knott et al., (2022), are flexible interviews, allowing for topics, ideas, and questions to be examined as they arise in further detail or passed upon if determined to be irrelevant for the topic of research. This allows the unseen data along with the seen data to be understood, explored and incorporated within data collection, enriching the content for data analysis (Knott et al., 2022). Semi-structured interviews enabled the observable and unobservable adaptive co-management to be included within the data collection of this thesis research.

Semi-structured interviews were utilized to answer the objectives of multiple content chapters within this thesis. The integration of semi-structured interview data expanded the depth and breadth of information intersecting this thesis. Table 2.4 explains the methods utilized within this thesis and how they were applied to the context and objectives of this thesis. Table 2.4 states the method, its methodology, the content chapter that uses the method and the objective of the content chapter that the specific method helps inform.

Table 2.4: Overview of the Methods Used and How They Informed the Research Objectives of this Thesis.

Objective.	Purpose.	Sampling Technique.	Data Collection Technique.	How Data Collection informs Objectives.
1	Identify the economic, social and environmental characteristics intersecting SSF in Indonesia, and determine the most influential characteristics.	Purposeful Sampling.	1. Observations. 2. Semi-Structured Interviews.	Observations provide an overview of the seen social, environmental, and economic characteristics intersecting SSF, from an outside perspective. While semi-structured interviews provide an overview of the unseen social, economic and environmental characteristics intersecting SSF, that can only be understood from the internal community dynamic.
2	Understand the adaptive co-management indicators present within SSF in Indonesia, determining if adaptive co-management can be transitioned to as a form of SSF governance.	Purposeful Sampling.	1. Household Surveys. 2. Semi-Structured Interviews.	Household surveys with fishers provided an understanding of the adaptive co-management dynamics intersecting the SSF from the views of fishers themselves. While semi-structured interviews were used to discover further depth of these adaptive co-management indicators intersecting Indonesian SSF by exploring the findings of the household surveys further and providing the view of leaders within SSF on adaptive co-management dynamics.
3	Determine how the adaptive co-management indicators can facilitate or not, the vulnerability to viability transitions within Indonesia SSF.	Purposeful Sampling.	1. Household Surveys. 2. Semi-Structured Interviews.	Household surveys provide an understanding of what adaptive co-management indicators, according to fishers, are the most influential at sparking the vulnerable to viable transition within Indonesian SSF. While semi-structured interviews provided an understanding of the adaptive co-management indicators from a leader perspective that can facilitate or not vulnerable to viable transitions within Indonesian SSF.

(Lister, 2025).

2.3 Sampling

The sampling procedures for this thesis research took place in three stages. Purposeful sampling was conducted for this thesis research to determine the communities of study, the fishers to include in household surveys and the fishery and institutional leaders to include in semi-structured interviews. Purposeful sampling as defined by Creswell & Creswell, (2023), is when individuals or study locations are selected for participation that will help to understand the specific study objectives and research questions. Purposeful sampling was used for this thesis as specific study sites, household survey and interview participants were required.

The first round of sampling was directed at selecting the study sites for this thesis. To determine the two study sites for this thesis case, purposeful sampling was conducted. The purposeful sampling criteria that were used to determine the study locations for this qualitative thesis case study were as follows:

1. The community must have at least 50% of its residents being small-scale fishers.
2. The community must be relatively close to Semarang, Indonesia.
3. There must be co-management or collaborative management practices already established in the communities.
4. The communities must have connections to the Universitas of Diponegoro, Indonesia.

The first sampling criteria was used to determine the study locations for this thesis research because the main focus of this thesis is on SSF. Communities to be included within this thesis research must have therefore had at least 50% of its population being classified as small-scale

fishers in the context of Indonesia. The second sampling criteria was including in the purposeful selection of study sites for this thesis research because I was staying in Semarang, Indonesia for the duration of my field research. Having communities relatively close to Semarang, Indonesia allowed for easy transportation to and from communities during data collection. The third sampling criteria was included to purposefully sample communities for this thesis research as collaborative management and co-management dynamics are essential to the foundation of this research. The fourth sampling criteria was including in the purposeful selection of communities for this thesis research because my co-supervisor and host institution was located within the Universitas of Diponegoro (UNDIP), Semarang, Indonesia. Communities that already had established connections to UNDIP allowed for the facilitation of data collection and collaboration between me, UNDIP and the communities.

Based on this purposeful sampling criteria, the two small-scale fishing communities of Tambak Bulusan, and Purwoejo, Morodemak, Demak, Indonesia were selected for this thesis research. Figure 3 indicates a map of the two study sites sampled for this thesis research.

Figure 3: Map of Location of the Two SSF Selected for this Thesis Research.

Demak Region, Java, Indonesia.

Tambak Bulusan + Purwoejo, Morodemak.

After the first round of sampling was completed and the two SSF were selected, the second round of purposeful sampling was conducted. The second round of purposeful sampling was conducted to determine the small-scale fishers that would be included in household surveys. The purposeful sampling criteria for small-scale fishers for the two small-scale fishing communities of Tambak Bulusan and Purwoejo were:

1) The small-scale fisher must have a fishing vessel with a total weight of 5 GT (gigatons) or less.

2) The small-scale fisher must be from either Tambak Bulusan or Purwoejo.
3) The small-scale fisher must have been participating in the SSF sector for at least five years.
4) The majority of the income for the small-scale fisher must come from small-scale fishing activities.

Table 2.5 below indicates the small-scale fisher demographics for the fishers included within household surveys in Tambak Bulusan.

Table 2.5: Household Survey Demographics for Small-Scale Fishers in Tambak Bulusan.

Demographic.	Descriptor.	Number of Participants.	Percentage.
Gender	Male.	40	100%
	Female.	0	0%
Occupation	Small-Scale Fishers.	40	100%
Income - Fishing Season.	>$2,000,000 IDR ($200 CAD).	Variable.	-
Income - Non-Fishing Season.	<$2,000,000 IDR ($200 CAD).	Variable.	-

(Primary Household Survey Data, 2024).

Table 2.6 below indicates the small-scale fisher demographics for the fishers included within household surveys in Purwoejo.

Table 2.6: Household Survey Demographics for Small-Scale Fishers in Purwoejo.

Demographic.	Descriptor.	Number of Participants.	Percentage.
Gender	Male.	79	100%
	Female.	0	0%
Occupation	Small-Scale Fishers.	79	100%
Daily Income - Fishing Season.	$500,000 - $2 Million ($100-$200 CAD).	Variable.	-
Daily Income - Non-Fishing Season.	$100,000 - $500,000 IDR ($30-$50 CAD).	Variable.	-

(Primary Household Survey Data, 2024).

In both Table 2.5 and 2.6 above it is noted that the gender of small-scale fishers sampled to partake in household surveys were predominantly male. This is a limitation of this research due to the purposeful sampling requirements carried out within this research women were excluded within surveys results. This is due to the Indonesian culture, as many woman do not participate within the harvesting processes of SSF and participate more in post-harvesting. If women within the SSF met the purposeful sampling criteria they would have been included.

The first sampling criteria was included in the purposeful sampling of small-scale fishers as the Indonesian communities of Tambak Bulusan and Purwoejo identified small-scale fishing vessels as any vessel of 5 GT (gigatons) or less. Any vessel that was classified above 5 GT was not included within the sample for small-scale fisher household surveys. The second sampling criteria was included within the purposeful sampling of small-scale fishers as the two

communities that were sampled in the first round of sampling were Tambak Bulusan and Purwoejo, Morodemak, Demak, Indonesia. The third sampling criteria was included within the sampling of small-scale fishers to get historical experiences from fishers operating within the fishery from previous years. Having fishers who have been operating within the fishery for more than five years increases the knowledge generated on feedback, knowledge sharing and leadership processes within SSF. The fourth sampling criteria was included within the purposeful sampling of small-scale fishers as the main livelihood dependency needed to be from fisheries. This was in part due to the main focus of this thesis being on SSF governance and only fishers who participated and were dependent on the small-scale fishing sector were sampled.

Based on this purposeful sampling criteria 119 small-scale fishers were sampled across the two SSF, including Tambak Bulusan and Purwoejo. Tambak Bulusan sampled 40 small-scale fishers for household surveys. While Purwoejo sampled 79 small-scale fishers for household surveys.

Table 2.7 identifies the fishing gear utilized by small-scale fishers surveyed in this chapter and is representative of the fishing gear utilized for all small-scale fishers within Tambak Bulusan. Table 2.7 states the type of fishing gear, its gear size, and what species is targeted.

Table 2.7: Fishing Gear Utilized by Small-Scale Fishers in Tambak Bulusan.

Fishing Gear	Gear Size	Targeted Species.
Gill Nets.	1-Inch Mesh Size.	Shrimp.
Gill Nets.	2-Inch + 3-Inch Mesh Size.	Pelagic Fish + Crabs.

(Primary Research Data, 2024).

Table 2.8 identifies the fishing gear utilized by small-scale fishers surveyed in this chapter and is representative of the fishing gear utilized for all small-scale fishers within Purwoejo. Table 2.8 states the type of fishing gear, its gear size, whether it is environmentally friendly or not, and what species is targeted.

Table 2.8: Fishing Gear Utilized by Small-Scale Fishers in Purwoejo.

Fishing Gear	Gear Size	Environmentally Friendly?	Targeted Species.
Sodo "Kuznets".	Large Scooping Nets.	No.	Various Species of Anchovies
Anchovy Nets.	Small Single Species Nets.	Yes.	Anchovies.
Butterfly Nets.	3 meters long by 1 meter deep.	Yes.	Anchovies.
Tiger Arad "Trawling".	Large Trawling Nets.	No.	Mackerel, Squid, Shrimp and Anchovies.

(Primary Research Data, 2024).

Once small-scale fishers completed household surveys, a third round of purposeful sampling occurred. The third round of purposeful sampling was conducted to determine the

fishery and institutional leaders that would participate in semi-structured interviews. The following criteria were the purposeful sampling criteria utilized when determining fishery and institutional leaders within each SSF sampled.

1) Must be a leader (fishery, government, or academic) in the community.
2) Must be partnered with Tambak Bulusan or Purwoejo, Morodemak.
3) Must work with small-scale fishers in the community.
4) Must be in a current position of leadership for at least three years in their respective community.

Table 2.9 below is an outline of the fishery and institutional leader demographics for both SSF of study.

Table 2.9: Semi-Structured Interview Participant Demographics.

Tambak Bulusan, Demak, Indonesia.			
Demographic.	Demographic.	Number of Participants.	Percentage.
Gender	Male	6	100%
	Female	0	0%
Occupation.	Fishery Leader(s)	2	33%
	Local Governmental Leader	1	16.67%
	Academic Institution	1	16.67%
	Tourism Leader	1	16.67%
	Manager of Fish Processing & Trading	1	16.67%
Purwoejo, Morodemak, Demak, Indonesia.			
Demographic	Demographic	Number of Participants	Percentage
Gender	Male	5	83.40%
	Female	1	16.60%
Occupation.	Fishery Leader(s)	3	50%
	Head of Woman Fishers and Processors.	1	16.67%
	Fishery Regulatory Authority	1	16.67%
	Academic Institution	1	16.67%

(Primary Semi-Structured Interview Data, 2024).

Table 2.9 above additionally indicates a disparity between the men and women who participated within semi-structured interviews. Due to purposeful sampling criteria and the structure of Indonesian leadership regimes, many leaders are men within governance processes. If women leaders met the criteria to be included within the research study, they were included.

The first sampling criteria was included in the purposeful selection of fishery and institutional leaders because interviews were focused on the views and responses from leaders within the communities. Leaders were required within this thesis research to determine the governance applicability of adaptive co-management within their communities and organizations. The second sampling criteria was included in the purposeful selection of fishery and institutional leaders as the two communities of study, determined from the first round of sampling were Tambak Bulusan and Purwoejo. Only governments, institutions, and organizations partners within the study sites were included within the sampling selection for fishery and institutional leaders. The third sampling criteria was included in the purposeful selection of fishery and institutional leaders as the main focus of this thesis study is SSF, their governance and viability strategies for these communities. The fourth sampling criteria was included in the purposeful sampling of fishery and institutional leaders because experience, history and knowledge of processes, connections and interactions between fishery and institutional leaders were required for semi-structured interviews.

Based on the third round of sampling, 12 fishery and institutional leaders were selected to participate within semi-structured interviews on adaptive co-management across both SSF

of study. Six fishery and institutional leaders were sampled from Tambak Bulusan. While six fishery and institutional leaders were sampled from Purwoejo.

2.4 Ethical Considerations

To carry out this research various permits and permissions were needed. First, ethical clearance was required by the University of Waterloo, Canada (see Appendix A), and the Universitas of Diponegoro, Indonesia (see Appendix B). These clearances were required as the research team would be asking questions to fishers, community leaders, government officials, and others within the community. Additionally, a requirement from the Indonesian federal government for the research VISA for the researcher was to obtain ethical clearance from the institution named BRIN, the Ethics and Research Licensing Submission Process of the Directorate of Research and Innovation Licensing Governance. Once ethical clearance forms were approved by the University of Waterloo, Canada, and BRIN, Indonesia, the researcher was able to obtain their research VISA and exit and re-entry permits.

Before the research was able to be conducted within the field, a permit was needed by the Faculty of Economics and Business Dean from the Universitas of Diponegoro. Once this form was approved, research was able to be conducted within the study sites. Once fieldwork started in Tambak Bulusan and Purwoejo, Morodemak, approval to conduct the research was needed by the community leaders and fishery authorities in each respective SSF community. This entailed signing information into logbooks and getting stamps of approval or verbal approvals from government and local officials. This approach is similar to the concept of gaining approval from gatekeepers as explained by Creswell & Creswell, (2023),

as the individuals who provide access to the research locations and allow research activities to be conducted within that location.

2.5 Data Analysis

To analyze the data gathered within this thesis a variety of data analysis procedures were completed and conducted. Data collected from qualitative observations and illustrations, household surveys and semi-structured interviews were analyzed.

First, observations were analyzed to aid in understanding the first objective of this thesis. Observational data for Tambak Bulusan and Purwoejo were collected through a researcher's journal. Table 2.10 indicates the overview of the data analysis procedures for observational data within this thesis.

Table 2.10: Overview of the Data Analysis Procedures for Observational Data in this Thesis.

Step.	Explanation.
1	Observational data was scanned and separated into the two separate small-scale fishing communities, Tambak Bulusan and Purwoejo.
2	After being separated into communities, observational data was split further into social, economic and environmental observations within each small-scale fishing community.
3	Once observations were split into social, economic and environmental categories, discoveries, linkages, connections and disparities were made regarding the data.
4	After social, economic and environmental data was analyzed and split, a preliminary set of social, economic and environmental factors that influence each SSF became known. This information was used to inform household surveys and semi-structured interviews.

(Lister, 2025).

After observational data was collected and analyzed small-scale fisher household surveys were conducted within Tambak Bulusan and Purwoejo. Small-scale fisher household surveys were utilized to answer the second and third objectives of this thesis. Table 2.11 indicates the data analysis procedures undertaken to analyze the responses from small-scale fisher household surveys.

Table 2.11: Overview of the Data Analysis Procedures for Small-Scale Fisher Household Surveys.

Step.	Explanation.
1	Household survey data, after being collected within each SSF, was scanned and secured in a OneDrive folder online that only I had access to.
2	Within the OneDrive folder, household surveys were split into two further folders of Tambak Bulusan and Purwoejo.
3	After data was organized within specific community folders, the data was inserted into Excel. Household survey data for each SSF and each fisher was uploaded to excel.
4	After the data from each community was uploaded to different excel sheets the data from each community evolved from numeric responses to a seven-point Likert scale (see Table 7 for breakdown).
5	After the household survey data was transitioned into qualitative responses the data was organized for each question within each SSF to determine the overall small-scale fisher responses to each question. Questions were summarized to show the total agree, disagreement and uncertain responses from small-scale fishers for each survey question.
6	After the total responses for each SSF were organized and understood tables, graphs and figures were created to visually represent the data.
7	Once data was organized into these tables, charts and graphs the best visualizations of the data were chosen to represent the household survey data from small-scale fishers.
8	After the data from small-scale fishers within each SSF was visually represented, this data was ranked. Household survey data was ranked to determine which adaptive co-management indicators small-scale fishers believed were intersecting and influencing their community.

(Lister, 2025).

Based on the data above in Table 2.11 household survey data evolved from a one-to-ten-point ranking scale to a seven-point Likert scale that best represented the responses from small-scale fishers. A Likert scale as defined by Batterton & Hale, (2017), is the measurement of participants' attitudes and opinions on the central topic of discussion and research. Table 2.12 indicates the breakdown of how the conventional, one to ten ranking system was broken down and converted into a seven-point Likert scale.

Table 2.12: The Parameters of Evolving Conventional Scale Data into Likert Scale Data for Small-Scale Fisher Household Surveys.

Numerical Scale.	Likert Scale Conversion.
9 and 10	Strongly Agree
7 and 8	Agree
6	Somewhat Agree
5	Uncertain
4	Somewhat Disagree
2 and 3	Disagree
0 and 1	Strongly Disagree

(Lister, 2024).

After household surveys were organized and analyzed the semi-structured interview data from fishery and institutional leaders within each community was analyzed. Semi-structured interview data was utilized to understand the third objectives of this thesis. Table 2.13 indicates the data analysis steps for analyzing semi-structured interview results from fishery and institutional leaders within Tambak Bulusan and Purwoejo.

Table 2.13: Overview of the Data Analysis Procedures for Fishery and Institutional Leader Semi-Structured Interviews.

Step.	Explanation.
1	Semi-structured interview data after being collected via audio recorder was immediately transferred into a secure OneDrive folder online that only I had access to.
2	Within the OneDrive folder, interview data was split into two further folders of Tambak Bulusan and Purwoejo.
3	Once audio files were uploaded to secure file folders, the audio files were transcribed and translated into English. This was done by one of the research team members collaborating with the Universitas of Diponegoro.
4	After data was translated and organized within specific community folders, an NVivo 15 account was created with the aid of technical support at the University of Waterloo, Canada.
5	Once an NVivo 15 account was created interview transcript data from each community was uploaded into NVivo in separate community folders.
6	Once interview data was transferred into NVivo three further folders were created under each small-scale fishing community, regarding the objectives of this thesis.
7	Interview data was then coded based on the objectives for each content chapter and this thesis and placed into the relevant folder within each community.
8	Data was organized for the first objective in each community into three further folders, including social, economic and environmental. The interview data for each community was coded and placed into each folder based on the key themes of social, economic and environmental influences within the community.
8-A	Based on the data that was organized within social, economic and environmental folders, connections, assumptions and inferences were made regarding these dynamic influences within SSF. Interview data was coupled with observation data to create qualitative illustrations of the dynamics intersecting the communities.
9	Data was organized for the second objective in each community by creating 10 sub folders within the second objective folder for each community. The 10 sub-section folders within each community for objective two enabled interviews to be coded for the specific information related to each specific adaptive co-management indicator.
9-A	Based on the organization of interview data into 10 adaptive co-management indicator folders, data was analyzed to determine which adaptive co-management indicators were the most influential and important as stated by fishery and institutional leaders.
10	To inform the third objective, interview data was ranked to determine the most influential adaptive co-management indicators at facilitating the vulnerable to viable transitions within each community.
10-A	Ranked results of interview data on adaptive co-management was compared with the rankings from small-scale fisher household surveys. After this comparison a defined set of adaptive co-management rankings for each community were discovered, informing the third objective if this thesis.

(Lister, 2025).

Table 2.13 notes that the data for semi-structured interviews was coded, which can be explained by Creswell & Creswell, (2023), as the process for organizing the data collected into key themes and segments, while writing a keyword that represents the overall category of the theme. After the completion of semi-structured interviews, the information to generate material for each thesis objective was discovered. Semi-structured interviews along with informing objectives for the second and third content chapters of this thesis, inform the first objective of this thesis. Semi-structured interview data was coupled with observational data from each fishing community to create qualitative maps of the seen and unseen social, economic and environmental dynamics influencing each community (see Figure 1 & 2).

Data for this thesis is presented in a multitude of formats to ensure visualization, understanding and conceptualization of the data. Tables are utilized to exemplify the expansive processes and results obtained from this thesis research. While illustrations and figures within this thesis aid in visually exemplifying conditions and locations of SSF within Indonesia.

2.6 Validation Strategies

To ensure the validity of the results and data collected within this thesis, validation of methods and results were conducted throughout this thesis research. Validity is essential within qualitative studies as ensuring accuracy of data from the researcher's standpoint must be understood (Creswell & Creswell, 2023). To ensure data collected within each community was accurate, multiple forms of qualitative data were collected, including qualitative observations, household surveys and semi-structured interviews. Using multiple forms of data

collection to acquire information on the research objectives can be defined as triangulation. Triangulation as defined by Creswell & Creswell, (2023) is the various different data sources utilized to examine evidence and build the correct themes and codes of the data. Triangulation aided in the validation of this thesis research.

Along with triangulation, data that was collected and analyzed was checked and corroborated by partners within the Universitas of Diponegoro. The Universitas of Diponegoro (UNDIP) was the host institution for this thesis research and also aided as translators within the field during data collection. The research team comprised of my co-supervisor from UNDIP, Prof. Indah Susilowati along with her team of eight research students from the vulnerability to viability global partnership. Working with local academics that have foothold within the Indonesian culture, fisheries and communities allowed information collected within this thesis to be checked by translators and researchers at UNDIP, ensuring results and data were accurate. Validating the results and data obtained for this thesis increases the reliability of the findings within this thesis research.

2.7 Limitations

This thesis research had limitations during its conduct. One limitation of this thesis was a time constraint on data collection. Time was a factor influencing this thesis research as there was only time or three months of data collection. Ensuring data could be collected within this time frame was essential for this thesis. Data collection was planned and conducted within this short time period, so it was difficult to obtain large numbers of interviews and surveys as data had to be collected for all three objectives.

Another limitation of this study is the lack of woman representation. This research lacked women representation within the samples due to the purposeful sampling processes that were undertaken. This research investigated fishers who partook in the harvesting side of SSF, which within Indonesia are predominantly men. Additionally, when sapling for leaders and partners within each SSF, due to the culture and structure of Indonesian leadership results were unexpectedly skewed towards men.

Lastly, language was a limitation of this study. There was a language barrier between me and the research participants within Indonesian SSF. To combat this, mutual partnerships with the Universitas of Diponegoro were carried out to aid with translation, cultural understanding, and transcription. With this language barrier data was translated multiple times from Indonesian to English. Data was translated by two translators from the University of Diponegoro, who also transcribed the data into full Indonesian text, and again into full English text. This is a limitation of this research as because the native language of the research participants is not the same as me, a variety of extra steps were required to get the data into English format, which may have impacted it. However, this was mitigated by having the translators who conducted the surveys and interviews conduct the transcription processes as they were familiar with the data collection.

Increasing the reach of this thesis research to include the perceptions of women on adaptive co-management indicators within their community would provide more depth and information regarding the most influential adaptive co-management indicators within each

SSF. The limitations of this thesis research were known and did not influence the outcome of the study.

2.8 Sharing of Outcomes

The results, outcomes, and conclusions discovered within this thesis will be shared and distributed to partners and governments within Indonesia. A copy of this thesis will be distributed and shared with researchers at the Universitas of Diponegoro, within the faculty of economics and business and marine and fisheries department. Additionally, a copy of this thesis will be provided to the local governments and marine and fisheries government services within the small-scale fishing communities that were included within this study. This will be done through the distribution from Indonesian partners with the university of Waterloo, Canada. Sharing the outcomes of this research will enable governance processes for SSF within Indonesia to improve aiding in the facilitate of vulnerable to viable transitions for SSF.

Chapter 3 Social, Economic, and Environmental Dynamics Intersecting Small-Scale Fishing Communities in the Demak Regency of Indonesia.

3.1 Introduction

Coastal Small-Scale Fisheries (SSF) are complex and dynamic, often influenced by multilevel drivers. Effective governance is required to govern SSF. SSF operate using minimal technology and energy while fishing, fish in locally known waters, eat fish for consumption, sell fish within local markets, have fishing vessels less than 12 meters in length and have a total weight of less than 5 GT (gigatons) (Bakiu et al., 2018; FAO, 2015; Mozumder et al., 2020). SSF require specific governance strategies because they are highly vulnerable to social and ecological change (Dias et al., 2023; Nayak, 2014). Understanding the dynamic interplay between social, economic and environmental characteristics within SSF can aid in understanding the transition of SSF from vulnerability to viability.

SSF can be described as a commons. A commons is a dynamic and complex system, collectively shared by the diverse users that interact with it (Berkes, 2005; Nayak & Berkes, 2021; Ostrom, 1994). A commons is a common-property resource source such as a fishery, where various actors interact with the resource at varying scales, either through subtraction or exclusion (Berkes, 2005; Ostrom, 1994; Schlager & Heikkila, 2011). Subtraction in a commons is when one user's subtraction from the resource influences the availability of the resource for the next user (Berkes, 2005; Ostrom, 1994). Excludability is when an organization or user excludes the access of users or limits the number of users that can directly benefit from the resource (Berkes, 2005; Ostrom, 1994). Commons are areas of governance contention due

to diverse users interacting with the resources of the system all with varying intentions. Dilemmas arise within commons when the collective community cannot communicate effectively, establish collective use rules, and no overall enforcement authority regulating collective rules (Ostrom, 1994). The commons of fisheries can be explained as followed; fishers initially interact with a fishery, begin having successful harvests, leading to the expansion of more fishers harvesting from the fishery, however, increased harvest levels from the fishery will eventually lead to a downfall in the fisheries ability to naturally regenerate, creating a tragedy in this commons (Berkes, 2005; Berkes, 1985; Nayak & Berkes, 2021; Ostrom, 1994). A tragedy of the commons can be created within a commons three ways according to Berkes, (1985) and Ostrom, (1994); (1) when the users of the resource become economically incentivized and pursue private individual gains over the collective interests of the community, (2) when the SSF exhibits a pattern of utilization that exceeds its natural ability to regenerate, and (3) when the SSF is collectively owned by the general population. Tragedies within SSF lead to appropriation externalities, technological externalities, and assignment problems (Berkes, 1985; Berkes, 2005; Ostrom, 1994). This makes the governance of SSF imperative as mismanagement can lead to commons dilemmas.

Along with being classified as a commons, SSF can be further classified as a complex social-ecological system. A complex social-ecological system is a human-environment system that contains human interactions along with environmental interactions on a consistent basis within the system (Ostrom, 2007). A social-ecological system has social interactions that influence the ecological interactions within the system, while also producing ecological

interactions that influence the social interactions with the system (Berkes, 2011; Folke et al., 2005; Nayak, 2014). Nayak, (2014) outlines that social-ecological systems can be used to understand SSF, because issues are repeatedly occurring, complex, hard to define, and result from political, social, economic, and ecological factors. Major challenges that occur within social-ecological systems governance, identified by Nayak, (2014), are (1) institutional replacement, where powerful institutions take over the already established local institutions, (2) legitimacy, where new institutions lack local support and trust, (3) institutional disappearance, where powerful institutions engulf already established institutions, and (4) missing linkages between institutions are created. These challenges highlight the importance of effective governance within social-ecological systems.

Social-ecological systems governance heavily relies on effective participatory management approaches (Berkes, 2011), collaboration and learning (Berkes, 2011; Plummer et al., 2013), building adaptive capacity (Plummer et al., 2013), and the delineation between social and ecological interactions within the system (Folke et al., 2005; Nayak et al., 2016). To manage social-ecological systems effectively Folke et al., (2002) and Berkes, (2011) explain that governance requires the integration of local stakeholder knowledge and perspectives at various governance levels, helping improve knowledge at various cross scale linkages. To understand the complexity of SSF, identifying social, economic and environmental drivers within the system are crucial.

SSF can lastly be described through systems thinking. Systems thinking highlights the non-linear linkages that are interwoven in social and ecological interactions, providing

indication when systems are vulnerable or in equilibrium (Armitage et al., 2007; Monat & Gannon, 2015; Nayak, 2014; Williams et al., 2017). Systems thinking is an efficient lens to understanding dynamic change occurring at various scales, through interconnected linkages, feedback, self-organization, and the adaptive capacity of communities (Armitage et al., 2007; William et al., 2017). Systems thinking in SSF helps identify boundaries, ecological and human interactions, and social linkages between users and institutions that are vital for building resilience and sustainable operation of SSF (Nayak, 2014). To understand the complex system of SSF, social, economic and environmental drivers that influence the system need to be understood.

Current governance of social-ecological systems, such as SSF, has been insufficient at addressing the vulnerabilities faced by small-scale fishers. Governance of SSF has historically excluded small-scale fishers from participation, strengthening vulnerabilities faced by fishers including competition, fish stock decline, and exploitation of fishery resources (Issac, 2013; Sowman et al., 2014; Mozumder et al., 2020). Current governance approaches for SSF will continue to exacerbate vulnerabilities for small-scale fishers as top-down management approaches are insufficient at addressing the diverse socioeconomic characteristics of fishers (Mozumder et al., 2020). Effective governance strategies for SSF therefore must be able to address the dynamic economic, social and environmental characteristics influencing small-scale fishers' viability.

Indonesia is of particular importance for SSF governance. Indonesia's population is heavily reliant on the production of SSF. In 2022 capture fisheries around the globe accounted

for 92.3 million tons of aquatic species and Indonesia was the second highest contributor at 8%, behind China at 14% (FAO, 2024). Additionally, due to a high proportion of the Indonesian population relying on fisheries production, the consumption of fish has increased 34% from 1961 to 2021 (FAO, 2024). Indonesia is also the largest archipelagic country in the world with over 17,000 island states, many directly reliant on the production of SSF. Finding effective governance strategies for Indonesian SSF are vital to ensure viability of the Indonesian population.

Classifying SSF as social-ecological systems can aid in identifying social (economic and political) and environmental (ecological and geographical) elements within the system (Nayak, 2014). Classifying SSF as social-ecological systems allows governance to understand economic, social, and environmental characteristics before drafting policy. Scholars such as. Berkes, (2011), have noted that increased attention is required in SSF within social-ecological systems to determine effective governance.

Additionally, identifying social, economic and environmental characteristics influencing SSF can aid in understanding the transition of SSF from vulnerability to viability. Vulnerability is defined by Dias et al., (2023), as the loss of community resilience and capacity for that same community to adapt and overcome future impacts, created by social, cultural, and ecological interactions (Dias et al., 2023). Viability within SSF is defined by Dias et al., (2023) and Nayak & Berkes, (2019), as the transforming of vulnerable fishing communities through increasing SSF abilities to navigate uncertainty, adapt to changing conditions, build resilience, create social capital and networks, and increase the working relationships of trust between

users. Dias et al., (2023), notes how understanding the vulnerability to viability transition within SSF needs increased attention.

The objective of this chapter is to identify the economic, social and environmental characteristics intersecting two SSF in Indonesia and determine the most influential characteristics within each community. This chapter will classify SSF in Indonesia as social-ecological systems, bring increased attention to the characteristics influencing the governance of SSF in Indonesia, and identify pathways to viability for Indonesia SSF.

3.2 Methods

3.2.1 Sampling

During implementation of this thesis case study two SSF were purposefully sampled to use as case study sites within Indonesia. Purposeful sampling as outlined in Creswell & Creswell, (2023), is when a researcher deliberately selects participants or research sites, that will allow the researcher to best understand the research objectives and answer the central phenomenon. The sampling criteria when purposefully selecting the SSF of Tambak Bulusan and Purwoejo were:

(1) Must be a community with at least 50% of its members being small-scale fishers.

(2) The community must be relatively close to Semarang, Indonesia.

(3) There must be co-management or collaborative management practices already established in the communities.

(4) The communities must have connections to the Universitas of Diponegoro, Indonesia.

Based on this criteria the SSF of Tambak Bulusan, Demak, Indonesia, and Purwoejo, Morodemak, Demak, Indonesia were selected (see Chapter 2 Figure 3).

After SSF were purposefully selected, observations and semi-structured interviews with fishery and institutional leaders were conducted. Observations were completed in public spaces in the two SSF, where there was no expectation of privacy. Leaders for the semi-structured interviews were purposefully selected within each SSF by meeting the following criteria:

1) Must be a leader (fishery, government, or academic) in the community.

2) Must be partnered with Tambak Bulusan or Purwoejo, Morodemak.

3) Must work with small-scale fishers in the community.

4) Must be in a current position of leadership for at least three years in their respective community.

Based on the purposeful sampling criteria, 12 fishery and institutional leaders were sampled in Tambak Bulusan (6) and Purwoejo (6) (see Chapter 2 Table 2.9).

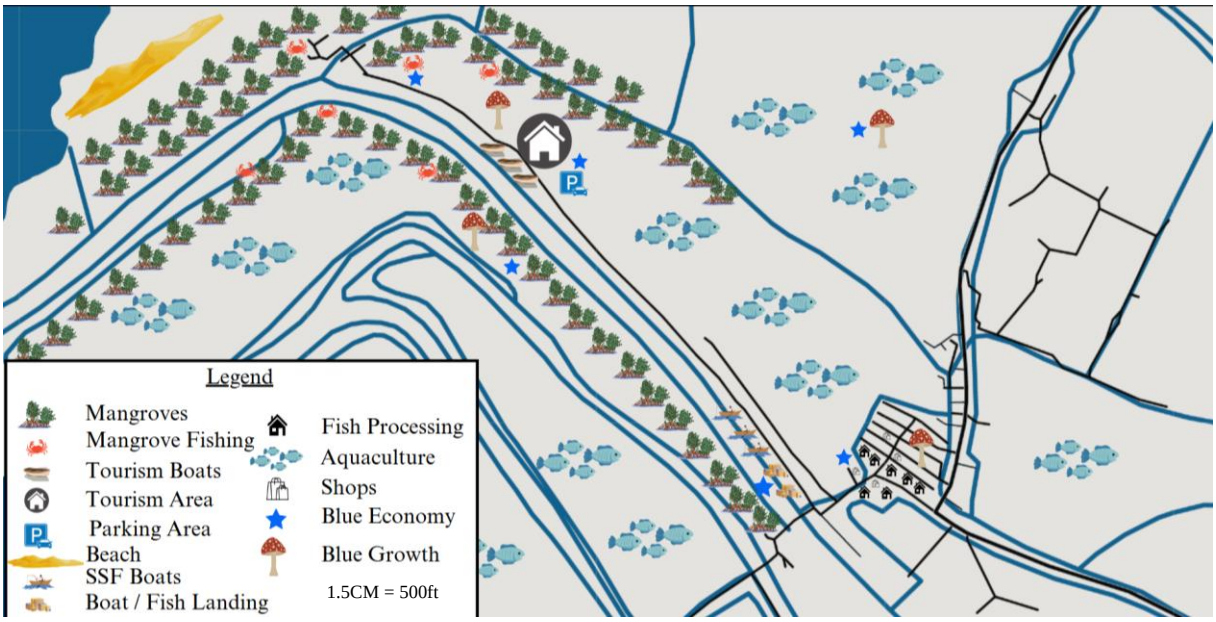
3.2.2 Data Collection

To collect social, economic, and environmental data for this chapter various methods of data collection were employed. First, observations in communal places within each SSF in Indonesia were employed to observe the social, economic and environmental dynamics intersecting the community. Qualitative observations are defined by Creswell & Creswell,

(2023), as a researcher taking field notes of their observations in unstructured ways, typically in the form of open-ended responses. After observations, informal conversations and semi-structured interviews were conducted, they were coupled together to illustrate the social, economic, and environmental characteristics intersecting each SSF.

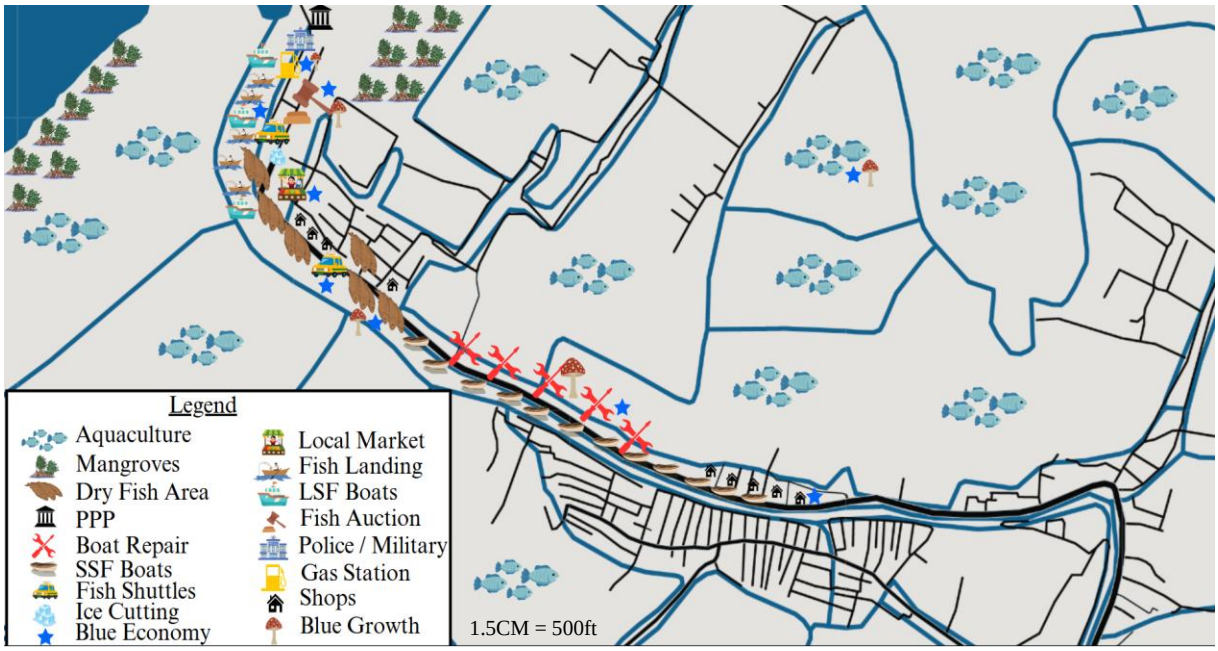
Figure 1 represents the economic, social, and environmental characteristics observed in Tambak Bulusan, Demak, Indonesia. While figure 2 represents the economic, social and environmental characteristics observed in Purwoejo, Morodemak, Demak, Indonesia. Figure 1 and Figure 2 were both created from primary observational and interview data, coupled with Google Maps and Canva software allowing for an illustrative representation of the characteristics influencing the two sampled SSF.

Figure 1: Illustrative Survey of Economic, Social and Environmental Dynamics Intersecting the SSF of Tambak Bulusan, Demak, Indonesia.



(Primary Observation & Interview Data, 2024).

Figure 2: Illustrative Survey of Economic, Social and Environmental Dynamics Intersecting the SSF of Purwoejo, Morodemak, Demak, Indonesia.



(Primary Observation & Interview Data, 2024).

Following initial observations in each SSF, in-depth semi structured interviews with fishery and institutional leaders within each SSF were conducted. Semi-structured interviews all for a flexible interview format throughout the interview as topics and ideas can be explored as they arise, in either more detail, or passed upon by the researcher if deemed irrelevant, allowing the unexpected to be incorporated into the data collection (Knott et al., 2022). Respondents for semi-structured interviews were purposefully selected (see Chapter 3 Section 3.2.1). Semi-structured interviews were intended to validate the results discovered in observations and informal conversations, providing a strong understanding of the social, economic and environmental dynamics in each SSF.

The data collection methods of observations and semi-structured interviews were used to inform distinct sections of the first objective of this thesis. See Chapter 2 Table 2.4, for a breakdown of how the methods of this chapter inform the first thesis objective.

3.3 Results

3.3.1 Tambak Bulusan, Demak, Indonesian

Economic, social and environmental characteristics were discovered in Tambak Bulusan to help determine the various influences in the SSF. Understanding social, economic and environmental characteristics provide an understanding of influence these characteristics have on Indonesian SSF. Additionally, economic, social, and environmental characteristics were identified to aid in determining effective governance strategies for social-ecological systems such as SSF, increasing their viability.

3.3.1.1 Economic Characteristics

Economic characteristics of Tambak Bulusan were identified through firsthand observations and semi-structured interviews with fishery and institutional leaders in the SSF. The following tables represent the observed economic characteristics, and economic characteristics discovered in semi-structured interviews.

Table 3.1 represents the economic characteristics that I observed intersecting the SSF of Tambak Bulusan. Table 3.1 identifies the economic characteristics being observed, the methods of how it was identified and an explanation of the observed economic influence.

Table 3.1: Economic Characteristics Intersecting Tambak Bulusan Identified from Qualitative Observations.

Economic Characteristics.	Method of Identification.	Economic Influence.
Fish Processing in Fisher Homes.	Observations.	Processing fish in fishers' homes increases fishers' economic livelihood by providing access to ship products to various Indonesian and Asian countries. Many of the processors are the wives of fishermen and the production of this processing is directly reliant on the production of the SSF.
Aquaculture Fishponds.	Observations.	Aquaculture fishponds are one of the alternative forms of livelihoods for small-scale fishers in Tambak Bulusan. Many small-scale fishers diversify their livelihood by also partaking in aquaculture fishing, along with marine capture fishing.
Tourism.	Observations.	Tourism has evolved in Tambak Bulusan due to its proximity to the Java Sea and the pristine beaches surrounding it. With declining fish stocks, tourism has served as an alternative livelihood for small-scale fishers. Fishers use their vessels to transport tourists.
Marine and Mangrove Fishing.	Observations.	This is the main form of capture fishing production in the community. The majority of small-scale fishers in this community are directly reliant on the production of these locations for their economic livelihood. Increased environmental damage to these locations is threatening fisher viability.
Fish and Boat Landings.	Observations.	Fish and boat landings provide an avenue for small-scale fishers to offload their fish catch and be transported to various locations in the community, including processing facilities, markets or fisher houses. These landings are the main locations for small-scale fishers to dock their boats between fishing trips as well.

(Primary Observational Data, 2024).

Table 3.2 identifies the economic characteristics intersecting the SSF of Tambak Bulusan that were discovered in semi-structure interviews with fishery and institutional leaders. Table 3.2 identifies the economic characteristic, how it was identified, the number of

total interview participants that mentioned it and the percentage of total interview participants that identified the characteristic.

Table 3.2: Economic Characteristics Intersecting Tambak Bulusan Identified from Semi-Structured Interviews.

Economic Characteristics.	Method of Identification.	Number of Respondents Identifying Characteristics.	Percentage of Total Interview Respondents
Environmental Damage.	Semi-Structured Interviews.	5	83.33%
Declining Fish Stocks.	Semi-Structured Interviews.	3	50%
Illegal Fishing Gear.	Semi-Structured Interviews.	3	50%
Supply Chain Management.	Semi-Structured Interviews.	1	16.67%

(Primary Semi-Structured Interview Data, 2024).

Table 3.3 identifies what fishery and institutional leaders within the SSF of Tambak Bulusan said when identifying each economic characteristic. Table 3.3 indicates the characteristics of focus, the leader in the SSF that mentioned it, and the quote of what the leader said in regard to the characteristic.

Table 3.3: Institutional and Fishery Leader Explanation of Economic Characteristics in Tambak Bulusan.

Economic Characteristics.	Interview Respondent.	Quote:
Environmental Damage.	Community Tourism Leader.	"Mangrove damage is our biggest obstacle, because our tourism concept is mangrove tracking and coastal panorama. So, if there is damage in the mangrove and coastal areas, the repair process will take a long time."
	SSF Leader.	"There are several problems, starting from the weather, big waves, and floods. Because if there are these conditions, fishermen must stop fishing."
	SSF Leader.	"There are several problems that cause a decrease in income, […] Abrasion."
	Academic Institution.	"(Tambak Bulusan) is facing environmental degradation problems, due to the impact of natural disasters."
	Local Village Government Leader.	"Of course, it is related to climate and weather. In addition to natural conditions, currently, water quality is also decreasing."
Declining Fish Stocks.	Academic Institution.	"The community there faces problems in managing fisheries productivity, but there is still ecotourism to help alleviate the problem during the low season."
	Local Village Government Leader.	"Currently, many factories are standing and dumping waste into the river. So, the fisheries ecosystem here is very affected, and very disturbed for the quality of the fish caught."
	SSF Leader.	"This destructive fishing gear is the cause of the large number of fish stocks decreasing […] Evidence 10 years ago before the massive destructive fishing gear, the community here could harvest fish

		with nets alone, reaching 100-150 kg in one trip to sea."
Illegal Fishing Gear.	SSF Leader.	"Currently, the development of fishing gear is increasingly rapid. This information can provide alternatives for new ways to catch fish."
	SSF Leader.	"There are already regional regulations that bind the use of this fishing gear. But in its implementation, it has not been implemented effectively by the government."
	Local Village Government Leader.	"In the past, the use of fishing gear was still very traditional, but now there are many types of fishing gear."
Supply Chain Management.	Manager of Fish Processing and Trading.	"We have difficulty getting raw materials for the processing. But we can still continue, but it will definitely be different if we don't get the right raw materials […] Usually we buy fish from the market in Semarang."

(Primary Semi-Structured Interview Data, 2024).

3.3.1.2 Social Characteristics

Seen social characteristics of Tambak Bulusan were identified through firsthand observations, while unseen social characteristics were identified through semi-structured interviews with fishery and institutional leaders. Seen characteristics are the observable characteristics to outside observers, while the unseen characteristics are only understood through the understanding of community dynamics. The following data tables represent the observed social characteristics, and the social characteristics discovered in interviews.

Table 3.4 represents the observed social characteristics identified in the SSF of Tambak Bulusan. Table 3.4 identifies the social characteristic, how it was identified, and an explanation of the observed social influence of each characteristic.

Table 3.4: Social Characteristics Intersecting Tambak Bulusan Identified from Qualitative Observations.

Social Characteristics.	Method of Identification.	Social Influence.
Pollution.	Observations.	Pollution is evident throughout the community and its waterways. Piles of garbage can be seen on the shores of waterways, in boats, and around houses in the community. Community members were also observed throwing trash into the main waterway in the community.
Small-Scale Fisher Living Conditions.	Observations.	The living conditions of small-scale fishers are subliminal. Fishers mainly live in concrete homes, with few windows or doors. Materials used to construct homes were observed to be concrete, metal sheets, and a variety of wood materials. Houses in this community are impacted by extreme weather conditions further impacting the living conditions of fishers.

(Primary Observational Data, 2024).

Table 3.5 identifies the social characteristics discovered in semi-structured interviews with fishery and institutional leaders. Table 3.5 states the social characteristic, how it was identified, the number of interview respondents who mentioned it, and the percentage of total interview participants that mentioned the characteristic.

Table 3.5: Social Characteristics Intersecting Tambak Bulusan Identified from Semi-Structured Interviews.

Social Characteristics.	Method of Identification.	Number of Respondents Identifying Characteristic.	Percentage of Total Interview Respondents
Pollution.	Observation + Semi-Structured Interviews.	3	50%
Fishing Location Disputes.	Semi-Structured Interviews.	3	50%
Small-Scale Fisher Living Conditions.	Observation + Semi-Structured Interviews.	2	33.33%

(Primary Semi-Structured Interview Data, 2024).

Table 3.6 identifies the social characteristics that were discovered in semi-structured interviews with fishery and institutional leaders and what they said regarding them. Table 3.6 states the social characteristic, what interview respondents mentioned it, and what the interview respondent stated about the characteristic.

Table 3.6: Institutional and Fishery Leader Explanation of Social Characteristics in Tambak Bulusan.

Social Characteristic.	Interview Respondent.	Quote:
Pollution.	Local Village Government Leader.	"“In addition to natural conditions, currently water quality is also decreasing. Maybe because of waste produced by households and factories. Because currently many factories are standing and dumping waste into the river".
	SSF Leader.	"If there is currently a more productive and environmentally friendly fishing gear, we will […] reduce income pressure."
	Community Tourism Leader.	"Problem of garbage, because Tambakbulusan has several river upstream(s), so that many piles of garbage from downstream settle in the area around the Tambakbulusan river".
Fishing Location Disputes.	Academic Institution.	"“The conflict that occurs in fishing is about the location, so we help resolve the problem between communities so that there is no conflict in fishing areas”.
	SSF Fishery Leader.	"However, because in its development, many parties intervene in the management of tourism and operations"
	Community Tourism Leader.	"All villagers who have boats can participate in the beach exploration/boat taxi business."
Small-Scale Fisher Living Conditions.	Academic Institution.	"Another conflict is about housing. Some housing around the river mouth is not legal. So, the management here is often constrained by this problem, therefore we together with the government and local communities are looking for solutions to provide decent and legal housing."
	SSF Leader.	"Our group does not seem to get any benefit from the village development funds. Even though we have submitted several proposals, they were not responded to by the village government".

(Primary Semi-Structured Interview Data, 2024).

3.3.1.3 Environmental Characteristics

Environmental characteristics were observed and discovered by semi-structured interviews with fishery and institutional leaders. The following data tables represent the observed environmental characteristics, and environmental characteristics discovered in interviews.

Table 3.7 indicates the environmental characteristics that were observed to be intersecting the SSF of Tambak Bulusan. Table 3.7 states the environmental characteristics, how it was identified followed by an explanation of the observed environmental influence.

Table 3.7: Environmental Characteristics Intersecting Tambak Bulusan Identified from Qualitative Observations.

Environmental Characteristics.	Method of Identification.	Environmental Influence.
Extreme Weather Conditions.	Observations.	Evident markings of water damage from variable water levels in the community were evident on the majority of fisher homes. Additionally, major thunderstorms and flooding were experienced and observed during data collection in this community.
Mangrove + Marine Fishing.	Observations.	Mangrove and marine fishing are the main forms of fisheries production for SSF in the community. Without access to these vital ecosystems SSF livelihoods would be negatively impacted. Increased variable weather conditions are threatening these vital ecosystems.
Water Pollution.	Observations.	Water pollution is a major issue in this community. Waterways are heavily polluted with residents in the community not diverting attention to the issue because there is little educational awareness about the environmental impacts of pollution.

(Primary Observational Data, 2024).

Table 3.8 indicates the environmental characteristics discovered in semi-structured interviews with fishery and institutional leaders. Table 3.8 states the environmental characteristic, how it was identified, the number of interview participants that identified it, and the percentage of total interviews participants that mentioned the characteristic.

Table 3.8: Environmental Characteristics Intersecting Tambak Bulusan Discovered in Semi-Structured Interviews.

Social Characteristics.	Method of Identification.	Number of Respondents Identifying Characteristics.	Percentage of Total Interview Respondents
Declining Fish Populations.	Semi-Structured Interviews.	4	66.67%
Extreme Weather Conditions.	Observations + Semi-Structured Interviews.	4	66.67%
Mangrove + Marine Fishing.	Observations + Semi-Structured Interviews.	2	33.33%
Water Pollution.	Observations + Semi-Structured Interviews.	2	33.33%

(Primary Semi-Structured Interview Data, 2024).

Table 3.9 indicates the responses of fishery and institutional leaders for each environmental characteristic that was discovered. Table 3.9 states the environmental characteristic, what interview respondents mentioned it, and what the respondent stated about the characteristic.

Table 3.9: Institutional and Fishery Leader Explanation of Environmental Characteristics in Tambak Bulusan.

Environmental Characteristics.	Interview Respondent.	Quote:
Declining Fish Populations.	SSF Leader.	“This destructive fishing gear is the cause of the large number of fish stocks decreasing. Even though there are already regional regulations that bind the use of this fishing gear."
	Local Village Governmental Leader	"“In the past, the use of fishing gear was still very traditional, but now there are many types of fishing gear.”
	Fish Processing & Trading Manager.	"We have difficulty getting raw materials for the processing […] Usually we buy fish from the market in Semarang. Because we already have suppliers from the fish market in Semarang, so we often get raw materials from there."
	Academic Institution.	"The community there faces problems in managing fisheries productivity, […] during the low season."
Extreme Weather Conditions.	SSF Leader.	“There are several problems, starting from the weather, big waves, and floods. Because if there are these conditions, fishermen must stop fishing”
	Community Tourism Leader.	"One of them is tourism repair due to natural damage (abrasion and big waves). In addition, mangrove damage is our biggest obstacle."
	Local Village Governmental Leader	“Of course, it is related to climate and weather."

	Academic Institution.	"Environmental degradation problems, due to the impact of natural disasters."
Mangrove + Marine Fishing.	SSF Leader.	"Evidence 10 years ago before the massive destructive fishing gear, the community here could harvest fish with nets alone, reaching 100-150 kg in one trip to sea."
	Academic Institution.	"Rehabilitation program by planting mangroves from the beginning to mapping the right position in the planting."
Water Pollution.	Community Tourism Leader.	“The last is the problem of garbage because Tambak Bulusan has several rivers […] so that many piles of garbage […] settle in the area around the Tambakbulusan river."
	Local Village Governmental Leader	"Currently water quality is also decreasing."

(Primary Semi-Structured Interview Data, 2024).

3.3.2 Purwoejo

Economic, social and environmental characteristics were discovered in Purwoejo, Morodemak, Demak, Indonesia, to help determine the various influences on SSF. Additionally, economic, social, and environmental characteristics were identified to aid in determining effective governance strategies for Purwoejo SSF.

3.3.2.1 Economic Characteristics

Table 3.10 identifies the economic characteristics that were observed in Purwoejo SSF. Table 3.10 indicates the economic characteristic, how it was identified and an explanation of the observed economic influence of the characteristic.

Table 3.10: Economic Characteristics Identified by Qualitative Observations in Purwoejo.

Economic Characteristics.	Method of Identification.	Explanation of Influence.
Fishing Vessel Repair.	Observations.	An operation performed by small-scale fishers when they are not fishing. This operation repairs small-scale and large-scale fishing vessels. Without this vital service in the community fishers would be unable to keep their vessels in seaworthy conditions.
Fish Auction.	Observations.	This auction only operates from 1 pm to 4 pm daily. This is where fishers sell their fish catch to a variety of stakeholders from within and outside of the community. This is one of the main ways of acquiring income for fish catch in the community.
Dry Fish Processing.	Observations.	Dry fish processing is an alternative livelihood for many SSF and women in the community. These fish processors buy from the fish auction, process the fish, then sell them to neighbouring Indonesian island states. Dry fish is also exported to neighbouring southeast Asian countries, including Malaysia and Singapore.
Fish & Boat Landing.	Observations.	The fish and boat landings are near the mouth of the Java Sea. This is where fish catch is offloaded and transported to auction, processing, or fisher homes. This is the main area where boats dock, and unload fish within the community, marking it a vital economic hot spot.
Fish Catch Shuttles.	Observations.	This is a job that has been created as a direct result of the fish landing location. The fish landing location is away from community houses in Purwoejo. These shuttles transport large quantities of fish for a small fee, creating the basis of their livelihood, while allowing fish catch to be transported to other locations away from the boat landing.

(Primary Observational Data, 2024).

Table 3.11 indicates the economic characteristics discovered in semi-structured interviews with fishery and institutional leaders in Purwoejo. Table 3.11 identifies the economic characteristic, how it was identified, the number of interview respondents that identified it, and the percentage of total respondents that mentioned the characteristic.

Table 3.11: Economic Characteristics Influencing SSF in Purwoejo Discovered in Semi-Structured Interviews.

Economic Characteristics.	Method of Identification.	Number of Respondents Identifying Characteristics.	Percentage of Total Interview Respondents
Economic Subsides.	Semi-Structured interviews.	4	66.67%
Fishing Gear Utilized.	Observations + Semi-Structured Interviews.	2	33 .33%
Aquaculture Pond Structure.	Observations + Semi-Structured Interviews.	2	33.33%

(Primary Semi-Structured Interview Data, 2024).

Table 3.12 indicates the institutional and fishery leaders' explanation of the economic characteristics discovered in semi-structured interviews. Table 3.12 identifies the economic characteristic, what leader identified it, and what the leader said about the characteristic.

Table 3.12: Institutional and Fishery Leader Explanation of Economic Characteristics in Purwoejo.

Economic Characteristics.	Interview Respondent.	Quote:
Economic Subsides.	Community Governmental Fishery Leader.	"Fishermen who do not have a sailing permit, will not receive a recommendation to get fuel subsidies."
	SSF Leader.	"Here at the moment, we only get fuel subsidy assistance, each member gets a fuel subsidy of 2 liters/per day."
	SSF Leader.	""“The current problem is the difficulty of accessing fuel oil for the ship's engine”.
	Head of Women Fishers and Processors.	"The most frequently encountered issues are sailing permit administration and fuel subsidy letters."
Fishing Gear Utilized.	Community Governmental Fishery Leader.	""“Fishing gear that is not environmentally friendly usually provides more fish harvests in the sea than fishing gear that is in accordance with the regulations. So, from an economic perspective, it encourages people to also use the fishing gear”.
	SSF Leader.	"Currently we are competing with environmentally unfriendly tools. [...] This tool allows almost all fish to enter the net, unlike our fishing gear."
Aquaculture Pond Structure.	SSF Leader.	""“The ponds here that I know are not in the form of embankments. So, because of using that, the number of fish living in ponds (here on average milkfish ponds) is low, many die - compared to ponds made of soil."
	Academic Institution.	"There are other problems in the sale of fishery products, especially the problem of fishponds. This problem is related to the management of fishery products."

(Primary Semi-Structured Interview Data, 2024).

3.3.2.2 Social Characteristics

Table 3.13 indicates the social characteristics that I observed in the SSF of Purwoejo. Table 3.13 identifies the social characteristic, how it was identified and then an explanation of the observed social influence of the characteristics on the community.

Table 3.13: Social Characteristics Identified by Qualitative Observations in Purwoejo.

Social Characteristics.	Method of Identification.	Explanation of Influence.
Fishing Gear Utilized.	Observations.	There is a variety of fishing gear used including gill nets, traps, trawl nets, and throw nets. There is a high degree of competition between fishers in this community due to disparities in fishing gear and fish catch production between fishing gear.
Housing Crisis.	Observations + Semi-Structured Interviews.	The housing for small-scale fishers is in a state of vulnerability. The majority of houses are made from concrete, metal sheets and other structural materials. Houses in this community are impacted by floods, water damage, and erosion of buildings due to inclement weather.

(Primary Observational Data, 2024).

Table 3.14 indicates the social characteristics discovered in semi-structured interviews from the fishery and institutional leaders in Purwoejo. Table 3.14 identifies the social characteristic, how it was identified, the number of respondents that identified it, and the percentage of interview respondents that identified this characteristic.

Table 3.14: Social Characteristics Influencing SSF in Purwoejo Discovered in Semi-Structured Interviews.

Social Characteristics.	Method of Identification.	Number of Respondents Identifying Characteristics.	Percentage of Total Interview Respondents
Competition.	Semi-Structured Interviews.	3	50%
Government Regulations.	Semi-Structured interviews.	2	33.33%
Housing Crisis.	Observations + Semi-Structured Interviews.	1	16.67%

(Primary Semi-Structured Interview Data, 2024).

Table 3.15 identifies the institutional and fishery leader explanations of the social characteristics discovered in semi-structured interviews. Table 3.15 indicates the social characteristic, what leader identified it, and what the leader said about the characteristic.

Table 3.15: Institutional and Fishery Leader Explanation of Social Characteristics in Purwoejo.

Social Characteristics.	Respondent.	Quote:
Competition.	Community Governmental Fishery Leader.	"The number of fishermen here is around 300 people."
	SSF Leader.	"The problem is like this, because fishermen here can have 2-3 fishing gear per boat. So, the total number of fishermen is around 300 people."
	SSF Leader.	"Competition between fishermen, related to the differences in fishing gear used."
Government Regulations.	Academic Institution.	"Morodemak has a bigger problem, because the fishing community is very large."
	Head of Women Fishers and Processors.	"There are various agencies that usually help in fisheries management, starting from the marine and fisheries service (province - district), the Marine and Air Police Corps, the environmental service, the local government (district). They have various tasks and authorities here in regulating the management of fish here."
	Community Governmental Fishery Leader.	"The provincial government has the authority to regulate and manage marine resources from a distance of 0-12 miles, then the national authority is above 12 miles-200 miles (EEZ). While for land management (fish auction and fishermen) is the task of the district government."
		"In terms of supervision, there is good cooperation from the fisheries and maritime services, the Directorate of Water and Air Police, and also from the Indonesian Navy".
		"Fishing gear that is not environmentally friendly usually provides more fish harvests in the sea than fishing gear that is in accordance with the regulations."
Housing Crisis.	Academic Institution.	"It can be seen that on the coast of Morodemak, it is affected by high abrasion and erosion, and some households have to look for other places to live because of the impact."
		"Another conflict is about housing. Some housing around the river mouth is not legal. So, the management here is often constrained by this problem."

(Primary Semi-Structured Interview Data, 2024).

3.3.2.3 Environmental Characteristics

Table 3.16 indicates the environmental characteristics identified by observations in Purwoejo. Table 3.16 states the environmental characteristic, how it was identified, and an explanation of its environmental influence.

Table 3.16: Environmental Characteristics Identified by Qualitative Observations in Purwoejo.

Environmental Characteristic.	Method of Identification.	Explanation of Influence.
Flooding.	Observations.	Due to proximity to the Java Sea Purwoejo experiences fluctuating water levels and floods. Water damage was evident on various small-scale fishers' homes throughout the community. Informal conversations with fishers stated that water levels have been steadily increasing with no sign of stopping.

(Primary Observational Data, 2024).

Table 3.17 indicates the environmental characteristics that were discovered in semi-structured interviews with fishery and institutional leaders in Purwoejo. Table 3.17 states the environmental characteristic, how it was identified, the number of interview respondents that noted it, and the total percentage of interview respondents that identified the characteristic.

Table 3.17: Environmental Characteristics Influencing SSF in Purwoejo Identified by Semi-Structured Interviews.

Environmental Characteristics.	Method of Identification.	Number of Respondents Identifying Characteristics.	Percentage of Total Interview Respondents
Dynamic Weather Conditions.	Semi-Structured Interviews.	3	50%
Flooding	Observations + Semi-Structured Interviews.	2	33.33%
Soil Sedimentation.	Semi-Structured Interviews.	2	33.33%
Fishing Gear Utilized.	Semi-Structured Interviews.	1	16.67%

(Primary Semi-Structured Interview Data, 2024).

Table 3.18 indicates the environmental characteristics discovered by fishery and institutional leaders from semi-structured interviews. Table 3.18 identifies the environmental characteristic, the leader that mentioned it, and what the leader said about the environmental characteristic.

Table 3.18: Institutional and Fishery Leader Explanation of Environmental Characteristics in Purwoejo.

Environmental Characteristics.	Interview Respondent.	Quote:
Dynamic Weather Conditions.	SSF Leader.	""“The fishing community here has long experience in dealing with extreme weather that often occurs in November – February."
	SSF Leader.	"Every morning, many of the nets are damaged every time there is a tidal wave."
	Academic Institution.	"It can be seen that on the coast of Morodemak, it is affected by high abrasion and erosion."
Flooding	SSF Leader.	"This area can experience rough and high-water levels every 2 weeks. This can also be seen from the shoulder of the road here, now it is high, in the past water often flooded the road here, even entering the house."
	Community Governmental Fishery Leader.	"The Morodemak tridesa area is an area affected by abrasion and accretion, so that many coastal ecosystems (for example: mangroves) have been damaged a lot."
Soil Sedimentation.	Academic Institution.	"The Morodemak area is an estuary area, where there is a lot of sedimentation. The community there needs to think about how to solve the sedimentation problem to make it easier for their boats to dock on the shore."
	Community Governmental Fishery Leader.	"Collaboration is carried out from the national level to the village level, from the national government side, contributing from the budget to solve these problems, starting from sedimentation, rehabilitation, and mangroves."
Fishing Gear Utilized.	Community Governmental Fishery Leader.	"There are already existing limitations to divide the fishing lanes of each fishing gear. So that there is no massive damage to the marine ecosystem."

(Primary Semi-Structured Interview Data, 2024).

Table 3.18 indicates the environmental characteristics discovered by fishery and institutional leaders from semi-structured interviews. Table 3.18 identifies the environmental characteristic, the leader that mentioned it, and what the leader said about the environmental characteristic.

3.3.3 Economic, Social and Environmental Characteristic Comparison Between SSF

Table 3.19 indicates the summary and comparison of the economic, social and environmental characteristics identified in the SSF of Tambak Bulusan and Purwoejo, Morodemak, Demak, Indonesia. Table 3.19 identifies each respective characteristic, how it was identified, how many interview respondents mentioned them, and the total percentage of interview respondents that noted the characteristic. Cells that are represented with "N/A" relate to characteristics that were discovered through observations and not interviews.

Table 3.19: Summary of Economic, Social and Environmental Characteristics Influencing SSF in the Demak region of Indonesia.

SSF of Tambak Bulusan, Demak, Indonesia.			
Economic Characteristics			
Economic Characteristics	**Method of Identification.**	**Number of Respondents Identifying Characteristic.**	**Percentage of Total Interview Respondents.**
Environmental Damage.	Semi-Structured Interviews.	5	83.33%
Declining Fish Stocks.	Semi-Structured Interviews.	3	50%
Illegal Fishing Gear.	Semi-Structured Interviews.	3	50%
Supply Chain Management.	Semi-Structured Interviews.	1	16.67%
Fish Processing in Fisher Homes.	Observations.	N/A	N/A
Aquaculture Fishponds.	Observations.	N/A	N/A
Tourism.	Observations.	N/A	N/A
Marine and Mangrove Fishing.	Observations.	N/A	N/A
Fish and Boat Landing.	Observations.	N/A	N/A
Social Characteristics.			
Social Characteristics.	**Method of Identification.**	**Number of Respondents Identifying Characteristic.**	**Percentage of Total Interview Respondents.**
Pollution.	Observation + Semi-Structured Interviews.	3	50%
Fishing Location Disputes.	Semi-Structured Interviews.	3	50%
Small-Scale Fisher Living Conditions.	Observation + Semi-Structured Interviews.	2	33.33%
Environmental Characteristics.			
Environmental Characteristics.	**Method of Identification.**	**Number of Respondents Identifying Characteristic.**	**Percentage of Total Interview Respondents.**
Declining Fish Populations.	Semi-Structured Interviews.	4	66.67%
Extreme Weather Conditions.	Observations + Semi-Structured Interviews.	4	66.67%
Mangrove + Marine Fishing.	Observations + Semi-Structured Interviews.	2	33.33%

Water Pollution.	Observations + Semi-Structured Interviews.	2	33.33%
SSF of Purwoejo, Morodemak, Demak, Indonesia.			
Economic Characteristics			
Economic Characteristics	**Method of Identification.**	**Number of Respondents Identifying Characteristic.**	**Percentage of Total Interview Respondents.**
Economic Subsides.	Semi-Structured interviews.	4	66.67%
Fishing Gear Utilized.	Observations + Semi-Structured Interviews.	2	33 .33%
Aquaculture Pond Structure.	Observations + Semi-Structured Interviews.	2	33.33%
Fishing Vessel Repair.	Observations.	N/A	N/A
Fish Auction.	Observations.	N/A	N/A
Dry Fish Processing.	Observations.	N/A	N/A
Fish & Boat Landing.	Observations.	N/A	N/A
Fish Catch Shuttles.	Observations.	N/A	N/A
Social Characteristics.			
Social Characteristics.	**Method of Identification.**	**Number of Respondents Identifying Characteristic.**	**Percentage of Total Interview Respondents.**
Competition.	Semi-Structured Interviews.	3	50%
Government Regulations.	Semi-Structured interviews.	2	33.33%
Housing Crisis.	Observations + Semi-Structured Interviews.	1	16.67%
Fishing Gear Utilized.	Observations.	N/A	N/A
Environmental Characteristics.			
Environmental Characteristics.	**Method of Identification.**	**Number of Respondents Identifying Characteristic.**	**Percentage of Total Interview Respondents.**
Dynamic Weather Conditions.	Semi-Structured Interviews.	3	50%
Flooding	Observations + Semi-Structured Interviews.	2	33.33%
Soil Sedimentation.	Semi-Structured Interviews.	2	33.33%
Fishing Gear Utilized.	Semi-Structured Interviews.	1	16.67%

(Primary Research Data, 2024).

3.4 Discussion

Results indicate that there are a variety of economic, social and environmental characteristics intersecting the two SSF of Tambak Bulusan and Purwoejo (see Table 3.19). Identifying these characteristics can aid in classifying these SSF as social-ecological systems, drafting effective governance, and understanding the vulnerability to viability transitions of SSF further.

3.4.1 Indonesian SSF as Social-Ecological Systems

Through the identification of economic, social and environmental characteristics in the SSF of Tambak Bulusan and Purwoejo (see Table 3.19), these SSF can be further classified as social-ecological systems. It can be seen in Table 3.19 in both SSF that social behaviors, such as fishing gear or cultural norms, are influenced by and influence environmental and economic dynamics within the SSF. While Table 3.19 also exemplifies environmental behaviors, such as extreme weather and flooding that are influenced by and influence social and economic dynamics in both SSF. Table 3.19 additionally exemplifies economic behaviors that are influenced and can influence environmental and social dynamics within the two SSF. These interactions can classify SSF as social-ecological systems.

The SSF of Tambak Bulusan can be classified as a social-ecological system due to the complexity of social (see Table 3.5) and environmental characteristics (see Table 3.8) intersecting and influencing each other. The SSF of Purwoejo can also be classified as a social-ecological system due to its complex social (see Table 3.13 & 3.14) and environmental characteristics (see Table 3.17) influencing each other within the system.

Therefore, using a social-ecological systems lens to examine the interworking's and dynamics of Indonesian SSF can help provide clarity on the process intersecting SSF and what possible outcomes and solutions could be discovered. Additionally, classifying the SSF of Tambak Bulusan and Purwoejo as social-ecological systems can aid in understanding the complexity of interactions between social, economic, and environmental interactions within the system. Through the classification of Tambak Bulusan and Purwoejo as social-ecological systems governance strategies for SSF can become increasingly informed of the economic, social and environmental factors that influence the dynamic systems of SSF.

3.4.2 SSF Governance

Identifying economic, social and environmental characteristics intersecting the SSF of Tambak Bulusan and Purwoejo can aid in drafting effective social-ecological system governance. Berkes, (2011) stated that there is a need to bring more attention to SSF governance and how it can be effective. Through the identification (see Table 3.19) and mapping (see Figure 1 & 2) of the economic, social and environmental characteristics, governance strategies for SSF can become increasingly informed of the conditions that influence viability. This can allow for effective governance strategies to be drafted for SSF as all economic, social and environmental factors that influence the system are identified and understood.

The identification of economic, social and environmental characteristics in the SSF of Tambak Bulusan and Purwoejo within Indonesia can aid in the transition of these communities from vulnerability to viability. By identifying economic, social and environmental

characteristics within each SSF the key vulnerabilities for each SSF were discovered. Table 3.20 explains the most pressuring economic, social and environmental vulnerabilities being faced by SSF in Tambak Bulusan. Table 3.20 states the importance rank of the characteristic, whether it is social, economic, or environmental, what the characteristic is, the number of interview respondents that identified it, and the total percentage of interview respondents that mentioned the characteristic.

Table 3.20: Ranking of the Most Important Economic, Social and Environmental Characteristics in Tambak Bulusan.

Rank.	Economic, Social or Environmental.	Characteristic.	Number of Respondents Identifying Characteristic.	Percentage of Total Interview Respondents.
1	Economic	Environmental Damage.	5	83.33%
2	Environmental	Declining Fish Populations.	4	66.67%
2	Environmental	Extreme Weather Conditions.	4	66.67%
3	Economic	Declining Fish Stocks.	3	50%
3	Economic	Illegal Fishing Gear.	3	50%
3	Social	Pollution.	3	50%
3	Social	Fishing Location Disputes.	3	50%

(Primary Research Data, 2024).

Table 3.21 additionally, states the most pressuring economic, social and environmental vulnerabilities being faced by small-scale fishers within Purwoejo. Table 3.21 states the importance rank of the characteristic, whether it is social, economic, or environmental, what

the characteristic is, the number of interview respondents that identified it, and the total percentage of interview respondents that mentioned the characteristic.

Table 3.21: Ranking of the Most Important Economic, Social and Environmental Characteristics in Purwoejo.

Rank.	Economic, Social, Environmental.	Characteristic.	Number of Respondents Identifying Characteristic.	Percentage of Total Interview Respondents.
1	Economic	Economic Subsides.	4	66.67%
2	Environmental	Dynamic Weather conditions.	3	50%
2	Social	Competition.	3	50%

(Primary Research Data, 2024).

Identifying the top economic, social and environmental characteristics and vulnerabilities within Tambak Bulusan and Purwoejo can aid in the facilitation of viable transitions within SSF. By understanding the most important vulnerabilities intersecting SSF socially, economically and environmentally policy can be tailored to the context specific needs of fishers in these communities. Identifying economic, social and environmental characteristics can help SSF navigate times of uncertainty through adaptation and resilience because policies are tailored to the community context. This is crucial to create viability as stated by Dias et al., (2023) and Nayak & Berkes, (2019), who explain increasing SSF abilities to navigate uncertainty, adapt to changing conditions and build resilience can increase the viability of SSF.

The identification of economic, social and environmental characteristics can aid in understanding the vulnerability to viability transitions of SSF. This is vital as scholars such as Dias et al., (2023), have noted that increased awareness and understanding is needed of how the facilitations of vulnerable to viable transitions can occur within SSF.

3.5 Conclusions

In conclusion, this chapter classified SSF in Indonesia as social-ecological systems, brought increased attention to the characteristics influencing the governance of SSF in Indonesia, and identify pathways to viability from vulnerability for Indonesia SSF. The objective of this chapter was to identify the economic, social and environmental characteristics intersecting two SSF communities in the Demak region of Indonesia determining the most influential characteristics within each community. Economic, social and environmental characteristics were mapped (see Figure 1 and Figure 2) and discovered (see Table 3.19) within the SSF of Tambak Bulusan and Purwoejo. Through the mapping and discovery of economic, social and environmental characteristics influencing the SSF of Tambak Bulusan and Purwoejo, progress can be made towards increasing SSF viability.

The variety of social, economic and environmental dynamics intersecting the SSF of Tambak Bulusan and Purwoejo represent the vast influences that SSF face on a daily basis. Understanding and addressing the most influential dynamics provide avenues for viable livelihoods for small-scale fishers in Indonesian SSF. Additionally, avenues for viable policy and institutional support can be created for vulnerable communities such as SSF with the inclusion of economic, social and environmental dynamics. Further research on how

economic, social and environmental characteristics are faced differently by gender in SSF can provide alternative ways to identify and address vulnerabilities and influential factors in SSF.

Chapter 4 Understanding adaptive co-management dynamics in the fishing communities of Tembak Bulusan and Morodemak, Demak region, Indonesia.

4.1 Introduction

Small-Scale Fisheries (SSF), as the name suggests, operate on a small-scale across the globe. Fishers within SSF use minimal technology, fish in local waters, sell fish locally or consume their catch, have boats less than 12 meters in length, and have a total boat weight of less than 5 GT (gigatons) (Bakiu et al., 2018; FAO, 2015; Mozumder et al., 2020). SSF are additionally comprised of marginalized individuals many of which are women, citing the need for effective governance (Harper et al., 2020; Winter et al., 2023). Determining effective governance approaches that address the diverse socio-economic needs of small-scale fishers are critically needed.

Due to the complexity of SSF, they are further defined as social-ecological systems. A social-ecological system is a complex, self-organizing system that has social and ecological interactions intersecting it, with various users interacting and depending on the system (Bennett & Gosnell, 2015; Folke et al., 2002; McGinnis & Ostrom, 2014; Ostrom, 2009; Ostrom, 2007). Social and ecological interactions can create varying impacts on each other within the social-ecological system, calling for adaptive approaches that can characterize the complex linkages, feedback, and uncertainty within the system (Berkes & Nayak, 2018; Nayak, 2014; Nayak et al., 2016). Governance approaches that are able to adapt, change, and learn from dynamic conditions need to be explored for effective SSF governance.

Adaptive co-management is a governance approach that can be employed within SSF. Adaptive co-management is a governance approach implemented within social-ecological systems that relies on the ecological knowledge of local users, institutional linkages and connections, social capital, formal and informal networks, and learn-by-doing approaches, to refine and adapt to dynamic conditions occurring within social-ecological systems, building the systems adaptive capacity and resilience to uncertainty (Armitage, 2007; Armitage et al., 2009; Armitage et al., 2007; Berkes, 2007; Plummer et al., 2013; Folke et al., 2005). Adaptive co-management is a different form of governance than co-management or adaptive management as it requires, social capital, social networks at vertical and horizontal scales and learn-by-doing approaches (Armitage et al., 2009; Armitage, 2007; Folke et al., 2005; Plummer et al., 2013). Adaptive co-management applicability within fisheries needs to be explored further.

Adaptive co-management requires strong social capital. Social capital in adaptive co-management according to Armitage et al., (2009) and Folke et al., (2005) is the societal norms, exchanges, rules, networks between actors and institutions, and relationships of trust between stakeholders that enable actors of a social-ecological systems to work collaboratively and collectively. Within social capital trust is an essential requirement. Trust within adaptive co-management is critical, as when users of a common-pool resource trust the managers, a sense of community is established and the system's ability to work collaboratively is enhanced (Armitage et al., 2009; Folke et al., 2005). Without trust in an adaptive co-management users will not work collaboratively, causing conflicts to arise between individual users and managers

(Folke et al., 2005). Having trustworthy managers in social-ecological systems, in local government, SSF management, and fish trading is vital for the successful governance of these systems. Leaders create partnerships among actors, mobilize and generate support and create linkages between actors inside and outside the system (Folke et al., 2005). To have successful adaptive co-management social capital must be present within the social-ecological system.

Along with social capital, social networks are an essential component of adaptive co-management governance in social-ecological systems. Social networks as described by Armitage et al., (2009), Berkes, (2007), and Folke et al., (2005), are the connections and linkages established between users of a social-ecological system and the institutions that encompass it. Social networks are complex within social-ecological systems due to the immense number of users that interact with them, creating vertical and horizontal linkages between people and organizations (Armitage et al., 2009; Berkes, 2007). Vertical linkages as described by Berkes, (2007), are the links between users and institutions at various geographical scales, linking users to institutions and users outside of the system. Horizontal linkages as described by Berkes, (2007), are the links between different levels of organization within the social-ecological system, such as links between various levels of government. Within adaptive co-management social networks at both vertical and horizontal scales are required for viability.

Lastly, an essential component of adaptive co-management is a learn-by-doing approach. A learn-by-doing approach is an approach to governance that utilizes users' social memory to adapt and manage change within social-ecological systems (Armitage et al., 2009;

Armitage et al., 2007; Folke et al., 2005). Social memory as defined by Folke et al., (2005), and Armitage et al., (2009), is the past historical experiences of users who utilize and interact with the social-ecological system most frequently. Incorporating learning within adaptive co-management increases the adaptive capacity and expertise that the social-ecological system has, increasing the system's ability of sense making in governance, allowing the system to respond to uncertainty (Armitage et al., 2007; Folke et al., 2005; Plummer et al., 2013). Incorporating learning within adaptive co-management additionally, allows for flexible and continuous feedback from users of the social-ecological system, increasing the expertise for governance (Berkes, 2007). To have successful governance in social-ecological systems, learn-by-doing approaches are vital.

The current governance of SSF, however, has not successfully addressed vulnerabilities faced by small-scale fishers. SSF continue to be excluded from governance processes within the fisheries sector, increasing vulnerabilities including competition, fish stock decline, and exploitation of fishery resources (Issacs, 2013; FAO, 2015; Sowman et al., 2014; Mozumder et al., 2020; Winter et al., 2023). Top-down, command-and-control powered governance of SSF is continuing to strengthen vulnerabilities faced by small-scale fishers, as governance approaches do not address the socio-economic characteristics of small-scale fishers (Mozumder et al., 2020). Effective governance strategies for SSF must be able to adapt to dynamic conditions and address diverse economic, social and environmental characteristics of fishers and the fishery.

This chapter will investigate SSF governance in Indonesia. Indonesia is an important study site for research in SSF governance because they are the largest archipelagic country in the world, with 54% of animal consumption coming from fish (Warren & Steenbergen, 2021). In 2015 there were approximately six million fishers in Indonesia that were directly reliant on the production of SSF, with over 90% of fisheries production coming from SSF, marking Indonesia as the second largest marine capture fisheries producer in the world (Warren & Steenbergen, 2021; FAO, 2024). However, small-scale fishers in Indonesia have received little attention, even though their livelihoods are under immediate pressure from fisheries collapse (Warren & Steenbergen, 2021; FAO, 2024). Halima et al., (2019) states that Indonesia SSF require increased governance attention because these fisheries are not regulated and have their own set of rules and norms. Additionally, Warren & Steenbergen, (2021), state that more attention is required in the small-scale fishing sector in Indonesia. Effective governance strategies for SSF within Indonesia are imperative for the sustained livelihoods of Indonesian small-scale fishers.

The study sites of SSF within Indonesia for this thesis require investigation into the governance processes and the relationships these processes have on fisher livelihoods. Within the two study sites for this thesis fishers do not have great relationships and connections to officials who partake in governance processes. Governance within the two Indonesian study sites for this thesis is complex, as there are a variety of actors, federal, provincial (state) and local governments who monitor and enforce varies rules and regulations. These regulations combat those rules, norms and traditions of fishers within these communities impacting the

livelihoods of fishers. Understanding and strengthening the governance processes that intersect SSF are vital for these Indonesian communities. Effective governance strategies for SSF within Indonesia are imperative for the sustained livelihoods of Indonesian small-scale fishers.

This chapter seeks to fill the following knowledge gaps in adaptive co-management and Indonesian SSF literature, while also generating knowledge on effective governance for SSF.

1) Armitage, (2007), states that there have been difficulties increasing the adaptation of social-ecological systems in common-pool resources where livelihoods are closely connected to the outcomes of the system.
2) Berkes, (2011) notes that more attention is needed in SSF governance in social-ecological systems to understand the dynamic change and management needs of the system.
3) Warren & Steenbergen, (2021), state that more attention is needed in the relationships and governance of SSF in Indonesia.
4) Halima et al., (2019) state that Indonesia SSF require increased governance attention because fisheries are not regulated and have their own rules and norms.

The objective of this chapter is to determine the adaptive co-management indicators present within two SSF in Indonesia to determine how adaptive co-management can be transitioned to as a form of SSF governance. This chapter will identify adaptive co-management indicators intersecting SSF in Indonesia, bring increased attention to the

governance of SSF within Indonesia, and identify the ability current SSF governance within Indonesian can be evolved.

4.2 Methods

4.2.1 Sampling

To identify the specific communities of study for this chapter purposeful sampling was conducted (see Chapter 2 Section 2.3). Once the two SSF were selected small-scale fishers from each respective SSF were purposefully selected. Purposeful sampling as outlined in Creswell & Creswell, (2023) is when a researcher deliberately selects participants or research sites, that will allow the researcher to best understand the research objectives and answer the central phenomenon. The purposeful selection criteria for small-scale fishers in Tambak Bulusan and Purwoejo were as follows:

1) The small-scale fisher must have a fishing vessel with a total weight of 5 GT (gigatons) or less.
2) The small-scale fisher must be from either Tambak Bulusan or Purwoejo.
3) The small-scale fisher must have been participating in the SSF sector for at least five years.
4) The majority of the income for the small-scale fisher must come from small-scale fishing activities.

After this round of purposeful sampling a total of 119 small-scale fishers were sampled to complete household surveys across the two SSF, Tambak Bulusan (40) and Purwoejo (79) (see Chapter 2 Tables 2.5 & 2.6).

After household surveys were completed with small-scale fishers, fishery and institutional leaders were purposefully sampled for semi-structured interviews in the fishing communities of Tambak Bulusan and Purwoejo (see Chapter 2 Section 2.3). After purposeful sampling 12 fishery and institutional leaders were interviewed across the two SSF. 6 from Tambak Bulusan and 6 from Purwoejo, Morodemak (see Chapter 2 Table 2.9).

Therefore, after purposeful sampling was completed the total number of respondents for this chapter were 119 small-scale fishers and 12 fishery and institutional leaders across two SSF in Indonesia.

4.2.2 Data Collection

To collect data on the adaptive co-management indicators intersecting two SSF in Indonesia various forms of data collection methods were employed. These included qualitative observations, household surveys and semi-structured interviews. Multiple forms of data were gathered to support the central phenomenon and ensure validation of the research results (Creswell & Creswell, 2023). First, qualitative observations were conducted regarding the adaptive co-management indicators observed in the communities when in public settings and around the SSF. Qualitative observations as defined by Creswell & Creswell, (2023) are the observations of researchers in the field that are written in unstructured and open formats within

a researcher's journal. Observational notes were written down in a researcher's journal as they occurred and at the end of every day.

After qualitative observations were completed, household surveys were conducted with small-scale fishers within each SSF. Household surveys for small-scale fishers were designed to examine the adaptive co-management indicators intersecting the SSF. The household surveys employed with small-scale fishers included 10 adaptive co-management indicators to be tested (Table 4.1). These adaptive co-management indicators were developed through extensive review of current adaptive co-management and co-management indicators for successful implementation in coastal communities, combining the works of various scholars (Armitage et al., 2007; Armitage et al., 2009; Pomeroy and Williams, 1994; Pomeroy et al., 2001; Pomeroy, 1993; Susilowati and Budiati, 2003; Ostrom, 1990; Ostrom, 1994 ; Ostrom, 2007; Berkes, 2007; Berkes, 2009; Folke et al., 2005; Islam et al, 2023).

Table 4.1: Ten Adaptive Co-Management Indictors for Successful Adaptive Co-Management.

Indicator	Works Evolved From
Well-Defined Resource System.	Armitage et al., 2007; Armitage et al., 2009; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Ostrom, 1990; Ostrom, 1994.
Community Collectivity.	Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Pomeroy et al., 2001; Ostrom, 1990; Ostrom, 2007.
Clear Property Rights.	Armitage et al., 2007; Armitage et al., 2009; Ostrom 1990; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Pomeroy et al., 2001; Ostrom, 2007.
Access to Adaptable Management Portfolio.	Armitage et al., 2007; Armitage et al., 2009; Berkes, 2007; Berkes, 2009; Folke et al., 2005.
Institutional Support.	Armitage et al., 2007; Armitage et al., 2009; Berkes, 2007; Berkes, 2009; Pomeroy, 1993.
Capital Building.	Armitage et al., 2007; Armitage et al., 2009; Berkes, 2009; Berkes, 2007; Pomeroy et al., 2001; Islam et al, 2023; Ostrom, 2007; Carlson and Berkes, 2005; Folke et al., 2005.
Leadership.	Armitage et al., 2007; Armitage et al., 2009; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Pomeroy et al., 2001; Berkes, 2007.
Community Participation.	Pomeroy and Williams, 1994; Susilowati and Budiati, 2003; Ostrom, 1990; Pomeroy et al., 2001.
Delegation of Authority.	Pomeroy, 1993; Susilowati and Budiati, 2003; Pomeroy and Williams, 1994; Pomeroy et al., 2001; Berkes, 2007; Armitage et al., 2009.
Community Empowerment.	Pomeroy et al., 2001; Pomeroy and Williams, 1994; Susilowati and Budiati, 2003.

(Adapted from: Armitage et al., 2007; Armitage et al., 2009; Berkes, 2009; Berkes, 2007; Carlson and Berkes, 2005; Folke et al., 2005; Islam et al, 2023; Ostrom, 1990; Ostrom, 1994; Ostrom, 2007; Pomeroy et al., 2001; Pomeroy and Williams, 1994; Pomeroy, 1993; Susilowati and Budiati, 2003).

See Chapter 2 Tables 2.2 & 2.3 for a breakdown of how these ten adaptive co-management indicators were systematic discovered throughout various research databases.

After small-scale fishers completed household surveys, these household surveys were analyzed to create interview questions for fishery and institutional leaders with each SSF. Questions to fishery and institutional leaders focused on areas that were essential to adaptive co-management identified through literature review and the indicators from small-scale fisher household surveys that needed further expansion. Questions to the academic partners both SSF were different from those asked to fishery and institutional leaders. These questions centered around institutional support, capital building, adaptable management and social networks. The interviews conducted with fishery and institutional leaders were semi-structured, which allowed the researchers to interchange the questions as per the responses of the interviewee and add additional questions to the interview based on the responses provided (Knott et al., 2022). This allowed the most amount of information to be obtained from interview participants.

To determine how each method was utilized to inform the objectives of this chapter, see Chapter 2 Table 2.4.

4.3 Results

4.3.1 Tambak Bulusan, Demak, Indonesia

40 small-scale fishers completed household surveys to understand the adaptive co-management dynamics intersecting the SSF of Tambak Bulusan. Table 4.2 identifies the small-scale fisher household survey results for each survey question asked to small-scale fishers in Tambak Bulusan. Table 4.2 states the indicator, what the question is for that indicator, and the total number of small-scale fishers out of 40 that agreed, disagreed or were uncertain with the indicator. The majority of respondents in Table 4.2 was defined as over 21 respondents for each response, based on the total sample of 40 small-scale fishers in Tambak Bulusan.

Table 4.2: Small-Scale Fisher Household Survey Results from Tambak Bulusan.

Indicator.	Question.	Agree	Disagree	Uncertain
Well Defined Resource System.	The physical boundaries of the fishery are well-known to community members.	22	5	13
	The users of the fishery are identifiable.	38	0	2
	The fishery is directly around the community and does not require fishers to travel far distances.	39	1	0
	The community fishery does not have migratory fish and aquatic species.	22	15	3

Community Collectivity.	The culture and ethnicity of fishers using the fishery are the same.	40	0	0
	Fishers are empowered to work together and make decisions based on the collective community instead of their own self-interest.	31	9	0
	The gear use by fishers within this fishery is similar.	32	8	0
	There are organizations and institutions within the community that share the same interests as community fishers.	38	2	0
Clear Property Rights.	There is a clear set of users who have the right to manage and own the fishery.	31	8	1
	There are policies outlining who has specific access and rights to the fishery.	25	14	1
	Community fishers/members have the right to manage and own the fishery.	38	2	0
Accessible Adaptable Management Portfolio.	There are multiple management strategies used to manage the fishery at any given time.	36	4	0
	There is knowledge and information sharing between different stakeholders and users of the fishery.	30	9	1

	Knowledge within the fishery is generated from what has worked in the past for fishers and the community.	37	3	0
	Fisheries management processes are informed by feedback from various users that help management processes grow and adapt to new problems that arise within the fishery.	38	0	2
Institutional Support.	Institutions and organizations that are in the community understand that there is a need for long-term institutional support.	24	16	0
	Connections to outside organizations and institutions are/or would be beneficial to the community.	37	1	2
	There are organizations within the community that aid in conflict resolution between users.	32	7	1
	There are partnerships between organizations, institutions, and fishers, that allow for collaborative decision-making processes.	26	12	2
	There are organizations within the community that aid in bridging the knowledge and information between institutions, organizations, and users.	26	12	2

Capital Building.	Financial resources are being provided by governments and organizations to aid in monitoring, enforcement, training, and education.	21	17	2
	There are governmental educational programs in the community that educate fishers on fisheries management processes and practices.	22	17	1
	There is a need for more education and training in fisheries management for the community and fishers by outside organizations.	38	1	1
Leadership.	Current management of the fishery is done by a collective of community members.	38	2	0
	There is a sense of trust in the current manager(s) of the fishery in the community.	39	1	0
	Having managers of the fishery who are not from the community, such as scientists or non-governmental agencies, would improve my trust in the managers.	27	13	0
	The leaders of fisheries management processes within the community take accountability and are transparent.	37	2	1

	The leaders of the fishery are legitimized by the government and outside organizations.	35	3	2
Participation.	Individuals who are affected by fisheries management decisions can participate in fisheries decision-making processes.	35	5	2
	There is a high degree of competition for fishery resources.	6	34	0
	There have been fewer fishers from the community participating in fisheries activities over the past five years.	24	14	2
Delegation of Authority.	Governments have created legislation that allows local communities to make fisheries management decisions and rules.	27	0	13
	Governments, institutions, organizations, and community members share the risks and benefits of fisheries management.	23	8	9
	There is little interference from outside organizations and institutions in the management of the fishery.	32	8	0
	Monitoring and enforcement of the fishery are performed by the community.	40	0	0

Community Empowerment.	The community is empowered to act in fisheries decision-making, as the benefits of working together outweigh the costs of working as individuals.	34	6	0
	Fishers are positively influenced by governments to take part in fisheries decision-making processes.	29	8	3

(Primary Household Survey Data, 2024).

Table 4.3 identifies a summary of the collective responses of all 40 small-scale fishers who completed household surveys in Tambak Bulusan. Table 4.3 indicates the adaptive co-management indicator, and the total agree, disagree, and uncertain responses from 40 small-scale fishers in Tambak Bulusan. Some indicators in Table 4.3 have more total responses than other indicators. This is because Table 4.3 summarizes the total amount of agree responses from small-scale fishers above in Table 4.2.

Table 4.3: Summary of the Small-Scale Fisher Responses Within Tambak Bulusan on Adaptive Co-Management Indicators Intersecting Their Community.

ACM Indicator.	Small-Scale Fisher Response.		
	Agree	Disagree	Uncertain
Well Defined Resource System.	121	21	18
Community Collectivity.	141	19	0
Clear Property Rights.	94	24	2
Accessible Adaptable Management Portfolio.	141	16	3
Institutional Support.	145	48	7
Capital Building.	81	35	4
Leadership.	176	21	3
Participation.	65	53	4
Delegation of Authority.	122	16	22
Community Empowerment.	63	14	3

(Primary Household Survey Data, 2024).

After household surveys were completed with small-scale fishers in Tambak Bulusan, 6 Semi-structured interviews with fishery and institutional leaders were conducted. These interviews expanded on the results found in household surveys, with small-scale fishers, while also determining what adaptive co-management indicators leaders and institutional partners believed were the most imperative for their communities.

Table 4.4 below provides an overview of a ranking of the 10 adaptive co-management indicators tested in Tambak Bulusan from fishery and institutional leaders. Table 4.4 indicates the rank of the adaptive co-management indicator, what the adaptive co-management indicator was, the number of fishery and institutional leaders that noted the indicator's importance, followed by the total percentage of fishery and institutional leaders that noted the adaptive co-management indicator.

Table 4.4: Ranking the Adaptive Co-Management Indicators Based on Importance as Discovered in Semi-Structured Interview with Fishery and Institutional Leaders in Tambak Bulusan.

Rank	Adaptive Co-Management Indicator	Number of Respondents.	Percentage of Total Interview Respondents.
1	Institutional Support.	6	100%
1	Capital Building.	6	100%
2	Adaptive Management Portfolio.	5	83.33%
3	Leadership.	4	66.67%
4	Participation.	3	50%
4	Delegation of Authority.	3	50%
5	Clear Property Rights.	2	33.33%
6	Community Empowerment.	1	16.67%
7	Community Collectivity.	0	0%
7	Well-Defined Resource System.	0	0%

(Primary Semi-Structured Interview Data, 2024).

Table 4.5 indicates the fishery and institutional leader responses from Tambak Bulusan, and what each leader had to say about specific adaptive co-management indicators. Table 4.5 identifies the adaptive co-management indicator, the leader or institutional partner that mentioned it and a quote of what the leader or institutional partner stated.

Table 4.5: Semi-Structured Interview Responses from Fishery and Institutional Leaders in Tambak Bulusan Regarding Adaptive Co-Management Indicators.

ACM Indicator.	Leader Title in Community.	Quote:
Clear Property Rights.	SSF Leader.	"We fishermen are the initiators of the establishment of the "Tambakbulusan Palace" beach tourism, but because the management is now in the village, the fishermen here are only members, and have no special authority in the management of the tourism itself."
	Community Tourism Leader.	"This means that all efforts made by Bumdes must be managed together with the residents of Tambakbulusan village."
Accessible Adaptive Management Portfolio.	Community Tourism Leader.	"The relationship between Bumdes and small-scale fishermen is the provision of additional income by fishermen as boat taxis for tourist transportation."
	Local Village Governmental Leader.	"Previous experience gives us a better understanding of what we need to do now. The most common form of development is the use of newer fishing gear, considering the effectiveness of the catch."
	SSF Leader.	""“I manage by following the conditions and situations that occur in our fishermen."

	SSF Leader.	"Currently the development of fishing gear is increasingly rapid. This information can provide alternatives for new ways to catch fish."
	Academic Institution.	"The community there faces problems in managing fisheries productivity, but there is still ecotourism to help alleviate the problem during the low season."
Institutional Support.	Community Tourism Leader.	"Many UNDIP academics help here: tourism infrastructure development, mangrove planting, business management education, and tourism area management. Many collaborations have been carried out with UNDIP as a partner to encourage the development of this tourism."
	Academic Institution.	"I have been doing research and community service there since 2013. We do community development and coastal area management. I have a long-term program on sustainability, and collaborate with local government, local communities, and universities."
		"Currently, we also have fostered MSMEs in Bulusan ponds, where they work selling processed fishery products from their community, and various financial management training and education in their management, so that they can provide added value to fishery products."

		"We have several partners that we connect with [...] Tambak Bulusan communities: Datares, Wetlands, and JICA. These NGOs handle coastal area conservation and coastal community management, so they are very helpful to us and [...] Tambak Bulusan communities in transferring knowledge and technology. Currently, we also have a connectivity program between local communities and the local government of Demak Regency, the Central Java government, and the central government (national)."
		"Rehabilitation program by planting mangroves from the beginning to mapping the right position in the planting. [...] The reduction of plastic waste in the management and planting of mangroves. One more thing about sustainability, we also have sustainable development, which covers all socio-economic-ecological elements, so that it can increase public awareness about protecting the surrounding environment."
	SSF Leader.	"At least, here every 3 months there will definitely be counseling and training held by the local government, so that it can help provide knowledge to fishermen about how to manage the fishery products."

		"For universities today, they do not provide many direct benefits to fishermen. But many indirectly, because what is being developed by universities today is only tourism, and that is additional income for the fishermen here."
	Local Village Governmental Leader.	"The government always has a program to support people's livelihoods. Every year there must be a program, besides that there is also frequent coordination between the government and the community livelihood groups in Tambakbulusan village."
	Manager of Fish Processing and Trading.	"We often coordinate with local governments (trade, tourism, and fisheries departments). Second from CSR private companies. And third partnering with academics. Where these three partners can also help us develop this business."
	SSF Leader.	"Very helpful, in terms of maintenance and operation of the machine is often assisted by the government. In addition, there are training and counseling that can provide new knowledge for fishermen."
Capital Building.	SSF Leader.	"The assistance from the university for tourism development itself I admit is very much, UNDIP in tourism development assistance here alone can reach hundreds of millions of rupiah. But not directly to fishermen because there are several other types of groups there, starting

		from mangroves, micro businesses/traders, and fisheries cultivation."
		"The perception of fishermen in the past was that when they got it, they sold it directly, but because they have received training, now some are stored for food stock when the lean season occurs. Education and training can also drive social progress in the community here."
	Manager of Fish Processing and Trading.	"Forms of incentives such as training and coaching are often carried out by the government and academics given to the community. but the community itself has not been able to continue the development of the business that has been done".
	Local Village Governmental Leader.	"Currently we are providing training and counseling, and coordinating with related agencies in providing guidance to the community's livelihoods."
		""“If in the form of money/capital there is currently none. usually for ponds, the assistance provided is in the form of seeds, feed, and other supporting tools. While for fishermen, it is usually in the form of machines and fishing

		gear. In addition, there is also coaching and direction only."
	SSF Leader.	"What we need now is a lot of training and coaching, especially in managing fish catches."
	Academic Institution.	"For financial capital, it is usually done by local governments, non-governmental institutions, and also companies in order to encourage the economic welfare of coastal communities."
		"The education we do is knowledge of rehabilitation and management of coastal ecosystems, especially in […] Bulusan ponds."
	Community Tourism Leader.	"We often coordinate (with governments) for counseling, coaching, and assistance."
Leadership.	SSF Leader.	"We went through a group deliberation meeting. But until today no one wants to replace me in managing this fishermen's group. Because my social network is large, starting from the village, local government, and fisheries managers. Finally, no one wants to replace me since 1998. I was replaced in 2008 but, because there were no activities in this group for 2 years because of the new chairman, I finally replaced him again."

	Local Village Governmental Leader.	"For the fishermen group, it is selected through a member meeting, then ask for a letter of recommendation from the village head to make a letter to the district government. While the village head is selected through a general election."
	SSF Leader.	"It comes from a discussion of the members of the fishermen's group, […] At least every 2 months we have regular meetings to discuss existing fishermen's problems."
	Community Tourism Leader.	"The principle of managing bumdes is "from the people, by the people, for the people. This means that all efforts made by bumdes must be managed together with the residents of Tambakbulusan village."
Participation.	Local Village Governmental Leader.	"(Greater incentives) are very necessary. Especially now there are many complaints and problems that occur in the fisheries sector, not only in the form of assistance with tools and materials, but also other support from coaching and direction carried out in the livelihoods of these fishermen."
	SSF Leader.	"Because our group does not seem to get any benefit from the village development funds. Even though we have submitted several proposals, they were not responded to by the village government."

		“In my opinion, (governments share) around 50%. There still needs to be openness from organizations and the government in handling fisheries management in this Bulusan pond village”
	SSF Leader.	"Evidence 10 years ago before the massive destructive fishing gear, the community here could harvest fish with nets alone, reaching 100-150 kg in one trip to sea."
Delegation of Authority.	SSF Leader.	"I think it's fair now. If you look at the profit and loss, the government never expects profit. Because they share knowledge and technology with us."
	Local Village Governmental Leader.	"Currently, we are still maintaining relations with organizations that have provided assistance here, so that the cooperation carried out can continue."
	SSF Leader.	"Cooperation is usually only from the government, in the form of us attending invitations given by the government to attend counseling and coaching."
Community Empowerment.	Academic Institution.	Connectivity provides great benefits for the local communities of […] Tambak Bulusan. Undip provides large funding to be developed through research and educational transfer (as I did), so this is very helpful in developing the local community there.

	Manager of Fish Processing and Trading.	"Very encouraging, often invited to conduct training in developing creative business ideas."

(Primary Semi-Structured Interview Data, 2024).

Table 4.5 above does not have any mention of two of the ten adaptive co-management indicators, a well-defined resource system and community collectivity. This is due to fishery leaders and institutional partners in Tambak Bulusan not mentioned heavy importance on these adaptive co-management indicators.

4.3.2 Purwoejo, Morodemak, Demak, Indonesia

79 small-scale fishers participated in household surveys aimed to understand the adaptive co-management dynamics intersecting the SSF of Purwoejo. Table 4.6 indicates the small-scale fisher responses to adaptive co-management indicators intersecting their fishery asked in household surveys. Table 4.6 states the indicator, what the question is for that indicator, and the total number of small-scale fishers out of 40 that agreed, disagreed or were uncertain with the indicator. The majority of small-scale fishers for Table 4.6 is defined as over 40 respondents, based on the total sample of 79 small-scale fishers in Purwoejo.

Table 4.6: Small-Scale Fisher Household Survey Data from Purwoejo.

Indicator	Question	Agree	Disagree	Uncertain
Well Defined Resource System.	The physical boundaries of the fishery are well-known to community members.	32	47	0
	The users of the fishery are identifiable.	77	1	1
	The fishery is directly around the community and does not require fishers to travel far distances.	59	20	0
	The community fishery does not have migratory fish and aquatic species.	44	30	5
Community Collectivity.	The culture and ethnicity of fishers using the fishery are the same.	78	1	0
	Fishers are empowered to work together and make decisions based on the collective community instead of their own self-interest.	58	18	3
	The gear use by fishers within this fishery is similar.	36	42	1
	There are organizations and institutions within the community that share the same interests as community fishers.	54	17	8

Clear Property Rights.	There is a clear set of users who have the right to manage and own the fishery.	49	14	16
	There are policies outlining who has specific access and rights to the fishery.	27	33	19
	Community fishers/members have the right to manage and own the fishery.	65	8	6
Accessible Adaptable Management Portfolio.	There are multiple management strategies used to manage the fishery at any given time.	16	61	2
	There is knowledge and information sharing between different stakeholders and users of the fishery.	69	9	1
	Knowledge within the fishery is generated from what has worked in the past for fishers and the community.	78	1	0
	Fisheries management processes are informed by feedback from various users that help management processes grow and adapt to new problems that arise within the fishery.	75	2	2

Institutional Support.	Institutions and organizations that are in the community understand that there is a need for long-term institutional support.	21	53	5
	Connections to outside organizations and institutions are/or would be beneficial to the community.	44	27	8
	There are organizations within the community that aid in conflict resolution between users.	34	39	6
	There are partnerships between organizations, institutions, and fishers, that allow for collaborative decision-making processes.	26	38	15
	There are organizations within the community that aid in bridging the knowledge and information between institutions, organizations, and users.	30	40	9
Capital Building.	Financial resources are being provided by governments and organizations to aid in monitoring, enforcement, training, and education.	27	49	3

	There are governmental educational programs in the community that educate fishers on fisheries management processes and practices.	39	36	4
	There is a need for more education and training in fisheries management for the community and fishers by outside organizations.	74	5	0
Leadership.	Current management of the fishery is done by a collective of community members.	52	22	5
	There is a sense of trust in the current manager(s) of the fishery in the community.	42	35	2
	Having managers of the fishery who are not from the community such as scientists or non-governmental agencies, would improve my trust in the managers.	27	31	21
	The leaders of fisheries management processes within the community take accountability and are transparent.	37	36	6

	The leaders of the fishery are legitimized by the government and outside organizations.	50	14	15
Participation.	Individuals who are affected by fisheries management decisions can participate in fisheries decision-making processes.	49	17	13
	There is a high degree of competition for fishery resources.	66	13	0
	There have been fewer fishers from the community participating in fisheries activities over the past five years.	27	46	6
Delegation of Authority.	Governments have created legislation that allows local communities to make fisheries management decisions and rules.	38	6	35
	Governments, institutions, organizations, and community members share the risks and benefits of fisheries management.	42	6	31
	There is little interference from outside organizations and institutions in the management of the fishery.	72	3	4

	Monitoring and enforcement of the fishery are performed by the community.	64	12	3
Community Empowerment.	The community is empowered to act in fisheries decision-making, as the benefits of working together outweigh the costs of working as individuals.	63	16	0
	Fishers are positively influenced by governments to take part in fisheries decision-making processes.	44	32	3

(Primary Household Survey Data, 2024).

Table 4.7 identifies a collective summary of the responses from all 79 small-scale fishers in Purwoejo who completed household surveys on adaptive co-management indicators intersecting their community. Table 4.7 indicates the adaptive co-management indicator, and the total agree, disagree, and uncertain responses from 79 small-scale fishers surveyed in Purwoejo. Some indicators in Table 4.7 have more total responses than others. This is due to the total number of questions used to examine each adaptive co-management indicator within Table 4.6, as Table 4.7 is a summary of the responses from each indicator's questions.

Table 4.7: Summary of the Small-Scale Fisher Responses Within Purwoejo on Adaptive Co-Management Indicators Intersecting Their Community.

ACM Indicator.	Small-Scale Fisher Response.		
	Agree	Disagree	Uncertain
Well Defined Resource System	212	98	6
Community Collectivity.	226	78	12
Clear Property Rights	141	55	41
Accessible Adaptable Management Portfolio	238	73	5
Institutional Support	155	197	43
Capital Building	140	90	7
Leadership	208	138	49
Participation	142	76	19
Delegation of Authority	216	27	73
Community Empowerment	107	48	3

(Primary Household Survey Data, 2024).

After household surveys were completed with small-scale fishers in Purwoejo, 6 Semi-structured interviews with fishery and institutional leaders were conducted. These interviews expanded results found in household surveys, while also determining what adaptive co-management indicators leaders and institutional partners believed to be the most influential.

Table 4.8 below provides a ranking overview of the 10 adaptive co-management indicators tested in Purwoejo from fishery and institutional leaders. Table 4.8 indicates the rank of the adaptive co-management indicator, what the adaptive co-management indicator was, the number of fishery and institutional leaders that noted the indicator's importance, followed by the total percentage of fishery and institutional leaders that noted the adaptive co-management indicator.

Table 4.8: Ranking the Adaptive Co-Management Indicators Based on Importance as Discovered in Semi-Structured Interviews with Fishery and Institutional Leaders in Purwoejo.

Rank	Adaptive Co-Management Indicator.	Number of Interviews Respondents.	Percentage of Total Interview Respondents.
1	Institutional Support.	6	100%
1	Capital Building.	6	100%
2	Leadership.	5	83.33%
3	Accessible Adaptive Management Portfolio.	4	66.67%
3	Community Collectivity.	4	66.67%
4	Delegation of Authority.	3	50%
4	Participation.	3	50%
4	Clear Property Rights.	3	50%
5	Well-Defined Resource System.	1	16.67%
5	Community Empowerment.	1	16.67%

(Primary Semi-Structured Interview Data, 2024).

Table 4.9 indicates the fishery and institutional leader responses from Purwoejo, and what each leader had to say about specific adaptive co-management indicators. Table 4.9 identifies the adaptive co-management indicator, the leader or institutional partner that mentioned it and a quote of what the leader or institutional partner stated.

Table 4.9: Semi-Structured Interview Responses from Fishery and Institutional Leaders in Tabak Bulusan regarding adaptive co-management indicators.

ACM Indicator.	Leader Title in Community.	Quote:
Well-Defined Resource System.	Head of Purwoejo Fishing Port.	"“The provincial government has the authority to regulate and manage marine resources from a distance of 0-12 miles, then the national authority is above 12 miles-200 miles (EEZ). While for land management (TPI and fishermen) is the task of the district government."
Community Collectivity.	Head of Purwoejo Fishing Port.	"If we follow the fisheries law, then the number of fishermen here is around 300 people."
		"Many fishing gears do not comply with the limits that have been given. For example, there are several destructive fishing gears: “arad” (mini trawl), “sodo” (kuznet). This has a damaging effect on the ecosystem and marine resources."

	SSF Leader.	"Fishermen here can have 2-3 fishing gear per boat. So, the total number of fishermen is around 300 people."
	SSF Leader.	"If the rainy season, this "butterfly" fishing gear can be more than 100 people, because in that season the type of anchovy is abundant."
		"Interaction between individuals, joint problem solving, and sharing new information about current ocean conditions (benefits of collectivity)."
	Academic Institution.	"(Purwoejo) has a bigger problem, because the fishing community is very large in the Morodemak area."
Clear Property Rights.	Head of Purwoejo Fishing Port.	"In terms of supervision, there is good cooperation from the fisheries and maritime services, the Directorate of Water and Air Police, and also from the Indonesian Navy. So, we share the risk of supervision with these government institutions, to ensure that fishermen catch fish in accordance with the permits that have been given."

	Head of Woman Fishers and Processors.	There are various agencies that usually help in fisheries management, starting from the marine and fisheries service (province - district), the Marine and Air Police Corps, the environmental service, the local government (district). They have various tasks and authorities here in regulating the management of fish here."
		"What I see now is that fishermen have not been able to properly utilize the access that has been provided by the government"
	SSF Leader.	"Average 6 times a week, Friday is a holiday. In 1 day usually only 1 time going to sea."
Accessible Adaptive Management Portfolio.	Head of Purwoejo Fishing Port.	"We currently base management on the problems that occur."
	SSF Leader.	"There are many previous experiences, starting from the stories of our predecessors that have become knowledge for many fishermen here."
	SSF Leader.	"Past experience is certainly used."
	Head of Woman Fishers and Processors.	"Of course, various experiences provide ways to manage (fisheries) better."
	SSF Aquaculture Leader.	"We also often get help from academics (usually from UNDIP) to carry out better pond cultivation management."

		"Collaboration with non-governmental organizations can have a positive effect on fishermen. From the government's side, it strongly encourages such collaboration, in fact we often act as intermediaries for collaborations between fishermen and non-governmental organizations and academics."
	Head of Purwoejo Fishing Port.	"From the Central Java provincial government. Several programs that are currently being run, one of which is increasing fishermen's income. The program is also one way to secure marine resources and ecosystems. There is a fish apartment program that is useful for restoring coral reef and fish ecosystems, so that it can create fishing grounds that are closer to the coast, and can also reduce their production costs."
		"Very often we help to form collaborations between academics and fishermen."
	Academic Institution.	"We together with the government and local communities are looking for solutions to provide decent and legal housing, so that coastal area management can be achieved."

		"Rehabilitation program by planting mangroves from the beginning to mapping the right position in the planting. The second is the reduction of plastic waste in the management and planting of mangroves."
		"We conduct problem-solving discussions with experts in their fields, of course together with representatives of the community as well. We build this connection to support the successful resolution of various problems that occur on the coast of [...] Morodemak."
		"Datares, Wetlands and JICA. These NGOs handle coastal area conservation and coastal community management, so they are very helpful to us and also the Morodemak […] communities in transferring knowledge and technology. Currently we also have a connectivity program between local communities and the local government of Demak Regency, the Central Java government, and the central government (national). We have a strong relationship with the Ministry of Marine Affairs and Fisheries, where they have a funding program for the

		rehabilitation of the Morodemak coastal area."
		"I have been collaborating with the coastal community of Morodemak […] since 2013-present."
	Head of Woman Fishers and Processors.	"Fishermen's knowledge here is very limited, so it is also necessary to have the latest information, which may be obtained from academic sources, government, and non-governmental institutions."
		"Closeness to the government makes it easier in terms of administration and various new information about fisheries management. This can provide convenience for fishermen in order to increase their individual capacity."
		"Usually in the form of training and counseling. For example, just yesterday there was a ship engine repair training, where they also received assistance in the form of 1 set of ship engine repair tools."

	SSF Leader.	"Fishermen here are still demanding easy access to resources and assistance that can be provided by the government."
		"Currently, we have only received some training, such as operating ship engines, and briefings about bad weather."
	SSF Leader.	"Many fishermen themselves ignore the programs provided by the government.
		"There has never been any collaboration outside the government's maritime and fisheries services."
Capital Building.	Head of Woman Fishers and Processors.	"The form of assistance here is usually not in the form of cash (money capital). But in the form of fishing gear, boat engines, administrative assistance, fishermen's insurance, and forms of training conducted to encourage increased fishermen's capacity."
	SSF Leader.	"Here at the moment we only get fuel subsidy assistance, each member gets a fuel subsidy of 2 liters/per day."
		"The current problem is the difficulty of accessing fuel oil for the ship's engine."
		"There are still many complaints from fishermen related to the services provided

		by the government. One example: there are still many difficulties in getting fuel oil."
	SSF Leader.	"The community has not fully utilized the assistance provided by the government."
		"One of the most frequently expected assistance by fishermen in order to join a fishermen's group organization is fuel subsidies, where every month they receive a fuel subsidy quota of 200 liters for each boat."
	SSF Aquaculture Leader.	"In 2018, we were given a capital loan from the agency of Rp. 500,000,000, but that was for several groups in this Purwoejo village."
	Head of Purwoejo Fishing Port.	"The more knowledge and education possessed by […] fishermen, the easier the management carried out by the government will be."
	Academic Institution.	"Undip provides large funding to be developed through research and educational transfer (as I did), so this is very helpful in developing the local community there."
		"Conducting a master plan to increase knowledge about the threat to the local community. What we do is coastal public

		space area management, rehabilitation, and increasing economic capacity."
Leadership.	SSF Aquaculture Leader.	"Our group was formed in 2018. All members were previously candidate leaders here but voting and deliberation were carried out to determine the group leader."
	Head of Woman Fishers and Processors.	"The group leader must be chosen through a deliberation of its members. Usually, the administrators are not from fishermen/ship owners, but from the crew, because they do not always work at sea."
		"Through deliberation, where the formation of the fishermen group is at least 15 members. Deliberation to determine the chairman, secretary, and treasurer."
	SSF Leader.	"The process is a deliberation, chosen from its members. Every month we also have a meeting to evaluate the condition of the fishermen's results."
	SSF Leader.	"Through deliberations among the members of the fishermen's group themselves."

	Head of Purwoejo Fishing Port.	"The selection of fisheries leaders here is chosen by the governor of Central Java, so the letter of assignment comes from the governor's regulation. For the head of the fishermen's group through deliberation, where there is also approval from the government."
Participation.	SSF Leader.	"As long as you have a group, you will often be included in activities carried out together with government agencies."
		"Currently, fuel subsidies must receive recommendations from fishermen groups, so to get a share of fuel subsidies, they must join a group. Because, the government cannot help individuals, the requirement to receive assistance from the government at this time is to have a joint business group (KUB)."
	SSF Leader.	"We have regular meetings every 2 weeks to discuss our members' problems. There are weekly contributions that are made for our fishermen's group's cash as well, in case something unexpected happens."
		"Competition between fishermen, related to the differences in fishing gear used. Currently we are competing with environmentally unfriendly tools."

	Head of Purwoejo Fishing Port.	"Fishermen who do not have a sailing permit, will not receive a recommendation to get fuel subsidies."
		"There are still many small-scale fishing vessels that do not have permits to sail at sea."
Delegation of Authority.	Head of Purwoejo Fishing Port.	"Collaboration is carried out from the national level to the village level, from the national government side, contributing from the budget to solve these problems (starting from cleaning sedimentation, rehabilitation, mangroves, and coastal embankments). Collaboration from the village side gathers the community to participate in "mutual cooperation" in implementing the program."
	SSF Leader.	"There is legitimacy, usually there is an introduction from the sub-district, notary, and later it will be submitted to the Maritime Affairs and Fisheries Service to grant the legitimacy."
	SSF Leader.	"If you already have a deed of establishment from the village and a notary, it will be legitimized by the marine and fisheries service."

Community Empowerment.	Head of Purwoejo Fishing Port.	"Encourage public awareness to comply with ship licensing documents. Encourage public awareness to maintain the marine ecosystem, so that the livelihoods of fishermen here can also be sustainable."

(Primary Semi-Structured Interview Data, 2024).

4.3.3 Small-Scale Fisher Household Survey Comparison

Table 4.10 indicates a comparison between the two SSF of Tambak Bulusan and Purwoejo, Morodemak, Demak, Indonesia. Table 4.10 indicates the responses from small-scale fisher household surveys in each SSF and their responses of agree, disagree, and uncertain to adaptive co-management indicators intersecting their respective communities.

Table 4.10: Comparison of Small-Scale Fisher Household Survey Data within Indonesian SSF.

Tambak Bulusan, Demak, Indonesia.			Purwoejo, Morodemak, Demak, Indonesia.		
Rank	Adaptive Co-Management Indicator.	Number of Fishers Agreeing with Indicator.	Rank	Adaptive Co-Management Indicator.	Number of Fishers Agreeing with Indicator.
1	Leadership.	176	1	Accessible Adaptable Management Portfolio.	238
2	Institutional Support.	145	2	Community Collectivity.	226
3	Community Collectivity.	141	3	Delegation of Authority.	216
3	Accessible Adaptive Management Portfolio.	141	4	A Well-Defined Resource System.	212
4	Delegation of Authority.	122	5	Leadership.	208
5	A Well-Defined Resource System.	121	6	Institutional Support.	155
6	Clear Property Rights.	94	7	Participation.	142
7	Capital Building.	81	8	Clear Property Rights.	141
8	Participation.	65	9	Capital Building.	140
9	Community Empowerment.	63	10	Community Empowerment.	107

(Primary Household Survey Data, 2024).

4.3.4 Fishery and Institutional Leader Comparison of Adaptive Co-Management Rankings

Table 4.11 indicates the fishery and institutional leader rankings of adaptive co-management indicators across both Tambak Bulusan and Purwoejo. Table 4.11 for each SSF

indicates the rank of the adaptive co-management indicator, what the indicator is, the number of fishery and institutional leaders that noted its importance and the total percentage of fishery and institutional leaders that mentioned the indicator's importance.

Table 4.11: Comparison of the Ranking of Adaptive Co-Management Indicators Based on responses from Fishery and Institutional Leaders in Two SSF in Indonesia.

Tambak Bulusan, Demak, Indonesia.				Purwoejo, Morodemak, Demak, Indonesia.			
Rank	Adaptive Co-Management Indicator	Number of Respondents.	Percentage of Total Interview Respondents.	Rank	Adaptive Co-Management Indicator.	Number of Interviews Respondents.	Percentage of Total Interview Respondents.
1	Institutional Support.	6	1	1	Institutional Support.	6	1
1	Capital Building.	6	1	1	Capital Building.	6	1
2	Adaptive Management Portfolio.	5	0.8333	2	Leadership.	5	0.8333
3	Leadership.	4	0.6667	3	Accessible Adaptive Management Portfolio.	4	0.6667
4	Participation.	3	0.5	3	Community Collectivity.	4	0.6667
4	Delegation of Authority.	3	0.5	4	Delegation of Authority.	3	0.5
5	Clear Property Rights.	2	0.3333	4	Participation.	3	0.5
6	Community Empowerment.	1	0.1667	4	Clear Property Rights.	3	0.5
7	Community Collectivity.	0	0	5	Well-Defined Resource System.	1	0.1667
7	Well-Defined Resource System.	0	0	5	Community Empowerment.	1	0.1667

(Primary Semi-Structured Interview Data, 2024).

4.4 Discussion

4.4.1 Presence of Adaptive Co-Management in Tambak Bulusan

In the SSF of Tambak Bulusan, Demak, Indonesia adaptive co-management indicators are perceived and felt differently between small-scale fishers and fishery and institutional leaders. Table 4.12 indicates a comparison of the adaptive co-management indicators noted by small-scale fishers and fishery and institutional leaders in Tambak Bulusan. Table 4.12 small-scale fisher results (Green) were adopted and ranked from Table 4.3 which summarized the results from household surveys. Fishery and institutional leader results in Table 4.12 (Blue) were adopted from Table 4.5 and indicate the respective ranking of adaptive co-management indicators based on semi-structured interviews.

Table 4.12: Comparison of Adaptive Co-Management Indicator Rankings for Small-Scale Fishers and Fishery and Institutional Leaders in Tambak Bulusan.

Tambak Bulusan Small-Scale Fisher Adaptive Co-Management Rankings from Household Surveys.			Tambak Bulusan Fishery and Institutional Leaders Ranking of Adaptive Co-Management Importance from Interviews.			
Rank	Adaptive Co-Management Indicator.	Number of Fishers Agreeing with Indicator.	Rank	Adaptive Co-Management Indicator	Number of Respondents.	Percentage of Total Interview Respondents.
1	Leadership.	176	1	Institutional Support.	6	1
2	Institutional Support.	145	1	Capital Building.	6	1
3	Community Collectivity.	141	2	Adaptive Management Portfolio.	5	0.8333
3	Accessible Adaptive Management Portfolio.	141	3	Leadership.	4	0.6667
4	Delegation of Authority.	122	4	Participation.	3	0.5
5	A Well-Defined Resource System.	121	4	Delegation of Authority.	3	0.5
6	Clear Property Rights.	94	5	Clear Property Rights.	2	0.3333
7	Capital Building.	81	6	Community Empowerment.	1	0.1667
8	Participation.	65	7	Community Collectivity.	0	0
9	Community Empowerment.	63	7	Well-Defined Resource System.	0	0

(Primary Household Survey & Semi-Structured Interview Data, 2024).

Results from Table 4.12 exemplify different results between small-scale fishers and fishery and institutional leaders regarding the ranking of adaptive co-management indicators. Table 4.12 indicates that small-scale fishers identified; leadership, institutional support and

community collectivity as the top three adaptive co-management indicators within their community. While fishery and institutional leaders in Table 4.12 noted the top three adaptive co-management indicators of institutional support, capital building and an adaptable management portfolio. This highlights the need to include all users of SSF into governance decision-making processes as what are priorities for fishery and institutional leaders are not the same for the small-scale fishers.

Small-scale fishers noted in Table 4.12 that the number 1 most influential and present adaptive co-management indicator within the community is leadership. This is different from the results obtained from fishery and institutional leader within Tambak Bulusan. Fishery and institutional leaders noted leadership as the third most influential adaptive co-management indicator in Tambak Bulusan. Institutional support dynamics were of similar importance to small-scale fishers and fishery and institutional leaders in Tambak Bulusan. Small-scale fishers noted institutional support as second, while fishery and institutional leaders noted institutional support as the most influential and present dynamic of adaptive co-management. Lastly, small-scale fishers note community collectivity as the third most influential and present adaptive co-management indicator intersecting the fishery. While fishery and institutional leaders noted community collectivity as one of the least important adaptive co-management indicators (see Table 4.12).

Fishery and institutional leaders in Tambak Bulusan noted in Table 4.12 that the along with institutional support, the most present and influential adaptive co-management indicator was capital building. This is different from the results obtained from small-scale fishers in

Tambak Bulusan as fishers ranked capital building, seventh in terms of adaptive co-management importance. In second, fishery and institutional leaders indicated access to an adaptable management portfolio as essential for adaptive co-management. This was similar to the results obtained from small-scale fishers in Tambak Bulusan, as fishers noted access to an adaptable management portfolio was at the same influential and importance level as community collectivity.

These differences in importance of adaptive co-management indicators identified by small-scale fishers and fishery and institutional leaders within Tambak Bulusan, highlight the importance of continued research in SSF. This has also been noted from other scholars such as Warren & Steenbergen, (2021), who state increased research is needed in SSF within Indonesia. Also, Berkes, (2011), notes that more attention is needed to SSF governance. This is due to the fact that the needs of small-scale fishers are different from those leading and partnering within the community, as can be observed from Table 4.12.

There are also differences between the adaptive co-management indicators discovered and ranked in Table 4.11 compared to the adaptive co-management indicators noted as essential in the literature. Current literature within adaptive co-management, however, has noted essential characteristics for adaptive co-management as social capital (trust and leaderships) (Armitage et al., 2009; Folke et al., 2005), social networks and linkages (institutional support) (Armitage et al., 2009; Berkes, 2007; Folke et al., 2005), and a learn-by-doing approach (adaptive management portfolio) (Armitage et al., 2009; Armitage et al., 2007; Folke et al., 2005; Plummer et al., 2013). Small-scale fishers noted leadership (social capital)

and institutional support (social networks) as two key dynamics for adaptive co-management just as the literature does. However, small-scale fishers in Tambak Bulusan also noted how community collectivity as an essential dynamic for governance to be successful within SSF.

Fishery and institutional leaders also indicated institutional support (social networks) and an adaptive management portfolio (learn-by-doing approach) as two essential dynamics influencing adaptive co-management within their SSF. However, Table 4.12 indicates that fishery and institutional leaders noted capital building as an essential adaptive co-management indicator. Capital building is similar to institutional support, however fishery and institutional leaders noted in Table 4.4 that there is a need for increased capital building within the community because it has the power to increase small-scale fisher capacity, income and knowledge. Additionally, in Table 4.4 fishery and institutional leaders noted there are a variety of social programs being conducted supporting fisher livelihoods, but very few monetary programs within the community.

Therefore, Table 4.12 indicates the ranking of adaptive co-management indicator importance within Tambak Bulusan based on small-scale fisher household surveys and fishery and institutional leader interviews. Table 4.12 exemplified similar results to the essential adaptive co-management indicators needed for successful adaptive co-management implementation as stated in the literature. However, disparities between the literature and the community were found. Additionally, disparities between fishery and institutional leader and small-scale fishers themselves were found within Tambak Bulusan.

4.4.2 Presence of Adaptive Co-Management in Purwoejo

In the SSF of Purwoejo, Morodemak, Demak, Indonesia adaptive co-management indicators are perceived and felt differently between small-scale fishers and fishery and institutional leaders within the community. Table 4.13 indicates a comparison of the adaptive co-management indicators noted by small-scale fishers and fishery and institutional leaders in Purwoejo. The small-scale fisher results (Green) were adopted and ranked from Table 4.7 that summarized the results from household surveys with small-scale fishers. The fishery and institutional leader rankings of adaptive co-management indicators (Blue) for Table 4.13 were adopted from Table 4.9.

Table 4.13: Comparison of Adaptive Co-Management Indicator Rankings for Small-Scale Fishers and Fishery and Institutional Leaders in Purwoejo.

Purwoejo Small-Scale Fisher Adaptive Co-Management Rankings from Household Surveys.			Purwoejo Fishery and Institutional Leaders Ranking of Adaptive Co-Management Importance from Interviews.			
Rank	Adaptive Co-Management Indicator.	Number of Fishers Agreeing with Indicator.	Rank	Adaptive Co-Management Indicator.	Number of Interviews Respondents.	Percentage of Total Interview Respondents.
1	Accessible Adaptable Management Portfolio.	238	1	Institutional Support.	6	1
2	Community Collectivity.	226	1	Capital Building.	6	1
3	Delegation of Authority.	216	2	Leadership.	5	0.8333
4	A Well-Defined Resource System.	212	3	Accessible Adaptive Management Portfolio.	4	0.6667
5	Leadership.	208	3	Community Collectivity.	4	0.6667
6	Institutional Support.	155	4	Delegation of Authority.	3	0.5
7	Participation.	142	4	Participation.	3	0.5
8	Clear Property Rights.	141	4	Clear Property Rights.	3	0.5
9	Capital Building.	140	5	Well-Defined Resource System.	1	0.1667
10	Community Empowerment.	107	5	Community Empowerment.	1	0.1667

(Primary Household Survey & Semi-Structured Interview Data, 2024).

Results from Table 4.13 exemplify adaptive co-management indicators noted as important by small-scale fishers and those for fishery and institutional leaders in Purwoejo. Table 4.13 indicates that small-scale fishers in Purwoejo noted, accessible adaptive

management portfolio, community collectivity and delegation of authority as the important adaptive co-management indicators intersecting the community. While Table 4.13 indicated that fishery and institutional leaders in Purwoejo noted, institutional support, capital building and leadership as the top adaptive co-management indicators intersecting the community. These results between small-scale fishers and fishery and institutional leaders in Purwoejo highlight the importance of continued research in the governance of SSF, as fishers and leaders have varying needs.

Small-scale fishers in Purwoejo noted that having access to an adaptive management portfolio is the most important adaptive co-management indicator (see Table 4.13). While fishery and institutional leaders ranked access to an adaptive management portfolio third in Table 18. For the second most influential and prominent adaptive co-management indicator present within Purwoejo, small-scale fishers noted community collectivity. While fishery and institutional leaders noted community collectivity as tied for third with accessible adaptable management portfolio (see Table 4.13). Lastly, small-scale fishers noted delegation of authority as the third most influential adaptive co-management dynamic in Purwoejo, in Table 4.13. While fishery and institutional leaders noted delegation of authority as the fourth most important and influential adaptive co-management dynamic.

Fishery and institutional leaders noted institutional support as the most influential and important adaptive co-management indicator intersecting Purwoejo. While small-scale fishers in Purwoejo had ranked institutional support as the sixth most important adaptive co-management dynamic intersecting the community (see Table 4.13). Next, fishery and

institutional leaders noted capital building as equally important to institutional support within Purwoejo. While small-scale fishers noted capital building as the ninth most influential adaptive co-management indicator intersecting Purwoejo (see Table 4.13). Lastly, fishery and institutional leaders noted leadership as the second most influential adaptive co-management indicator in Purwoejo. While small-scale fishers in Purwoejo note leadership as the fifth most important adaptive co-management indicator intersecting Purwoejo.

Along with differences between small-scale fishers and fishery and institutional leaders within Purwoejo, adaptive co-management indicators discovered are different from those noted in the adaptive co-management literature. Current literature within adaptive co-management, notes essential characteristics for adaptive co-management as; social capital (trust and leaderships) (Armitage et al., 2009; Folke et al., 2005), social networks and linkages (institutional support) (Armitage et al., 2009; Berkes, 2007; Folke et al., 2005), and a learn-by-doing approach (adaptive management portfolio) (Armitage et al., 2009; Armitage et al., 2007; Folke et al., 2005; Plummer et al., 2013).

Small-scale fishers in Purwoejo noted access to adaptable management portfolio in Table 4.13 as the number one most influential adaptive co-management indicator. This is similar to the current literature on adaptive co-management, which notes heavy importance on learn-by-doing approaches (adaptable management) within adaptive co-management (Armitage et al., 2009; Armitage et al., 2007; Folke et al., 2005; Plummer et al., 2013). However, small-scale fishers in Purwoejo noted community collectivity and delegation of authority as important influential adaptive co-management indicators intersecting their

community. While current literature in adaptive co-management does not note these indicators as one the topmost influential indicators for adaptive co-management. This is crucial as scholars such as Berkes, (2011) have been calling for increased SSF governance and management attention to determine the needs of these systems. This chapter helps provide increased awareness about the most influential adaptive co-management indicators within Purwoejo. While also stating the disparities between adaptive co-management indicator importance levels within literature, leadership and fishers in Purwoejo, aiding in the governance of this vulnerable SSF.

Fishery and institutional leaders within Purwoejo noted institutional support (social networks) and leadership (social capital) as two of the top three adaptive co-management indicators intersecting the community (see Table 4.13). These are similar to the most influential adaptive co-management indicators, social networks (Armitage et al., 2009; Berkes, 2007; Folke et al., 2005) and social capital (Armitage et al., 2009; Folke et al., 2005) as noted within the adaptive co-management literature. However, fishery and institutional leaders noted capital building as one of the most influential and important adaptive co-management indicators intersecting Purwoejo, over access to adaptable management portfolios (see Table 4.13). This is different from the current literature on adaptive co-management because current literature has learn-by-doing approaches (adaptable management) (Armitage et al., 2009; Armitage et al., 2007; Folke et al., 2005; Plummer et al., 2013), as one of the topmost influential adaptive co-management indicators in social-ecological systems. Continued research within Indonesian SSF is necessary to further determine the adaptive co-management

indicators that impact successful governance implementation as the needs of small-scale fishers and fishery and institutional leaders are different and evolve over time. This echoes the thoughts of Halima et al., (2019) who calls for increased governance attention in Indonesian SSF due to their unique structure.

Table 4.13 indicates that within the SSF of Purwoejo there are strong intersections with adaptive co-management indicators. Small-scale fishers noted in Table 4.13 that the 10 adaptive co-management indicators tested for within this chapter are present within their community. However, Table 4.10 indicates that the majority of small-scale fishers did not believe institutional support was present in their community as 197 fishers disagreed with it. This indication goes directly against what was discovered with fishery and institutional leaders in Table 4.9 as institutional support was identified as the most influential adaptive co-management indicator. This drastic difference in results for institutional support in the SSF of Purwoejo can be in part due to the low educational level of fishers and their inability to understand what support is coming from where and what is considered support. Interviews with fishery and institutional leaders mentioned in Table 4.8, note that there is institutional support from various institutions within the community. However, this is in form of training, education and knowledge sharing, while monetary support is in the form of subsidies (see table 4.8). Interviews with fishery and institutional leaders in Purwoejo exemplify that there is institutional support within the community of Purwoejo. However, initiatives of institutional support need to ensure they are providing support to all fishers, increase educational levels, and include what support is being provided and from whom or what institution. This will help

educate fishers on the institutional support that is being provided and intersecting the SSF of Purwoejo.

4.4.3 Adaptive Co-Management Governance Transitions in SSF

4.4.3.1 Tambak Bulusan, Demak, Indonesia

Table 4.12 indicates that out of the 10 adaptive co-management indicators tested within this chapter small-scale fishers noted all 10 indicators intersecting their community. While fishery and institutional leaders noted in Table 4.12 that eight out of the ten adaptive co-management indicators are intersecting and present within the community. This exemplifies that current governance conditions of Tambak Bulusan can provide an avenue to transition to adaptive co-management. This applicability is fluid and if socio-political conditions deteriorate, and adaptive co-management indicators become less prominent within the fishery transitions of governance would be hindered. This is due to having almost all of the adaptive co-management indicators needed for successful adaptive co-management present and intersecting the community. By transitioning to adaptive co-management small-scale fishers can increase their adaptability to dynamic change within the fishery, improving their livelihoods and social status within Tambak Bulusan. This is essential as scholars such as Armitage, (2007) have noted that there needs to be increased social-ecological system adaptation in resources where livelihoods are linked to outcomes of the system. By transitioning current SSF governance in Tambak Bulusan to adaptive co-management the adaptability of social-ecological systems, such as SSF, can be increased. Transitioning to adaptive co-management within the SSF of Tambak Bulusan can additionally aid in managing

dynamic changes that occur within the fishery. This is essential as Berkes (2011), and Halima et al., (2019), state that increased attention to how SSF governance can understand dynamic changes in social-ecological systems is crucial, marking the transition of current SSF governance to adaptive co-management as imperative.

Therefore, adaptive co-management is a viable governance strategy for the SSF of Tambak Bulusan due to the presence of adaptive co-management indicators intersecting the community. This brings further attention to SSF governance within Indonesia, which was noted by Warren & Steenbergen, (2021), and Halima et al., (2019), as a critical area for development within Indonesian SSF.

4.4.3.2 Purwoejo, Morodemak, Demak, Indonesia

Table 4.13 indicates that the SSF of Purwoejo has the majority of required adaptive co-management indicators intersecting their community. This exemplifies that the SSF of Purwoejo can have current SSF governance transitioned into adaptive co-management, as the indicators needed for successful adaptive co-management governance are present. However, strengthening the institutional support dynamics (see Table 4.9) within Purwoejo will increase the effectiveness of adaptive co-management governance. Increasing the knowledge of institutional support in Purwoejo will increase small-scale fisher understanding of where the support is coming from, what institution is providing support and how support is geared to aid fishers within the community. This would elevate small-scale fisher knowledge within Purwoejo, increasing the strength of the institutional support for adaptive co-management.

Transitioning current governance of Purwoejo to adaptive co-management can increase the fisheries adaptation to uncertain events. This has been marked critical, from scholars including, Armitage, (2007), that state, understanding ways social-ecological systems adapt to dynamic change is critical in areas that have livelihoods directly tied to the outcomes. Additionally, Berkes, (2011), explains increased attention is needed to understand how SSF governance can comprehend dynamic changes in social-ecological systems. Adaptive co-management can provide a viable governance approach for Purwoejo utilizing social learning (Armitage et al., 2009; Armitage et al., 2007; Folke et al., 2005; Plummer et al., 2013), social networks (Armitage et al., 2009; Berkes, 2007; Folke et al., 2005) and social capital (Armitage et al., 2009; Folke et al., 2005) to adapt to changing conditions within the fishery. This will improve the livelihoods of small-scale fishers who are directly tied to the success of the Purwoejo SSF. Adaptive co-management provides a viable governance approach for social-ecological systems, increasing adaptability of governance, filling in knowledge from the gaps identified by Armitage, (2007), and Berkes, (2011). Transitioning current SSF governance in Purwoejo to adaptive co-management will therefore provide an avenue to viability for SSF.

Therefore, adaptive co-management is a viable governance strategy for the SSF of Purwoejo, Morodemak, Demak, Indonesia. This generates new knowledge within SSF governance in Indonesia, which was noted by Warren & Steenbergen, (2021), and Halima et al., (2019), as a critical areas for research within Indonesian SSF.

4.5 Conclusions

In conclusion, this chapter identified the adaptive co-management indicators intersecting the SSF of Tambak Bulusan and Purwoejo, Morodemak, Demak, Indonesia. Increased attention was generated for governance of SSF within Indonesia, and the ability of current SSF governance within two Indonesian SSF to evolve from current forms into adaptive co-management were discussed. The objective of this chapter is to determine the adaptive co-management indicators present within two SSF in Indonesia to determine how adaptive co-management can be transitioned to as a form of SSF governance.

The 10 adaptive co-management indicators tested within this chapter provide insight into how to test for adaptive co-management intersecting SSF. Understanding how women in SSF view and feel adaptive co-management indicators can provide further avenues to viability as indicators will be tested across all genders, not only fishers. Adaptive co-management can provide viable pathways to transition SSF to viability because governance is understood through reflection, learning and social networks to determine the most effective and viable strategy forward. Transitioning SSF governance to adaptive co-management can provide an approach to spark the transition of small-scale fisher livelihoods from vulnerability to viability.

Chapter 5 Application of Adaptive Co-Management to Vulnerability to Viability Transitions within SSF communities of Demak Regency, Indonesia.

5.1 Introduction

Governance strategies within social-ecological systems, such as Small-Scale Fisheries (SSF), must overcome vulnerabilities intersecting the community, facilitating the transition of SSF from vulnerability to viability. Understanding vulnerability, is vital to understanding the transition of SSF from vulnerability to viability (Dias et al., 2023). Vulnerability in SSF is explained by Dias et al., (2023), Berkes & Nayak, (2018), and Nayak & Berkes, (2019), as a dynamic and multi-dimensional concept that includes inter and transdisciplinary approaches, while lacking individual wellbeing, capital(s), and resilience. Vulnerability within SSF is specifically the loss of community resilience and capacity for that same community to adapt to and overcome future impacts, created by social, cultural, and ecological interactions (Dias et al., 2023). Vulnerability within SSF is a wicked problem, as vulnerabilities associated with (1) the impacts of large-scale fisheries, (2) fishing gear and location competition, (3) conflicts with the aquaculture sector, (4) impacts from oil and gas production, (5) ocean port expansion into fishing locations, and (6) international tourism degrading historical fishing locations, are continuously arising within these social-ecological systems (Berkes & Nayak, 2018; Nayak & Berkes, 2019). Within SSF, Dias et al., (2023), outlines five over arching domains keeping SSF within vulnerable states including: (1) ecological and environmental interactions, (2) economic and developmental interactions, (3) complex governance interactions at varying levels, (4) social and cultural interactions and their influences on users, and (5) emerging

uncertain issues. Governance strategies for SSF need to address vulnerabilities intersecting the communities to facilitate transitions to viability.

To bring SSF out of states of vulnerability these communities must be transitioned into states of viability. Viability within SSF is defined by Dias et al., (2023), and Nayak & Berkes, (2019), as the transforming of vulnerable fishing communities through increasing their abilities to navigate uncertainty, adapt to changing conditions, build resilience, create social capital and networks, and increase the working relationships of trust between users. When aiding SSF in the transition from vulnerability to viability, SSF require safe and adequate infrastructure, preserved and sustainably managed fish stocks, and direct market access without the need for middle managers (Berkes & Nayak, 2018; Dias et al., 2023). There have been governance strategies developed for SSF to combat vulnerability stressors, such as, income diversification, increased access to capital, extensification (expand fishing area) and intensification (intensify fishing methods), increased collaboration, community-focused approaches, stricter governance on illegal, unreported and unregulated fishing practices (IUU), and incorporating the traditional ecological knowledge of SSF (Berkes & Nayak, 2018; Dias et al., 2023; Nayak, 2014; Nayak & Berkes, 2019). However, finding solutions on how to transition SSF into a states of viability from vulnerability are not yet developed within SSF literature (Dias et al., 2023). This calls for further research on the impacts and processes of transitioning SSF into viable communities (Dias et al., 2023). Governance strategies for SSF that can facilitate viable transition within the community are critically needed.

To achieve viable SSF it is essential to increase community capacity, building resilience within SSF. Resilience is closely linked with the processes of viability within SSF, as when resilience of these communities is built, the better equipped the community is to transition into a states of viability (Dias et al., 2023; Nayak & Berkes, 2019). Resilience is defined by Berkes & Nayak, (2018), and Folke et al., (2005), as the ability and capacity of social-ecological systems to withstand dynamic change, while remaining in the same state of function, feedback, and structure, while resisting degradation and unexpected movement into vulnerable states. To build resilience in SSF, adaptive capacity must be built, traditional fisher knowledge must be recognized, and flexible institutional linkages must be built and maintained not only within the community, but outside as well (Folke et al., 2002; Nayak & Berkes, 2019). Additionally, according to Armitage, (2007), to create resilient livelihoods within vulnerable communities, the community must be able to adapt and absorb future uncertain events, maintain the existing capabilities of that system, and provide sustainable livelihood opportunities to all members of the community. Transitioning SSF from vulnerability to viability is an ongoing challenge within the fishing industry, that is complex requiring increased attention.

Adaptive co-management provides a governance approach to SSF that can facilitate the transition of fisheries from vulnerability to viability. The adaptive co-management indicators that were discussed and tested in the Chapter 4 are the key dynamics of adaptive co-management, evolved from literature that aid in the viability of SSF. See Chapter 4 Table 4.1 for the 10 adaptive co-management indicators.

Adaptive co-management indicators that were tested in Chapter 4 were tested within this chapter to determine the level of adaptive management indicator ability at facilitating or not vulnerable to viable transitions within Indonesian SSF. The following sub-sections provide an overview of how each adaptive co-management is stated to facilitate the transition of vulnerability to viability within current SSF literature. This research will determine which adaptive co-management indicator is most influential or least influential to facilitate the transitions of SSF from vulnerable to viable.

5.1.1 A well-Defined Resources System

A well-defined resource system in one indicator of adaptive co-management that can be used to aid the facilitation of transitions of SSF from vulnerability to viability. Susilowati and Budati, (2003), and Ostrom, (199), state that a well-defined resource system in SSF is a system that has clearly defined individuals and members, along with clearly defined resource boundaries. Additionally, Pomeroy and Willians, (1994), note that to have successful boundaries they must be understandable and known to all users of the resource, while also being able to successfully manage the fishery within its boundaries with current capital. Armitage et al., (2009), tie in that a well-defined resource system in SSF has more immobile than transboundary fish stocks and few institutional challenges and conflicts. Having a well-defined resource system with clearly defined boundaries and users can strengthen governance policy for the SSF as the parameters of the system are known and distinct.

5.1.2 Community Collectivity

Community collectivity is another indicator of adaptive co-management that can be used to aid the facilitation of transitions of SSF from vulnerability to viability. Community collectivity as defined by Pomeroy and Williams, (1994), Susilowati and Budati, (2003), and Pomeroy et al., (2001), is the similarities between users' culture, ethnicity, religion, fishing practices and fishing gear. Susilowati and Budati, (2003), Ostrom, (2007) and Pomeroy and Williams, (1994), additionally explain that community collectivity is influenced by users' abilities to collectivity approach and agree upon solutions to complex problems facing their communities. Ostrom, (1990), adds that strong community collectivity can be influenced by strong community empowerment to collectivity organize. While, Pomeroy et al., (2001), states community collectivity has greater success within communities that have smaller populations and live in the direct area being managed. Therefore, community collectivity can facilitate vulnerability to viability transitions within SSF as the community thinks and approaches problems in similar ways, while providing solutions to these problems in ways that benefit the community over individuals.

5.1.3 Clear Property Rights

Clear property rights are an indicator of adaptive co-management that can be used to aid the facilitation of transitions of SSF from vulnerability to viability. Armitage et al., (2009), Susilowati and Budati, (2003), and Pomeroy and Williams, (1994), state that property rights need to be clearly outlined in policy or legislation and comprised of responsibilities tied to specific rights. Pomeroy et al., (2001) and Ostrom, (2007), note that property rights for fisheries need to give the local users autonomy over management and provide local users with

legal ownership over the resource. Additionally, Susilowati and Budati, (2003), and Pomeroy and Williams, (1994), state that having the legal rights to organize and determine management arrangements over the resource are key elements of strong property rights. Having effective and clear property rights over a fishery can not only improve the autonomy of local users but also allow the direct community to have management rights and authority over the resource, facilitating the vulnerable to viable transition.

5.1.4 Adaptable Management Portfolio

Adaptable management portfolio is an essential indicator of adaptive co-management that can be used to aid the facilitation of transitions of SSF from vulnerability to viability. Armitage et al., (2009), states that a system's ability to use a diversity of governance tools to achieve viable outcomes are essential along with collaborative governance processes. Berkes, (2007), and Folke et al., (2005) state that the key to having successful adaptable management strategies are learning from experience, feedback and sense making allowing governance to be prepared for the unknown. Berkes, (2009), additionally stated that collaborative processes to governance are essential to feedback situated problem solving abilities within social-ecological systems. Armitage et al., (2007), indicate building the adaptive capacity of social-ecological systems is essential to absorb and buffer dynamic changes within the system. Having governance strategies that are adaptable to dynamic conditions of SSF can aid in the facilitation of vulnerability to viability transitions.

5.1.5 Institutional Support

Institutional support is critical for adaptive co-management and can be used to aid the facilitation of transitions of SSF from vulnerability to viability. Pomeroy, (1993), and Pomeroy and Williams, (1994), explain that with the integration of institutional connections within SSF management viable governance strategies can be created. Institutional building within social-ecological systems has the ability to increase the capacity of local institutions ability for cross-scale connections with institutions outside of the community (Berkes, 2007; Berkes, 2009). Berkes, (2009), mentions that two-way feedback processes are vital between government policy creation and community institutions as they can strengthen existing relationships and created new ones. Bridging ecological knowledge of fishers with institutional support can facilitate learn-by-doing approaches (Armitage et al., 2007), improving the governance of SSF. Armitage et al., (2009), notes that institutional support will gain a stronghold within social-ecological systems if local residents see long-term institutional support, as this can act as stability within vulnerable situations in the fishery. Strengthening institutional, connections and support is critical for adaptive co-management, as well as the viability of social-ecological systems such as SSF.

5.1.6 Capital Building

Capital building within adaptive co-management is critical and can aid the facilitation of transitions of SSF from vulnerability to viability. Both financial and social capital are critical for community development. Islam et al., (2023), and Pomeroy et al., (2001), note that financial capital is needed to obtain physical assets for small-scale fisher livelihoods and to enhance community level monitoring, enforcement, operations and planning. Sustained

financial capital is needed to increase the capacity of local institutions within SSF, increasing resources available for fishers and the local community (Armitage et al., 2009; Berkes, 2007; Pomeroy et al., 2001).

Social capital is another form of capital that is essential for adaptive co-management and can aid in the facilitation of vulnerable to viable transitions within SSF. Strong social capital is essential with social-ecological systems as it can improve the system's ability to adapt to dynamic change (Armitage et al., 2007; Berkes, 2007; Folke et al., 2005). According to Islam et al., (2023), social capital enhances community relationships, improves social networks and strengthens social structure within social-ecological systems. Increasing trust levels, the knowledge of fishers and training within SSF can increase social capital improving the governance of the social-ecological system (Islam et al., 2023; Berkes, 2007; Berkes, 2009; Armitage et al., 2007; Armitage et al., 2009; Folke et al., 2005). Social capital also supports communication, information exchange between and cooperation between users of the system (Islam et al., 2023). By improving social and financial capital of SSF the facilitation of these systems from vulnerability to viability can be generated.

5.1.7 Leadership

Leadership is an essential adaptive co-management indicator that can aid in the facilitation of transitions of SSF from vulnerability to viability. Leadership is essential within social-ecological systems such as SSF because leaders maintain collaboration, create opportunities for learning and reflection and sets the example for fisheries management (Armitage et al., 2009; Pomeroy et al., 2001). Berkes, (2007) states that having leaders that are transparent and

accountable for management decisions will improve the viability of the fishery. Successful managers of social-ecological systems that experience dynamic change must be able to take the leadership and responsibility for fisheries management, while also having a strong connection to the resource being managed (Armitage et al., 2009; Pomeroy & Williams, 1994; Susilowati & Budati, 2003). To enact successful leadership within social-ecological systems there must be an individual, institution or group of people within the system that have the ability and capability to manage the resources and resolve conflicts that arise in management (Armitage et al., 2009; Pomeroy & Williams, 1994; Susilowati & Budati, 2003; Pomeroy et al., 2001). Leaders within social-ecological systems must have the capacity to drive the viability of SSF by setting the standards for fisheries governance.

5.1.8 Participation

Participation is an essential adaptive co-management indicator that can aid in the facilitation of transitions of SSF from vulnerability to viability. Various scholars including Pomeroy & Williams, (1994), Susilowati & Budati, (2003), Pomeroy et al., (2001), and Ostrom, (1990), state that participation of individuals who are affected by governance processes must be included in governance decision-making processes. Additionally, individuals who are affected by governance decision within social-ecological systems need the ability to modify and influence existing or new governance (Ostrom, 1990; Susilowati & Budati, 2003). Pomeroy & Williams, (1994), and Pomeroy et al., (2001), note that to have successful participation from individuals in the community the benefits of participating within the resource need to outweigh the costs of participating in the resource. In SSF, increasing

fisher participation increases knowledge generated to inform scientific knowledge, aiding in monitoring and management of the fishery (Pomeroy & Williams, 1994). By including the individuals in the community most affected by governance decision making processes can facilitate the transition of these community members from vulnerable to viable.

5.1.9 Delegation of Authority

Delegation of authority is an essential adaptive co-management indicator that can aid in the facilitation of transitions of SSF from vulnerability to viability. Local communities need partnerships with all levels of government that intersect the fishery to create enabling policy that decentralizes the administrations tasks of fisheries management (Susilowati & Budati, 2003; Pomeroy & Williams, 1994; Pomeroy et al., 2001; Pomeroy, 1993). Delegation of authority relies on the devolution of authority, responsibilities, and management from outside actors and governments to the local community (Pomeroy 1993; Pomeroy & Williams, 1994; Susilowati & Budati, 2003). Pomeroy et al., (2001) and Berkes, (2007), outlines that legislation must outline the rights, ownership, rules and management of the resource to the local community and the democratic processes that encompass them. Additionally, in order for delegation of authority to occur within social-ecological systems the leaders and governance processes of the local community must be legitimized from outside governmental actors (Berkes, 2007; Pomeroy et al., 2001; Susilowati & Budati, 2003; Pomeroy & Williams, 1994). Delegation of authority is a critical component of adaptive co-management that can facilitate the transitions of SSF from vulnerable to viable by transitioning authority to the local community.

5.1.10 Community Empowerment

Community empowerment is an essential adaptive co-management indicator that can aid in the facilitation of transitions of SSF from vulnerability to viability. Community empowerment is when the capacity of individuals and the community as a whole are increased leading to increased participation, community collectivity and collaboration (Susilowati & Budati, 2003; Pomeroy et al., 2001; Pomeroy & Williams, 1994). Pomeroy et al., (2001), states that increasing individual and community empowerment can lead to increased social awareness, community autonomy, self-reliance and establish a balance of power within the system. Creating the incentives necessary to enhance the empowerment of fishers and community members to take part in decision-making and collective processes are vital (Susilowati & Budati, 2003; Pomeroy et al., 2001; Pomeroy & Williams, 1994). Incentives such as increased education, training or individual capacity are strategies to increase individuals' willingness to participate and work collectivity (Pomeroy et al., 2001). Increasing the community empowerment of SSF can facilitate the vulnerability to viability transition by increasing individual incentives to participate in collective governance approaches.

However, small-scale fishers in Indonesia have received little attention, even though their livelihoods are under immediate pressure from fisheries collapse (Warren & Steenbergen, 2021; FAO, 2024). Halima et al., (2018) states that Indonesia SSF require increased governance attention because these fisheries are not regulated and have their own set of rules and norms. Additionally, Warren & Steenbergen, (2021), state that more attention is required in the small-scale fishing sector in Indonesia. Effective governance strategies for SSF within Indonesia are imperative for the sustained livelihoods of Indonesian small-scale fishers.

This chapter will address the following gaps and generate new knowledge in the current literature of:

1) Halima et al., (2019) states that Indonesia SSF require increased governance attention because fisheries are not regulated and have their own rules and norms.
2) Warren & Steenbergen, (2021), state that more attention is needed to understand the complex relationships, norms and rules intersecting and influencing viability of Indonesian SSF.
3) Dias et al., (2023), states finding solutions on how to transition SSF into a states of viability from vulnerability are not yet developed within SSF literature.

The objective of this chapter is to determine how the adaptive co-management indicators tested in chapter four can facilitate or not the vulnerability to viability transitions within each SSF. This chapter will identify the most prevalent adaptive co-management indicators intersecting SSF in Indonesia, understand how each indicator for adaptive co-management within each SSF influences the fishery and how addressing these adaptive co-management indicators can spark SSF transitions from vulnerable to viable.

5.2 Methods

5.2.1 Sampling

The sampling processes for this chapter include purposeful sampling. Purposeful sampling as outlined in Creswell & Creswell, (2023) is when a researcher deliberately selects participants or research sites, that will allow the researcher to best understand the research objectives and answer the central phenomenon. Three rounds of purposeful sampling were completed beginning with (1) community sampling, (2) fisher sampling and (3) institutional partner sampling.

First, purposeful community sampling was conducted to determine what two SSF would be studied within Indonesia (see Chapter 2 Section 2.3). Based on this criteria the two SSF of Tambak Bulusan and Purwoejo, Morodemak, Demak, Indonesia were selected. Next, after the SSF were selected small-scale fishers within each SSF were purposefully sampled for household surveys on adaptive co-management dynamics within their community (see Chapter 2 Section 2.3). Once purposeful sampling of small-scale fishers was completed a total of 119 fishers (40 – Tambak Bulusan, 79 – Purwoejo) were surveyed on the adaptive co-management dynamics intersecting their community (see Chapter 2 Tables 2.5 & 2.6). Lastly, after fishers completed household surveys, fishery and institutional leaders were purposefully sampled to determine their understanding of the adaptive co-management indicators intersecting their community (see Chapter 2 Section 2.3). After purposeful sampling of fishery and institutional leaders was complete, a total of 12 leaders (6 – Tambak Bulusan, 6 – Purwoejo) were sampled

for semi-structured interviews on the adaptive co-management indicators intersecting their community (see Chapter 2 Table 2.9).

5.2.2 Data Collection

Multiple forms of qualitative data collection were employed within this chapter including household surveys with small-scale fishers and semi-structured interviews with fishery and institutional leaders.

Qualitative surveys were conducted with 40 small-scale fishers from Tambak Bulusan, Demak and 79 small-scale fishers from Purwoejo, Morodemak, Demak, Indonesia. Small-scale fishers were surveyed on the 10 adaptive co-management indicators intersecting their community found in Chapter 4 Table 4.1. Responses to small-scale fisher surveys were recorded and ranked in order of importance and intersectionality within each SSF to determine their influence vulnerability to viability transitions within the community.

After household surveys were completed with small-scale fishers in Tambak Bulusan and Purwoejo, semi-structured interviews were conducted with institutional and fishery leaders. Semi-structured interviews allow for ideas to be explored as they arise in more detail or passed upon by the researcher if deemed irrelevant, allowing the unexpected to be incorporated into data collection along with the expected (Knott et al., 2022). Semi-structured interviews were specifically designed for each SSF based off of the household survey results obtained from small-scale fishers previously. Fishery and institutional leaders were interviewed on the adaptive co-management indicators intersecting their community and which ones were the most influential. Based on the responses from fishery and institutional leaders'

adaptive co-management indicators were ranked in order of importance and intersectionality within each SSF, determining the influence of each indicator on the vulnerable to viable transitions of SSF.

To understand how the methods of this chapter inform the objective of this chapter, see Chapter 2 Table 2.4.

5.3 Results

5.3.1 Tambak Bulusan, Demak, Indonesia

Small-scale fisher results were obtained on the adaptive co-management indicators intersecting the SSF of Tambak Bulusan rom small-scale fishers.

Table 5.1 indicates a comparison of the adaptive co-management indicators noted by small-scale fishers and fishery and institutional leaders in Tambak Bulusan. Small-scale fisher results in Table 5.1 (Green) were adopted and ranked from household surveys. While fishery and institutional leader results in Table 5.1 (Blue) were adopted from semi-structured interviews.

Table 5.1: Comparison of Adaptive Co-Management Indicator Rankings for Small-Scale Fishers and Fishery and Institutional Leaders in Tambak Bulusan.

Tambak Bulusan Small-Scale Fisher Adaptive Co-Management Rankings from Household Surveys.			Tambak Bulusan Fishery and Institutional Leaders Ranking of Adaptive Co-Management Importance from Interviews.			
Rank	Adaptive Co-Management Indicator.	Number of Fishers Agreeing with Indicator.	Rank	Adaptive Co-Management Indicator	Number of Respondents.	Percentage of Total Interview Respondents.
1	Leadership.	176	1	Institutional Support.	6	1
2	Institutional Support.	145	1	Capital Building.	6	1
3	Community Collectivity.	141	2	Adaptive Management Portfolio.	5	0.8333
3	Accessible Adaptive Management Portfolio.	141	3	Leadership.	4	0.6667
4	Delegation of Authority.	122	4	Participation.	3	0.5
5	A Well-Defined Resource System.	121	4	Delegation of Authority.	3	0.5
6	Clear Property Rights.	94	5	Clear Property Rights.	2	0.3333
7	Capital Building.	81	6	Community Empowerment.	1	0.1667
8	Participation.	65	7	Community Collectivity.	0	0
9	Community Empowerment.	63	7	Well-Defined Resource System.	0	0

(Primary Semi-Structured Interview and Household Survey Data, 2024).

Results from Table 5.1 indicate that adaptive co-management indicators which can facilitate strong vulnerable to viable transitions vary between individuals of social-ecological systems. What is important for fishers is not the same for fishery leaders or institutional

partners. However, to determine the overall influence of adaptive co-management indicators within Tambak Bulusan the rankings of fishers and leaders were weighed and combined to create an overall ranking of adaptive co-management indicators that can influence and spark vulnerable to viable transitions within SSF. Table 5.2 below indicates the rankings of adaptive co-management indicators from fishers and leaders and how they were weighed to determine the overall influence of the indicator on viability transitions.

Table 5.2: Weight of Adaptive Co-Management Rankings for Table 5.1.

Rank	Weight
1	10
2	9
3	8
4	7
5	6
6	5
7	4
8	3
9	2
10	1

(Lister, 2025).

Table 5.3 indicates the ranking of the adaptive co-management indicators and their associated rank of influence on facilitating vulnerable to viable transitions within the Tambak Bulusan. Table 5.3 weighed the data from table 5.1 using the weighting scale in table 5.2 to determine the overall influence and rank of each adaptive co-management indicators in facilitating vulnerability to viability transitions. Table 5.3 states that the rank of the adaptive co-management indicator, the indicator, the total weight of the indicator based off of the

rankings in table 5.2, and the associated rank for the indicator from fishers and leaders within Tambak Bulusan.

Table 5.3: Ranking of Adaptive Co-management indicators with Associated Rank to Determine Overall Influence of Indicator in Tambak Bulusan.

Rank	ACM indicator.	Total Weight	Fisher Survey Ranking.	Fishery and Institutional Rank.
1	Institutional Support.	19	1	1
2	Leadership.	18	2	3
3	Adaptive Management.	17	3	2
4	Capital Building.	14	7	1
5	Delegation of Authority.	13	4	4
6	Community Collectivity.	12	3	7
7	Clear Property Rights.	11	6	5
8	Participation.	10	8	4
8	Well Defined Resource System.	10	5	7
9	Community Empowerment.	7	9	6

(Lister, 2024).

5.3.2 Purwoejo, Morodemak, Demak, Indonesia

Small-scale fisher results were obtained on the adaptive co-management indicators intersecting the SSF of Purwoejo from small-scale fishers.

Table 5.4 indicates a comparison of the adaptive co-management indicators noted by small-scale fishers and fishery and institutional leaders in Purwoejo. The small-scale fisher results (Green) were adopted and ranked from household surveys with small-scale fishers.

The fishery and institutional leader rankings of adaptive co-management indicators (Blue) were adopted from semi-structured interviews.

Table 5.4: Comparison of Adaptive Co-Management Indicator Rankings for Small-Scale Fishers and Fishery and Institutional Leaders in Purwoejo.

Purwoejo Small-Scale Fisher Adaptive Co-Management Rankings from Household Surveys.			Purwoejo Fishery and Institutional Leaders Ranking of Adaptive Co-Management Importance from Interviews.			
Rank	Adaptive Co-Management Indicator.	Number of Fishers Agreeing with Indicator.	Rank	Adaptive Co-Management Indicator.	Number of Interviews Respondents.	Percentage of Total Interview Respondents.
1	Accessible Adaptable Management Portfolio.	238	1	Institutional Support.	6	1
2	Community Collectivity.	226	1	Capital Building.	6	1
3	Delegation of Authority.	216	2	Leadership.	5	0.8333
4	A Well-Defined Resource System.	212	3	Accessible Adaptive Management Portfolio.	4	0.6667
5	Leadership.	208	3	Community Collectivity.	4	0.6667
6	Institutional Support.	155	4	Delegation of Authority.	3	0.5
7	Participation.	142	4	Participation.	3	0.5
8	Clear Property Rights.	141	4	Clear Property Rights.	3	0.5
9	Capital Building.	140	5	Well-Defined Resource System.	1	0.1667
10	Community Empowerment.	107	5	Community Empowerment.	1	0.1667

(Primary Household Survey and Semi-Structured Interview Data, 2025).

Results from Table 5.4 indicate that adaptive co-management indicators which can facilitate strong vulnerable to viable transitions may vary between individuals of social-ecological systems. However, to determine the overall influence of adaptive co-management indicators within Tambak Bulusan the rankings of fishers and leaders were weighed and combined to create an overall ranking of adaptive co-management indicators that can influence and spark vulnerable to viable transitions within SSF (see Table 5.2).

Table 5.5 indicates the ranking of the adaptive co-management indicators and their associated rank of influence on facilitating vulnerable to viable transitions within the Tambak Bulusan. Table 5.5 weighed the data from table 5.1 using the weighting scale in table 5.2 to determine the overall influence and rank of each adaptive co-management indicators in facilitating vulnerability to viability transitions. Table 5.5 states the rank of the adaptive co-management indicator, the indicator, the total weight of the indicator based off of the rankings in table 5.1, and the associated rank for the indicator from fishers and leaders within Tambak Bulusan.

Table 5.5: Ranking of Adaptive Co-management indicators with Associated Rank to Determine Overall Influence of Indicator.

Rank	ACM indicator.	Total Weight	Fisher Survey Ranking.	Fishery and Institutional Rank.
1	Adaptable Management Portfolio.	18	1	3
2	Community Collectivity.	17	2	3
3	Institutional Support.	16	6	1
4	Leadership.	15	5	2
5	Delegation of Authority.	15	3	4
6	Well Defined Resource System.	13	4	5
7	Capital Building.	12	9	1
8	Participation.	11	7	4
8	Clear Property Rights.	10	8	4
9	Community Empowerment.	7	10	5

(Lister, 2025).

5.4 Discussion

5.4.1 Adaptive Co-Management Indicators Facilitating V2V

5.4.1.1 Tambak Bulusan, Demak, Indonesia

A combined overarching ranking of adaptive co-management indicator influencing Tambak Bulusan were created in Table 5.3. Based on the combined rankings of adaptive co-management indicators by small-scale fishers and fishery and institutional leaders (see Table 5.3), the top adaptive co-management indicators that can influence vulnerability to viability transitions within Tambak Bulusan become known. This relationship indicates that adaptive

co-management is an approach to governance within Indonesian SSF that can aid in the facilitation of viable transitions. Without specific indicators from adaptive co-management vulnerable to viable transitions within Indonesian SSF are less likely to occur. Table 5.3 indicates that the combined rankings of small-scale fishers and leaders within Tambak Bulusan place; institutional support as the most influential adaptive co-management dynamic that can facilitate vulnerable to viable transition.

Institutional support is essential to facilitate the vulnerable to viable transition within Tambak Bulusan. Institutional support is an essential adaptive co-management dynamic as small-scale fishers within Tambak Bulusan, noted institutional support as the second most essential dynamic behind leadership (see Table 5.1). While fishery and institutional leaders within Tambak Bulusan noted that institutional support along with capital building are the most essential adaptive co-management indicators to facilitate vulnerable to viable transitions (see Table 5.1). Institutional support within Tambak Bulusan is carried out by academic institutions, local governments and other organizations connected to the community through academic institutions. Without these vital connection's education, training, and knowledge sharing between fishers and institutions would diminish, increasing the vulnerability of Tambak Bulusan. However, with the continued connections to institutions within and outside of the community, fisher capacity, knowledge and awareness can be increased, aiding in the facilitation of this SSF from vulnerability to viability. Similar findings were produced in Pomeroy, (1993), Pomeroy & Williams, (1994), Berkes, (2007), and Berkes, (2009), that state institutional connections to organizations within and outside of the community in SSF

management create viable governance strategies, increasing capacity of fishers and local institutions. Strengthening the institutional support by current actors such as UNDIP and the Demak Regency government within the SSF of Tambak Bulusan will enhance the facilitation of this SSF from vulnerable to viable.

Next, the results from Table 5.3 indicate the second adaptive co-management indicator that is the most influential in facilitating vulnerable to viable transitions within Tambak Bulusan as Leadership. Leadership was ranked by small-scale fishers in Tambak Bulusan as the most influential adaptive co-management indicator in facilitating the vulnerable to viable transition within Tambak Bulusan (see Table 5.1). While fishery and institutional leaders within Tambak Bulusan noted leadership as the third most influential adaptive co-management indicator in the facilitation of vulnerable to viable transitions (see Table 5.1). Leadership within Tambak Bulusan is democratic, with decision-making processes occurring over periods of community deliberation, while being led and trusted by a local fisher within strong connections within the community. Having trust in managers is an essential aspect of social capital in adaptive co-management that can increase the viability of the community. This is because without trust fishers will not work collaboratively, creating conflicts (Folke et al., 2005). Leadership is essential within social-ecological systems because leaders maintain collaboration and facilitate opportunities for learning, knowledge creation and reflection, setting the example for fisheries management (Armitage et al., 2009; Pomeroy et al., 2001). Additionally, leadership can facilitate viability transitions within Tambak Bulusan as successful leaders will facilitate opportunities for learning, connection and reflection, setting

an example for all fishers within the community. Leadership is an essential adaptive co-management dynamic intersecting Tambak Bulusan that can aid in facilitating vulnerable to viable transitions.

The third, adaptive co-management indicator that small-scale fishers and leaders within Tambak Bulusan noted in Table 5.3 that can facilitate the vulnerable to viable transitions within SSF was an adaptable management portfolio. Small-scale fishers within Tambak Bulusan noted that having an adaptable management portfolio was the third most influential adaptive co-management indicator intersecting the community (see Table 5.1). While fishery and institutional leaders in Tambak Bulusan noted an adaptive management portfolio was the second most influential adaptive co-management indicator behind institutional support and capital building (see Table 5.1). Fisheries management within Tambak Bulusan is formulated based off of the past experiences of fishers and the current problems intersecting the fishery. Fishers within Tambak Bulusan have been adapting to the changing conditions of the fishery with additional income streams and fishing gear changes in order to create viable opportunities in times of vulnerability. Utilizing adaptable management strategies that help fishers learn from experience and rely on iterative feedback for governance, which has been noted by Berkes, (2007), and Folke et al. (2005) to increase governance abilities, allowing for preparation of the unknown. Adaptive management strategies for SSF governance is an adaptive co-management indicator that can aid in the facilitation of vulnerable to viable transitions within Tambak Bulusan.

Therefore, the top three most influential adaptive co-management indicators intersecting Tambak Bulusan that can aid in the facilitation of this SSF from vulnerable to viable are (1) institutional support, (2) leadership and (3) an adaptive management portfolio.

5.4.1.2 Purwoejo, Morodemak, Demak, Indonesia

A combined ranking of the overarching adaptive co-management indicators influencing vulnerable to viable transitions was created in Table 5.5. Based on these combined rankings in Table 5.5 small-scale fishers and fishery and institutional leaders in Purwoejo noted that an adaptable management portfolio is the most influential adaptive co-management indicator that can aid in the facilitation of vulnerable to viable transitions.

Small-scale fishers in Purwoejo noted that an adaptable management portfolio was the most influential adaptive co-management dynamic intersecting the community, influencing vulnerable to viable transitions (see Table 5.4). While fishery and institutional leaders noted an adaptable management portfolio as the third most influential adaptive co-management indicator at facilitating vulnerable to viable transitions (see Table 5.4). Within the SSF of Purwoejo fisheries management is based on the current experiences of fishers in the community, while past experience is used to inform decision-making processes. Additionally, Purwoejo SSF management was noted by fishery leaders to be informed by the traditions and experiences of knowledge from ancestors, being passed down through generations. Increasing the adaptability of SSF governance in Purwoejo can aid in increasing this community's ability to respond to unknown change. This can also be seen in previous studies, such as, Armitage et al., (2007), that states increasing a social-ecological system's adaptive capacity can enhance

the ability of this system to adapt to ever-changing dynamic conditions. Additionally, Armitage et al., (2009), states that using a diversity of governance tools can aid in achieving viability within the governance processes. Adaptive management strategies act as the most influential adaptive co-management indicator within Purwoejo that can facilitate vulnerable to viable transitions within the SSF.

Next, community collectivity was noted by small-scale fishers and fishery and institutional leaders in Table 5.5 as the second most influential adaptive co-management indicator influencing vulnerable to viable transitions within Purwoejo. Small-scale fishers in Purwoejo noted that community collectivity was the second most influential adaptive co-management indicator intersecting Purwoejo (see Table 5.4). While fishery and institutional leaders in Purwoejo noted that community collectivity was the third most influential adaptive co-management indicator intersecting the community (see Table 5.4). Community collectivity is of the upmost importance within Purwoejo for viable transitions within the SSF because the community has over 300 small-scale fishers interacting with the fishery daily. While also having diverse fishing equipment that can make collectivity organizing and working together difficult when determining fishing gear restrictions. Community collectivity has been noted by scholars such as Pomeroy and Williams, (1994), Susilowati and Budati, (2003), and Pomeroy et al., (2001), to be enhanced with similar culture, fishing gears and ethnicity between fishers, which is not the case in Purwoejo, calling for increase community collectivity. Additionally, due to the immense size of the Purwoejo population community collectivity can be difficult, as Pomeroy e al., (2001), notes that community collectivity has greater success in

smaller populated communities. Therefore, community collectivity acts as the second most influential adaptive co-management dynamic intersecting Purwoejo that can aid in the facilitation of vulnerable to viable transitions.

The third most influential adaptive co-management indicator for vulnerable to viable transitions for the SSF of Purwoejo is institutional support (see Table 5.5). Institutional support was noted by small-scale fishers within Purwoejo in Table 5.4 as the sixth most influential adaptive co-management indicator influencing vulnerable to viable transitions within the community. While fishery and institutional leaders noted institutional support as the most influential adaptive co-management indicator facilitating vulnerable to viable transitions in Purwoejo (see Table 5.4). Institutional support within Purwoejo has been intersecting the communities for over a decade, with connections to academic institutions, governments and non-governmental organizations aiding in knowledge creation, information sharing and management. Institutional support in Purwoejo increased the knowledge, capacity, education, and training of fishers within the community, aiding in the facilitation of these SSF from vulnerable to viable. Even with current connections, small-scale fishers are calling for continued and increased institutional support. Institutional support in Purwoejo is vital for successful governance of the SSF along with small-scale fisher livelihoods as increased connections to institutions will drive vulnerable to viable transitions within the community. Scholars including Berkes, (2007), and Armitage et al., (2007) note connections to institutions increase feedback processes informing governance, increasing the facilitation of learn-by-doing approaches strengthening community viability. Institutional support within Purwoejo is

an essential adaptive co-management indicator that can aid in the facilitation of the vulnerable to viable transitions of the SSF.

Therefore, based on data derived from Table 5.5 the top three most influential adaptive co-management indicators aiding in the facilitation of vulnerable to viable transitions for SSF are; (1) adaptable management portfolio, (2) community collectivity and (3) institutional support.

5.5 Conclusions

The objective of this chapter is to determine how the adaptive co-management indicators tested in chapter four for SSF in Demak regency, Indonesia can facilitate or not the vulnerability to viability transitions within each SSF. This chapter will identify the most prevalent adaptive co-management indicators intersecting SSF in Indonesia, understand how each indicator for adaptive co-management within each SSF influences the fishery and how addressing these adaptive co-management indicators can spark SSF transitions from vulnerable to viable.

The most influential adaptive co-management indicators that can aid in the facilitation of SSF from vulnerable to viable are different for Tambak Bulusan and Purwoejo. Tambak Bulusan identified institutional support, leadership and adaptive management portfolio as the most influential adaptive co-management indicators influencing vulnerable to viable transitions. While Purwoejo noted adaptable management portfolio, community collectivity and institutional support as the most influential adaptive co-management indicators facilitating the vulnerable to viable transitions within SSF. Adaptive co-management serves as a

governance approach that can facilitate vulnerable to viable transitions within Indonesian SSF. While serving as a new governance approach within SSF governance in Indonesia and the globe.

Adaptive co-management serves as a governance approach that can transition Tambak Bulusan and Purwoejo, Morodemak, Demak, Indonesia from vulnerable to viable. Adaptive co-management serves as a way forward for SSF governance and viability.

Chapter 6 Summary and Conclusions

6.1 Summary of Findings

The purpose of this thesis was to understand the applicability of adaptive co-management within Indonesian SSF, while determining how adaptive co-management can facilitate vulnerable to viable transitions. This thesis research had three objectives to understand this central phenomenon. The first objective of this thesis was aimed at identifying the economic, social and environmental characteristics intersecting SSF in Indonesia, determining the most influential dynamics. The second objective of this thesis was to understand the adaptive co-management indicators present within SSF in Indonesia, determining if adaptive co-management can be transitioned to as a form of SSF governance. The final objective of this thesis was to determine how the adaptive co-management indicators tested in chapter two can facilitate or not vulnerability to viability transitions within Indonesia SSF.

6.1.1 Social, Economic and Environmental Characteristics of Indonesian SSF

The SSF of Tambak Bulusan and Purwoejo can be classified as social-ecological systems based on the diverse social, economic and environmental dynamics intersecting the communities identified in Chapter 3. Additionally, Tambak Bulusan and Purwoejo have diverse social dynamics characteristics intersecting and influencing environmental characteristics and vice versa. These characteristics can be used to classify SSF as social-ecological systems, as Nayak, (2014), and Berkes, (2011) note social-ecological systems are classified by the ecological and social interactions intersecting and influencing each other within systems.

Classifying Tambak Bulusan and Purwoejo as social-ecological systems aids the governance of these SSF as increased knowledge about the diverse social, economic and environmental dynamics can improve decision-making. Governance within these SSF can now be tailored to the specific needs of the community or the most pressing adaptive co-management indicator. For example, if Institutional support is identified as the most important and influential adaptive co-management indicator, policy can target institutional support to aid in viable SSF transitions. Classifying Tambak Bulusan and Purwoejo as social-ecological system can therefore aid in the governance processes of these SSF.

Through the identification of social, economic and environmental characteristics intersecting Tambak Bulusan and Purwoejo the governance viability of SSF can be improved. Through the identification of the seen (observable) and unseen (only observable through an understanding of community dynamics) social, economic and environmental characteristics governance strategies within Indonesian SSF can become more informed. The qualitative visualizations and Figures 1 & 2 in Chapter 3 provide a visual representation of the social, economic and environmental dynamics intersecting Indonesia SSF. Understanding the context specific social, economic and environmental dynamics that intersect social-ecological systems, specifically within SSF, can increase the ability for governance within these communities to address the most determinantal or beneficial dynamics intersecting them. This understanding is crucial for SSF within Indonesia as scholars including Warren & Steenbergen, (2021), and Halima et al., (2019), note that SSF governance within Indonesia needs an increased understanding and strengthened approach to understand the complexity of SSF. Therefore,

understanding the social, economic and environmental dynamics intersecting SSF within Indonesia can bring increased attention the governance of SSF critically require.

Lastly, understanding the social, economic and environmental dynamics intersecting SSF within Indonesia can identify pathways to facilitate vulnerable to viable transitions. By mapping and representing the prominent social, economic and environmental dynamics intersecting SSF strategies can be drafted to target the most influential indicators. Results from chapter 3 of this thesis indicate the most pressing dynamics influencing the SSF of Tambak Bulusan and Purwoejo. Through an understanding of what social, economic or environmental characteristics are most influential within SSF can help provide pathways to viability for fishers, by addressing the most pressing dynamics within the community. Understanding the social, economic and environmental characteristics intersecting SSF is vital as these characteristics are different between communities and not all characteristics will influence viability with the same effect. Future governance within Indonesian SSF can look to solve and understand the most influential characteristics noted within Tambak Bulusan and Purwoejo to spark vulnerability to viability transitions.

6.1.2 Adaptive Co-Management Dynamics Intersecting Indonesian SSF

The fourth chapter indicated the adaptive co-management indicators intersecting Indonesian SSF. The understanding of these indicators was formulated based on the responses from small-scale fisher household surveys and fishery and institutional semi-structured interviews. Adaptive co-managements indicators intersecting Tambak Bulusan and Purwoejo were discovered and ranked based on importance. Understanding the most influential adaptive

co-management indicators intersecting SSF within Indonesia is essential in order to determine successful facilitation of SSF governance.

Current literature within adaptive co-management, has identified essential characteristics for adaptive co-management as social capital (trust and leaderships) (Armitage et al., 2009; Folke et al., 2005), social networks and linkages (institutional support) (Armitage et al., 2009; Berkes, 2007; Folke et al., 2005), and a learn-by-doing approach (adaptive management portfolio) (Armitage et al., 2009; Armitage et al., 2007; Folke et al., 2005; Plummer et al., 2013). Adaptive co-management indicators found to be most influential within Tambak Bulusan were not in line with the current literature. Underscoring the importance of understanding adaptive co-management indicators intersecting social-ecological systems before transitioning governance, as indicator influence can vary based on SSF location, context and social structure.

By understanding the most influential adaptive co-management dynamics present within each SSF the applicability of adaptive co-management governance is understood. Tambak Bulusan noted different influential adaptive co-management indicators between small-scale fishers and institutional and fishery leaders. This was observed similarly within the SSF of Purwoejo as well. The differences in adaptive co-management indicators felt to be intersecting SSF is context based, with actors that encompass SSF having different ideas of what is the most influential dynamic. Understanding influential adaptive co-management indicators intersecting governance within social-ecological systems must understand the influence of factors from all stakeholder's who interact with the system.

Understanding the adaptive co-management dynamics intersecting SSF within Indonesia aids in drafting viable governance strategies for SSF. Adaptive co-management provides an approach to SSF governance that can be used to understand the diverse dynamics and changes encompassing SSF. This allows governance to tailor policy, legislation and regulations to the most prominent issues intersecting SSF. While also, providing an approach that is adaptable in times of uncertainty, increasing adaptive capacity and community resilience. Additionally, understanding if adaptive co-management indicators are present within SSF, can allow for an understanding of how adaptive co-management can be transitioned to within current SSF governance. This provides a governance approach that can improve that adaptability of local communities where livelihoods are interconnected with system success, as called for by Armitage, (2007).

Through increased awareness of adaptive co-management dynamics intersecting the SSF of Tambak Bulusan and Purwoejo, calls for increased SSF governance attention within Indonesia from Halima et al., (2019), and Warren & Steenbergen, (2021), can be solved. Additionally, gaps identified by Berkes, (2011), indicating increased knowledge is required within SSF governance processes within social-ecological systems can be further solved as adaptive co-management offers a form of viable governance for Indonesian SSF.

Lastly, adaptive co-management indicated positive relationships in both SSF. This indicates that adaptive co-management can act as a form of viable governance for the SSF of Tambak Bulusan and Purwoejo. Current SSF governance within Tambak Bulusan and

Purwoejo exhibit strong relationships with adaptive co-management indicators that provide strong avenues to transition into forms of adaptive co-management.

6.1.3 Facilitation of Adaptive Co-Management Indicators on V2V

Overall adaptive co-management rankings were created to determine which indicators of adaptive co-management facilitated vulnerability to viability transitions most prominently within each SSF. Tambak Bulusan, noted the most influential adaptive co-management dynamic at facilitating vulnerable to viable transitions as institutional support. Institutional support acts as the strongest adaptive co-management indicator to facilitate vulnerable to viable transitions within Tambak Bulusan, as it promotes cross-scale linkages, fisher capacity and increased awareness. Strengthening and improving policy around institutional support will improve the relationships between institutions (governments or academic) and fishers as they are broken. Improving institutional connections from outside of the immediate community would directly benefit and accelerate vulnerable to viable transitions within the Tambak Bulusan SSF. Scholars including Pomeroy, (1993), Pomeroy & Williams, (1994), Berkes, (2007), and Berkes, (2009), found similar findings in the connections with institutional support and viability, as they state, vertical and horizontal connections in SSF create viable governance strategies and improved capacity of local fishers.

The most influential adaptive co-management indicator at facilitating vulnerable to viable transitions within Purwoejo was access to and utilization of an adaptable management portfolio. The SSF of Purwoejo is a large community, part of the Morodemak tridesa area, and experiences fluctuations in climate conditions that negatively affect the livelihoods of its

residents. Management of Purwoejo has been based on current experiences of fishers, while past experience is used to inform decision-making processes. Purwoejo experiences difficulties however, with government proposal processes to get approved for monetary and social support. Having adaptable management strategies utilized for the various unexpected problems that arise within the dynamic social-ecological system of Purwoejo are critical for the viable transitions of these communities. Adaptable co-management strategies can facilitate vulnerable to viable transitions within SSF as Armitage, (2007), states that governance strategies for social-ecological systems that are able to overcome dynamic conditions faced by these systems on a daily basis are critically required. Strengthening the use and abilities of management within the SSF of Purwoejo to foster relationships and share knowledge will directly benefit and aid in the facilitation of vulnerable to viable transitions of the SSF.

SSF governance within Indonesia can transition to adaptive co-management governance, aiding in the facilitation of SSF from vulnerable to viable. Understanding the adaptive co-management indicators that influence each SSF are essential as SSF perceive and feel vulnerabilities differently at varying scales. Understanding the adaptive co-management indicators that can facilitate vulnerable to viable transitions within Indonesian SSF can aid in generating viable governance approaches for SSF as called for by Halima et al., (2019), and Warren & Steenbergen, (2021). Additionally, understanding how adaptive co-management indicators can aid in the facilitation of vulnerable to viable transitions within SSF increases the knowledge of vulnerable to viable transitions in SSF, as called for by Dias et al., (2023). Understanding the contextual differences between SSF governance within Indonesia is vital as

SSF perceive, feel and overcome vulnerabilities differently as seen in this thesis case study between Tambak Bulusan and Purwoejo.

6.2 Key Contributions

The key contributions of this research are three-fold. First, this thesis contributes and increases the knowledge around SSF governance and its processes. This thesis provides an approach to SSF governance (adaptive co-management) that is capable of managing the dynamic, uncertain and complex social, economic and environmental characteristics influencing SSF. Adaptive co-management provides a way to adapt to the conditions and dynamics of specific SSF to tailor effective policy to the indicators that drive vulnerable to viable transitions within SSF. Next, this thesis contributes to the adaptive co-management literature within SSF. There has been little application of adaptive co-management within social-ecological systems, specifically SSF. This thesis provides a case study that exemplifies adaptive co-management applicability within SSF in Indonesia. This thesis serves as an example for other SSF within social-ecological systems, that adaptive co-management may serve as an applicable governance strategy. Lastly, this thesis provides a governance approach to SSF that can be utilized to aid in the facilitate of vulnerable to viable transitions within Indonesian SSF. Through an understanding of what adaptive co-management indicators can facilitate or not vulnerable to viable transitions, the specific needs of SSF can be discovered allowing strategies to tackle these indicators facilitating viable transitions. Adaptive co-management provides an approach to SSF that can aid in understanding and addressing the complex vulnerable to viable processes the are in constant flux within SSF. Therefore, this

thesis contributes to SSF governance, adaptive co-management literature, and provides increased understanding of vulnerable to viable transitions within SSF.

6.3 Final Thoughts & Conclusions

This thesis research has discovered significant results that can facilitate and influence the vulnerable to viable transitions within SSF. First, this thesis indicates that SSF are not identical, an approach that works for one will not always work for another. This is in part because of the varying social, economic and environmental dynamics that intersect SSF with different social, economic and environmental factors influencing the closest communities. Understanding the characteristics that influence communities is an essential aspect of viable governance, as not doing so can facilitate transitions into vulnerability. Understanding how economic, social and environmental vulnerabilities are faced differently by gender in SSF can provide alternative avenues to understand and generate viable governance policies.

Next, this thesis research indicates that adaptive co-management indicators are present within SSF, and the governance of these social-ecological systems can be transformed into adaptive co-management. Understanding the intersections of adaptive co-management indicators within social-ecological systems can provide information on the abilities of current governance to transition. Understanding the adaptive co-management indicators within social-ecological systems can aid in determining the most influential adaptive co-management indicator for each community. Current literature for adaptive co-management does not capture the contextual differences between social-ecological systems when it comes to adaptive co-

management indicator influence. Understanding the adaptive co-management indicators from place to place is required before attempting to facilitate viable transitions of SSF.

Lastly, this thesis research indicates the most influential adaptive co-management indicators at facilitating vulnerable to viable transitions within SSF. Understanding ways to facilitate transitions of viability within social-ecological systems are the benefits of adaptive co-management. Adaptive co-management utilizes a variety of influential dynamics to facilitate vulnerable to viable transitions, and what influences one community may have no effect on another. However, specific influential adaptive co-management indicators that intersect social-ecological systems can only be understood through on the ground testing in these communities.

Therefore, adaptive co-management is a viable governance approach for social-ecological systems. Adaptive co-management can successfully manage the complexities of SSF, facilitating vulnerable to viable transitions.

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Appendix A

UNIVERSITY OF WATERLOO

Notification of Ethics Clearance to Conduct Research with Human Participants

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Principal Investigator: Prateep Nayak

Student investigator: Murray Lister

Collaborator: Indah Susilowati (University of Diponegoro, Java, Indonesia)

File #: 46457

Title: How can a Co-Management Tool, such as Adaptive Co-Management Aid in the Transition of Small-Scale Fisheries from a State of Vulnerability to a State of Viability within the Java Province of Indonesia.

The Human Research Ethics Board is pleased to inform you this study has been reviewed and given ethics clearance.

Initial Approval Date: 07/05/24 (m/d/y)

University of Waterloo Research Ethics Boards are composed in accordance with, and carry out their functions and operate in a manner consistent with, the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS2 2022), the Ontario Personal Health Information Protection Act (PHIPA), and all laws and regulations of the province of Ontario (as applicable). Additionally, CREB operates in a manner consistent with the International Conference for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH) Guidance E6(R2): Good Clinical Practice , the International Organization for Standardization of Good Clinical Practices (GCP) as set out by ISO 14155 - Clinical investigation of medical devices for human subjects, Part C, Division 5 of the Food and Drug Regulations, Part 4 of the Natural Health Products Regulations, Part 3 of the Medical Devices Regulations. Both Boards are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (HREB) and IRB00007409 (CREB).

Expiry Date: 07/06/25 (m/d/y)

Multi-year research must be renewed at least once every 12 months unless a more frequent review has otherwise been specified. Studies will only be renewed if the renewal report is received and approved before the expiry date. Failure to submit renewal reports will result in the investigators being notified ethics clearance has been suspended and Research Finance being notified the ethics clearance is no longer valid.

Level of review: Delegated Review

Signed on behalf of the Human Research Ethics Board

Karen Pieters, Manager, Research Ethics, karen.pieters@uwaterloo.ca, 519-888-4567, ext. 41495

This above-named study is to be conducted in accordance with the submitted application and the most recently approved versions of all supporting materials.

Documents reviewed and received ethics clearance for use in the study and/or received for information:

file: Refernece List of Citations - Version 1 - Murray Lister - April 30th.pdf

file: Verbal Recruitment Script - Version 3 - July 4 - Murray Lister.pdf

file: Verbal Informed Consent Script - Murray Lister - Version 3 - July 4.pdf

file: Verbal Consent Script - Murray Lister - Version 3 - July 4.pdf

file: Interview Protocol - Murray Lister - Version 2 - July 4.pdf

file: Interview Observation Protocol - Murray Lister - Version 1 - April 30th.pdf

file: Observational Protocol (Not for Interviews) - Murray Lister - Version 1 - April 30th.pdf

file: Verbal Thank You and Feedback Verbal Script- Murray Lister - Version 2 - July 4 (1).pdf

Approved Protocol Version 3 in Research Ethics System

This is an official document. Retain for your files.

You are responsible for obtaining any additional institutional approvals that might be required to complete this study.

Appendix B

BRIN
BADAN RISET DAN INOVASI NASIONAL

DIREKTORAT TATA KELOLA PERIZINAN RISET DAN INOVASI DAN OTORITAS ILMIAH
Gedung B.J. Habibie, Jalan M.H. Thamrin No. 8, Jakarta Pusat 10340
Telp: 081110646768 Surel: deputi.fr@brin.go.id Laman: https://brin.go.id/

HAKTEKNAS 2024

SURAT IZIN PENELITIAN
(LETTER OF RESEARCH PERMIT)
Nomor : 555/SIP/IV/FR/7/2024

Badan Riset dan Inovasi Nasional dengan ini memberikan izin untuk melakukan penelitian kepada:
(National Research and Innovation Agency hereby granted permission to):

Nama (***Name***)	:	**Mr. Murray Ross Lister**
Tempat dan tanggal lahir (***Place and date of birth***)	:	Kitchener, Ontario, 9 April 2000
Warga Negara (***Nationality***)	:	Kanada
Jabatan (***Position***)	:	Graduate Student
Institusi (***Institution***)	:	University of Waterloo
Nomor Paspor (***Pasport no.***)	:	[redacted]
Judul Penelitian (***Research Title***)	:	*"How can a co-management tool, such as adaptive co-management aid in the transition of small-scale fisheries from a state of vulnerability to a state of viability, within the Java province of Indonesia"*
Bidang Penelitian (***Field of Research***)	:	Perikanan
Lama Penelitian (***Research Duration***)	:	Mulai 11 Agustus 2024 s.d. 31 Oktober 2024 ***(month, starting from)***
Daerah Penelitian (***Research Location***)	:	Jawa Tengah (Kab. Demak)
Mitra Kerja (***Counterpart***)	:	Fakultas Ekonomi dan Bisnis Universitas Diponegoro (Prof. Dra. Indah Susilowati, MS.c., Ph.D.)

dengan ketentuan sebagai berikut (***with the following norms as stated in the following***) :