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Impact of climate change on quality, availability, sustainability for aquaculture and seafood in Nha Trang, Vietnam

Master's thesis in Global Health
Supervisor: Jon Øyvind Odland
Co-supervisor: Ngo Dang Nghia
November 2022



Norwegian University of
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ACKNOWLEDGEMENTS

I would like to extend my sincere gratitude to my main supervisor Jon Øyvind Odland from NTNU, and my External Supervisor Ngo Dang Nghia from the University of Nha Trang.

Thank you for giving me inspiring ideas and encouragement to conduct this study.

I'm also grateful to other tutors, for providing me with helpful advice and inspiration to complete my study.

A special thanks to the co-supervisors and assistants in Nha Trang, Vietnam. Thank you so much for your assistance with data collection.

I would like to express my gratitude to the fishermen, fish farmers, and shipowners of Nha Trang.

Thank you for taking the time to share your perceptions and experiences during the interviews.

I've learned a lot from all of you. It was an honour meeting you.

Thank you to my loving family, especially my daughter Kari and my husband Per. I could never have done this without you. Thank you for your kindness and support. I would also like to thank the rest of my wonderful family and friends.

ABSTRACT

BACKGROUND: Aquaculture development is under heavy pressure to be able to meet the demand for food and food security. However, aquaculture has resulted in several sustainability concerns, and any future growth in aquaculture is facing serious environmental and climate change challenges. Vietnam's aquaculture industry is particularly vulnerable to the unpredictable and shifting weather patterns brought on by climate change due to its small-scale nature. The environmental and climate change implications of aquaculture must be significantly lessened for its growth to be sustainable. Studies on how climate change is impacting aquaculture still have gaps in developing good adaptation strategies to meet these challenges. Exploring what factors are perceived by fishermen in the first line on the seafood quality, availability, and sustainability under the impact of climate change is therefore essential to gain solutions for the future challenges on this topic.

METHODS: Fishermen, fish farmers, and shipowners from Nha Trang, Vietnam participated in the study as informants. To collect data, two in-depth interviews and two focus group discussions were conducted. Data from the in-depth interviews and focus group discussions were analysed thematically after being transcribed verbatim.

FINDINGS: The thematic analysis of the collected data revealed two main themes: Beneficial and challenging factors concerning quality, availability, and sustainability of seafood under impact of climate change. The reported beneficial factors: easy access to seafood and economic profit, affiliation and secure livelihood, technological support, and adaptation techniques. Furthermore, the challenging factors were higher costs and lower profit, pressed price and lack on demand of assured quality seafood, lack of sufficient equipments, overfishing and illegal fishing, poorer and polluted water, less seasonal period of catch, storm and unforeseen weather, and lack knowledge, higher risk, reduced health and well-being.

CONCLUSION: A range of both beneficial and challenging factors perceived and experienced revealed from various fishers, farmers and shipowners, on what and how they impacted the quality, availability, and sustainability of seafood under pressure of climate change in Nha Trang, Vietnam. The findings in this study are undertaken by fishermen on the front line to meet these

benefits and challenges, Therefore the result of this study may address and express the needs from the perspective of the fisherman to make awareness and can be disseminated to policymakers, stakeholders, developers and implementers of adaptation strategies of what matters in light of pressure from climate change. Moreover, this study can improve existing solutions to better manage both the benefits and challenges concerning the quality, availability and sustainability of aquaculture and seafood in Nha Trang. This valuable recognition can be relevant for other countries as well. Furthermore, this in the term could lead to improved human health around the world and malnutrition, and poverty, particularly in the global problem area of sustainable development strategies and food insecurity.

KEYWORDS: Climate change, fishers/fishermen, fish farmer, shipowner, perceptions, experiences, thematic analysis, Vietnam.

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ABBREVIATIONS

CRI	Climate Risk Index
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
IDI	In Depth Interview
NTNU	Norwegian University of Science and Technology
NTU	Nha Trang University
SGD	Sustainable Development Goals
TA	Thematic Analysis
UN	United Nations
WHO	World Health Organization

DEFINITIONS

FISHERS/FISHERMEN: A person with a profession as a seafood catcher. Often small-scale fishermen and owners of small boats near land (Collins, 2022a).

FISH FARMER: “Someone who rear fish for commercial proposals” (Collins, 2022b).

SHIPOWNER: A fisherman who owns a ship, has an employer and uses it to catch seafood. Often deep-sea fishermen's (Collins, 2022c).

1 INTRODUCTION

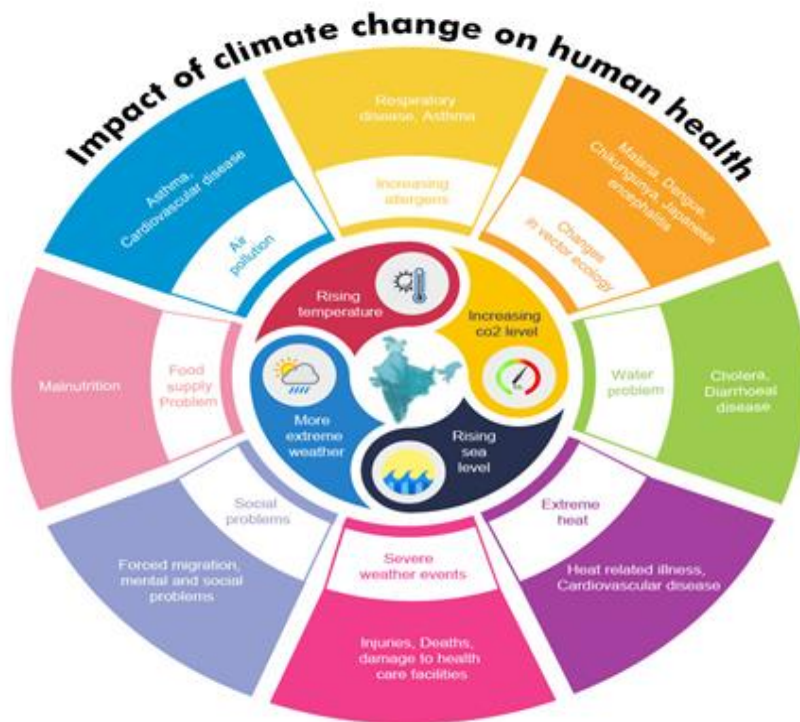
This chapter presents the research background and current literature on the topic under investigation. The chapter then outlines the investigation's purpose. The objective of the study, aim, and research question is then stated.

1.1 BACKGROUND AND LITERATURE REVIEW

1.1.1 Climate change and its impact on food security, sustainability, and human health

The United Nations defines climate change as long-term changes in temperature and weather patterns (United Nations, n.d.). Climate change has a wide range of effects on human lives and health. Furthermore, it hinders basic health needs such as clean air, safe drinking water, a nutritious food supply, and safe shelter and has the potential to undo decades of global health advances. According to the World Health Organization (WHO), this has been predicted for decades, and we have already seen and are still seeing it (2021). Additionally, the effects of climate change on food security, which is defined by the WHO as having access to enough safe and nutritious food to support an active and healthy lifestyle, are receiving a lot of attention (2022).

Based on these concerns, one of the WHO's priorities for combating climate change and improving human health is reducing greenhouse gas emissions through improved transportation, food, and energy choices, particularly reducing air pollution (2021). Between 2030 and 2050, it is predicted that the effects of climate change would result in around 250 000 extra yearly fatalities from hunger, malaria, diarrhea, and heat stress (WHO, 2021). By 2050, the world's population will be over 10 billion, necessitating a 70% increase in food production to feed those 2.5 billion extra mouths. To survive, we must seek solutions to rethink how we farm and eat. Furthermore, developing countries with poor health infrastructure will be the least equipped to manage without support in preparing for and responding to disasters (WHO, 2021).



Figur 1. *Health and Climate Change*, 2016, by National Health Portal India.
https://www.nhp.gov.in/health-and-climate-change_pg

1.1.2 Climate change and its impact on aquaculture and food security

The availability and trade of fish products will significantly rise due to temperature changes, according to the assessment of fisheries and aquaculture due to climate change (FAO UN). Significant societal and economic consequences may also occur, especially for the countries most dependent on the sector. The key finding of the 2018 UN FAO report is that "Aquaculture has increased food security," however. Research indicates aquaculture will increase food production (FAO UN, 2018). Aquaculture has further contributed to the ongoing and significant increase in the amount of fish available for human consumption, with catch fishing output mainly staying stable since the late 1980s (SOFIA, 2018). Research highlights the sector's potential for expansion and the severity of the environmental challenges it must overcome as production rises, calling for new sustainable aquaculture development strategies (FAO, 2022).

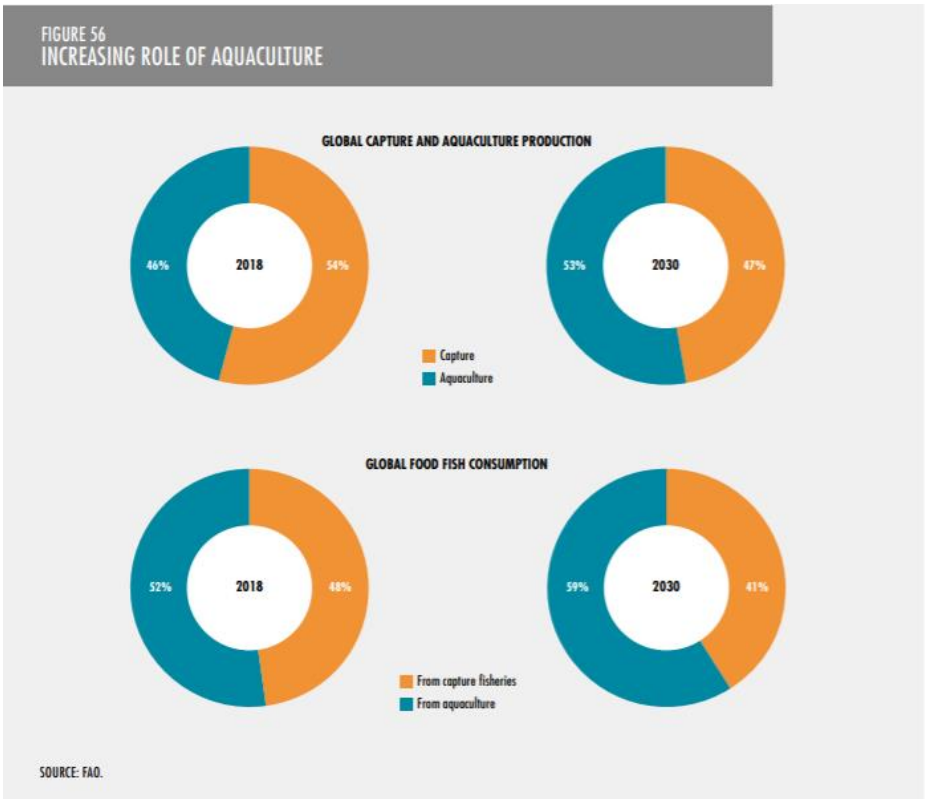


Figure 2. *Increasing role of aquaculture, 2020, by UN FAO.*
<https://www.fishfarmingexpert.com/aquaculture-fisheries-un-fao-report/aquaculture-has-improved-food-security-says-un/1154470>

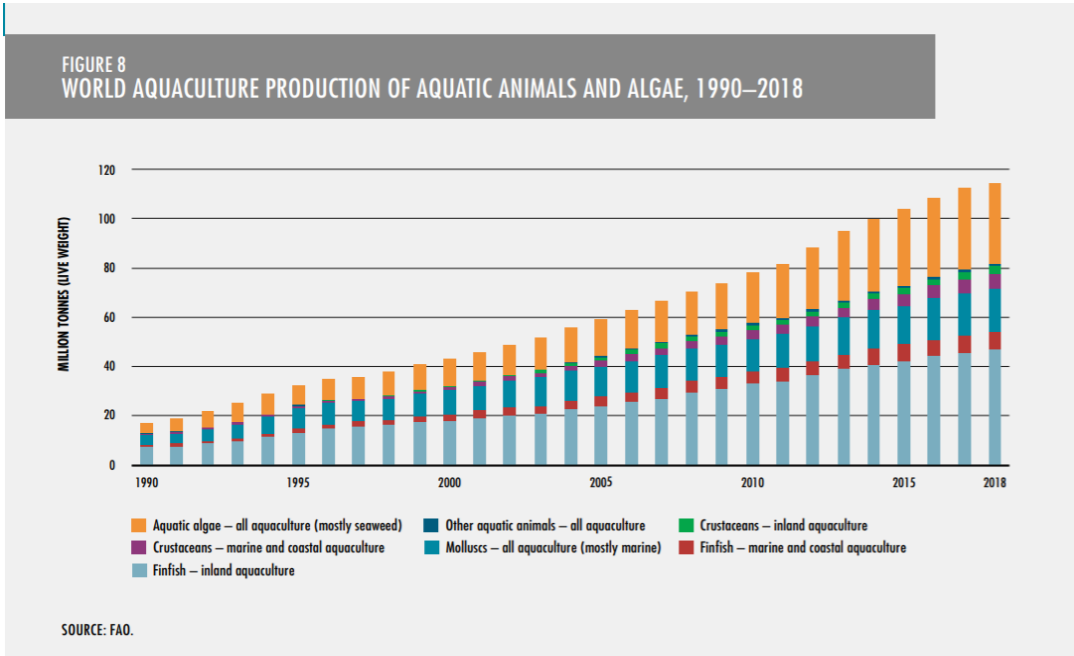


Figure 3. *World aquaculture production of aquatic animals and algae, 1990 – 2018, 2020, by UN FAO.* <https://www.fao.org/state-of-fisheries-aquaculture/2020/en>

Aquaculture and seafood provide numerous vital societal services. Their significance is justified not only by their biodiversity and recreational value but also by the fact that they offer food and livelihood for millions of people in communities all over the world, particularly in developing nations. Furthermore, aquaculture presently produces 82.1 million tons (46%) of the 179 million tons of fish expected to be produced globally, according to FAO (2020). However, aquaculture output is expected to account for 53% of all fish produced globally by 2030, up from 46% currently (FAO, 2020).

The effects of climate change on aquaculture sustainability have received much attention due to the sector's substantial contribution to global food security, nutrition, and livelihoods (Khalid, 2022). Furthermore, climate change has emerged as one of the significant issues posing numerous obstacles to aquaculture output (Do & Ho, 2022). According to several studies, some climatic changes, such as rising temperatures, changing weather patterns, and an increase in the frequency of extreme events, are already having an impact on water supplies, while others are still doing (Elsheikh, 2021, pp. 167-173).

While aquaculture and seafood are essential, some ecosystems, including coral reefs, are badly impacted by several causes, including overfishing, coastal development, tourism, ocean acidification, and climate change (Quach, 2018). Furthermore, it is critical to remember that climate change's effects will impact aquaculture production systems and the entire chain (Farmery et al., 2022). Climate change may therefore be seen as an unavoidable risk that endangers socioeconomic growth by putting more pressure on the demand for and supply of food and the livelihoods of the fishers community (IPCC, 2019).

Several studies have investigated how aquaculture will be impacted by climate change both locally and globally (Fleming et al., 2014; Maulu et al., 2021). Most of these studies' conclusions have been reviewed in light of climate change's detrimental effects. However, most research tends to focus on the negative implications of predicted climate change on aquaculture while paying little attention to the positive benefits, which are critical for creating adaptation measures. It needs to be clarified from the current literature assessments how the predicted climate shift could affect the aquaculture business's sustainability. Such information is precious in establishing the best climate change solutions for communities that rely on aquaculture for a living (FAO, 2018).

1.1.3 Climate change impact on quality, availability and sustainability of aquaculture and seafood in the context of Nha Trang and Vietnam

Vietnam is one of the top ten nations most impacted by climate change, according to Germanwatch's Global Climate Risk Index (CRI) 2020. The nation was ranked sixth in the world in 2018. (Deckstein et al., 2019). Furthermore, Vietnam is a coastal nation on the west bank of the East Sea, with a coastline that runs 3,444 kilometers from north to south and more than 3,000 major and minor islands (CIA, 2022). Because of a combination of geographical and societal characteristics, Vietnam is particularly vulnerable to climate change. The country is vulnerable to typhoons and flooding due to its long coastline. Despite its vulnerability, Vietnam is the fourth-largest aquaculture producer in the world after China, India, and Indonesia, and its share of global output in 2016 was 4.5%. Moreover, since 2014, the country has surpassed them as the third-largest fish exporter, after China and Norway (FAO, 2020). However, according to the Vietnam Fisheries Development Strategy for 2021-2030, capture output is predicted to fall from 3.8 million tons in 2020 to 2.8 million tons in 2030. In response to the fall in capture one of the goals of the Vietnam Fisheries Development Strategy for 2021-2030 is to increase aquaculture, particularly of marine species (Directorate of Fisheries, 2021). Even though the country is rapidly developing, there are still many low-income districts. In fact, low-income people will be most affected by climate change since they lack financial resources (Bangalore et al., 2019).

According to Johnson and Pham (2020), the largest portion of aquaculture production in Vietnam occurs on a small, or local, scale. The country's aquaculture industry is particularly vulnerable to the unpredictable and shifting weather patterns brought on by climate change due to its small-scale nature (Johnson & Pham, 2020). Although aquaculture has been successfully practised for centuries in Vietnam, there are still issues with sustainable growth in the industry (Tri et al. 2021). In addition, the country's fisheries sector faces serious barriers to sustainable development due to climate change (Tran et al., 2022). The Sustainable Development Goals of the United Nations, (SGDs) are in line with Vietnam's long-term development policy and call for responsible production methods, the protection of coastal, marine, and terrestrial ecosystems, and the combating of climate change (Ministry of Planning Investment, 2018). According to Wilbanks (2003), climate change both hinders and stimulates progress toward the SGDs. By avoiding the harshest effects of climate change, a solid foundation for the long-term growth of Vietnam's fisheries industry may be established (Wilbanks, 2003).

The study by Dang et al. (2015) looked at the contributions of fisher knowledge to marine fisheries management for sustainable development in order to find adaptation strategies. The study contends that fisher knowledge contributes greatly to the sustainable management of marine fisheries (Dang et al., 2015). Furthermore, a recent similar study conducted in Nha Trang examined the local knowledge of fish farmers about the impact of climate change on aquaculture in Vietnam (Johnson & Pham, 2020). Many serious climate-change threats were found as a result of this investigation. Farmers can already feel the effects of these concerns, and it is only a matter of time before things worsen. In addition, the study demonstrates that aquaculture farmers in Vietnam have a wealth of relevant climate change knowledge, which can aid in the development of climate change adaptation techniques (Johnson & Pham, 2020).

Nevertheless, evaluations of the literature and studies demonstrate that the influence of climate change on the quality, availability and sustainability of seafood is little known. Most studies addressing the consequences of climate change focus on the increase or fall of fish stocks, yields, and incomes (Asiedu et al., 2019; Marshall et al., 2009). Additionally, if supply is insufficient to meet demand, prices would rise, worsening the security of seafood and health-related problems. Therefore, a deeper comprehension of the connection between food insecurity and human health is required. As a result, according to the study by Belton et al. (2022), seafood from inland and marine capture fisheries is relatively undervalued despite being an important food that considerably contributes to diets and health. Another study attempts to highlight how fishing, aquaculture, and climate change are putting these relationships to the test, as well as the hazards and benefits to people's health that follow (Joseph et al., 2015). There are strong links between human health and well-being and living marine resources. These links are complicated, remain uncertain, and are influenced by global change (Joseph et al., 2015).

Given the foregoing, there is still an urgent need to act and investigate factors that may influence the impacts of aquaculture under pressure from climate change, and how this affects seafood quality, availability, and sustainability. This is important to be able to understand and adapt excellent tactics and fill the gap for what is unknown and predicted to be difficult in the future. Furthermore, exploration and understanding of these aspects might assist stakeholders and fishers to respond to policymakers' demands, ensuring ecosystem sustainability, and avoiding food insecurity. To better understand both the beneficial and challenging factors in light of climate change, as well as to adapt sustainable measures, this study aims to investigate fisher experiences

and perceptions on what factors affect the quality, availability, and sustainability skills of seafood in Nha Trang, Vietnam.

The majority of people in Nha Trang make their living mostly from fishing. Despite the fact that the most of them are small, unequipped wooden boats, fishing boats make up 30% of all landings in the province of Khanh Hoa (Do & Pham, 2020). Nearly 67,400 tons of seafood were reportedly harvested and raised in Khanh Hoa, Nha Trang, during the first half of 2021, up 2.86% from the year before, according to the estimates of the Khanh Hoa Provincial Statistics Office (2021).

More specifically, more than 59,593 tons of seafood were captured, while more than 7,800 tons of seafood were produced through aquaculture. The fisheries sector in the study area continues to implement measures to prevent illegal, unreported, and unregulated fishing in addition to timely implementation of policies to help fishermen. For seafood grown through aquaculture, local authorities have provided farmers instructions to pay attention to the seasonal calendar, minimize the impact of weather and diseases on seafood, and regularly monitor farming areas and the aquaculture process (Khanh Hoa News, 2021).

Despite aquaculture and seafood may give some benefits to human health on a local level, such as increased access to natural resources, there are still other factors that will have a huge impact on these natural resources as well. In light of climate change, these factors can and will create serious seafood security and safety concerns (Toan, 2022). As Nha Trang is a coastal area in Vietnam, other factors such as unsustainable fishing and aquaculture activities, as well as climate change, notably sea warming and ocean acidification, pose a concern. Nha Trang Bay has already been experiencing extreme weather events that affect livelihoods (Toan, 2022).



Figure 4. *Nha Trang City. Cyclone hazard is classified as high, n.d., by GFDRR.*

<https://thinkhazard.org/en/report/74132-vietnam-khanh-hoa-nha-trang-city/CY>

To better understand how literature and studies on this topic are linked with the food security of seafood and human health. This study sought to investigate how fishermen in Nha Trang perceive the factors and the impact of climate change on the sustainability, availability, and quality of seafood. A qualitative approach was used which included in-depth interviews and focus groups with farmers and fishers, to explore the perceived factors.

The interviews were conducted to acquire firsthand information on present climate change consequences as experienced by fishermen, farmers, and shipowners. Additionally, interviews were conducted to investigate what factors, in light of climate change, affect the quality, availability, and sustainability of seafood, as well as how they are adjusting to these risks and identifying gaps. The current study allows us to better understand, create awareness of, and link the impact of climate change on the quality, availability, and sustainability of seafood and human health.

1.2 RATIONALE FOR CONDUCTING THE STUDY

This chapter describes why this study was conducted and why the area and research topic were chosen.

The purpose of this study is to explore what factors and how environmental and climate change affects the quality, availability, and sustainability of seafood as perceived and experienced by fishers in Nha Trang, Vietnam. Furthermore, the research is especially focused on fishermen and farmers who have been and will continue to be exposed to varying degrees of climatic change throughout their working lifetimes. Climate change is still undergoing rapid and unpredictable change. Furthermore, in order to comprehend and have a better knowledge of these changes, it is critical to gain first-hand experience with how people on the front lines are affected by these changes.

To understand what factors and how climate change affects the quality, availability, and sustainability of seafood, it is critical to study how fishermen perceive and experience climate change in terms of capture, livelihood, and well-being. This is important because their perspectives may provide key indications about what factors and how climate change on aquaculture and seafood affect food insecurity. Fishermen's and farmers' experiences can be highly useful in determining where the shoe pinches the most in terms of issues and climate change implications. As a result of this, it is crucial to investigate fishermen's and farmers' perceptions and experiences about which factors and how climate change affects the quality, availability, and sustainability of seafood. By uncovering both beneficial and challenging factors that have an impact on this topic, we can likely discover sustainable strategies and solutions to fill the gap for food security and human health.

1.3 STUDY AIM, OBJECTIVES, AND RESEARCH QUESTION

The aim of the study, research objectives, and research question are described in this section.

1.3.1 Study aim

In order to gain insight into issues of seafood security and human health in the context of climate change, this study aims to explore the perspectives and experiences of fishermen in Nha Trang,

Vietnam. The results of this study may eventually influence policymakers to take climate change and its effects on food security and public health in fishing communities more seriously.

1.3.2 Research objectives

The study's overall objective is to investigate and gain an understanding of what factors and how climate changes affect the quality, availability, and sustainability of seafood as viewed and experienced by the fishermen community in Nha Trang, Vietnam. Furthermore, the study is guided by the following specific objectives:

- To discover what factors impact seafood quality, availability, and sustainability under the press of climate change
- To explore their perceptions and experiences of how these influences their lives, well-being, and health

1.3.3 Research question

What factors are associated with fishermen's perceptions of the quality, availability, and sustainability of seafood in light of climate change in Nha Trang, Vietnam?

2 METHODOLOGIES

This section contains a description of the chosen study design. It also covers how study participants are recruited and how data is collected. In addition, the data analysis technique is described. The chapter provides information on data management strategies and how the data was stored. The study's ethical considerations are also addressed.

2.1 STUDY DESIGN OVERVIEW

This section covers the research method used in the study.

2.1.1 Study design

The impact of climate change on food quality and availability can be a complex issue, particularly for a developing and culturally varied population, making a community-based approach especially appropriate for addressing this topic. This study focuses on fishermen, fish farmers, and their families. The University of Nha Trang, The Norwegian University of Science and Technology, and the participating community will achieve community participation by allowing for continuous knowledge exchange and feedback.

Furthermore, a qualitative design is used to investigate fishers' perceptions and experiences of what factors are associated with fishermen's perceptions of environmental and climate change on the quality, availability, and sustainability of seafood in Nha Trang, Vietnam. This research method is ideal since the community of fishermen and fish farmers is on the frontlines of climate change, and it will serve to draw attention to the human health and food security concerns of the environment and climate change. With a focus on connections and values that quantitative approaches are unable to capture, a qualitative design will also enable one to investigate public perceptions, experiences, and problems.

2.1.2 Research method

A qualitative research approach was used to conduct this study. In qualitative research, participants' experiences, perspectives, and actions are collected. Understanding human behavioral patterns and processes which can be hard to measure is one of the advantages of qualitative research. A qualitative method allows participants to describe how, why, or what they were thinking, feeling, and experiencing at a certain time or during an event of particular interest.

Phenomena like feelings, attitudes, and actions can be difficult to accurately capture quantitatively (Tenny et al., 2022). It is crucial to research and comprehend the perspectives of fishermen on this topic since they are in the first line and have a unique understanding of what and how climate change could impact their existing practice and the potential challenges as well as opportunities.

Therefore, it is vital to focus on fishers' perceptions, which could provide inventors of their experiences with valuable information. Focus group discussions (FGD) with subjects from various fishermen in Nha Trang, Vietnam, were used to collect data. Furthermore, Braun and Clarke's six-step thematic analysis method was used during data analysis (2006). It is a method for analysing the collected data, and when selecting codes and creating themes, it also involves perception (Kiger & Varpio, 2020).

2.2 RECRUITMENT OF THE INFORMANTS AND DATA COLLECTION

The study site, study population, sampling methodology, and recruitment process are all described in this section. This section also addresses the focus group question guide, how the interviews were run, and how data saturation was achieved.

2.2.1 Study site

The study area is in the seaside city of Nha Trang in the southern Vietnamese province of Khanh Hoa. The city is home to around 500,000 people. Because of its special marine ecosystem, Nha Trang Bay is one of the rare natural bay systems in the world. The bay of Nha Trang is in the southern maritime area of Central Vietnam. With a surface area of 507 km², the bay extends between Cay Cape (north) and Dong Ba Cape (south); the coastline (103 km) includes two distinct parts, continental, and islander. Thus, contributing to great biodiversity but also to the development of maritime activities (World Bays, 2018).

In Nha Trang, the study was conducted with three different levels of fishers. Each fishing position belonged to various levels of tasks, backgrounds, and experiences in fisheries. There are various fishing positions such as small-scale fishermen who navigate small fishing boats, fish farmers, deep-sea fishermen, or ship owners.

2.2.2 Study population

The included informants have professions as seafood catchers, seafood farmers, fishers as employers, and ship owners working as fishermen in Nha Trang, Vietnam. Furthermore, another criterion for inclusion was that the fishers had three years or more experience as fishermen. This is because they are in the first line when it comes to experiences with seafood catching and their perceptions about the environment and climate change have an impact on their catch.

Pictures/videos collected for this study demonstrated how they work and their environment.

To obtain diverse data, study participants were recruited from various levels of fishermen with different tasks and responsibilities in Nha Trang. This was done to collect various perceptions and experiences about the study's aim. The facility for recruitment was chosen based on the population size of the local government area, and whether the fishermen workers have experience.

2.2.3 Sampling strategy

In this study, purposeful sampling was chosen as it is known as a selection made with the intention of being the most informative. The more similarly the sample fits the intended study population, the easier it will be for the researcher to account for the many factors involved according to (Tenny et al., 2022). Communication will be done in the language best suited for the participants (either the local language or English); the study researcher is a native of Vietnam and speaks fluently in both languages.

The aim of the study and the available resources (such as money and time) was taken into account when choosing how many participants to include in the investigation. The co-supervisor and the researcher expected each informant to give data-rich insights into the issue under investigation when they recruited a total of 14 informants to participate in the study. Focus groups are utilized, when group dynamics and a community perspective on a topic are sought (Tenny et al., 2022). Two focus group discussions (FGDs) and two individual depth interviews (IDIs) were conducted. In-depth interviews are useful for learning more particularly about someone's behaviours and beliefs or for exploring more deeply into a new subject. The method is widely used to relate other data and give a fuller understanding of what occurred in the attempt and why (Boyce, 2006). FGDs, as compared to individual depth interviews, are small group talks intended to encourage conversation among interviewees regarding a certain topic (Patton, 2002, p. 385). FGDs are easier to organize than experiments or large-scale surveys and can offer more varied and natural

feedback than individual interviews (George, 2022). FGDs are also perfect for people from similar backgrounds as they are exploring investigations and can stimulate more active discussion between participants (Clarke & Braun, 2013). Furthermore, in order to assess the experiences and perceptions of a specific community, namely fishers and fish farmers, a similar sample method was adopted for this study. To get a variety of perspectives on the topic, many fishermen were interviewed at once. Additionally, it was intended to maximize discussion and give speakers a moment to pause and think before continuing.

2.2.4 Recruitment process

In collaboration with NTU University in Nha Trang, as well as an external supervisor and an external assistant co-supervisor, approval and assistance were provided for the data collection from the chosen sample. An approval letter was delivered to the NTU University in Nha Trang, to be able to access the facilities and collect data. Then, the master's student was given the opportunity to meet the external supervisor and the co-supervisor in person, where she was also able to present the project's purpose to them. The external co-supervisor relayed the information to the fishermen in the local community. Potential informants received a call from the co-supervisor and were given information about this study and were informed that they will get a consent form of information in Vietnamese via the master student, before the focus group discussion and the interviews. The aims, procedures, benefits, risks, confidentiality, and voluntariness of the research were all included in the information letter and permission form. Additionally, the letter provided contact information in case any questions or requests for explanations regarding the research were made. Additionally, interested fishermen and fish farmers informed the co-supervisor of their interest in participating in the study and provided verbal consent by answering. After a recall from the co-supervisor contacting potential informants, the date and location for the focus group discussions and the interviews were chosen. On the day of the FGDs and interviews, the participant gave written consent.

2.2.5 Conducting in-depth interviews and focus group discussions

The researchers were unable to make the scheduled trip to Vietnam because of the COVID-19 incident. The master student could then attend the interviews and FGDs with the assistant co-supervisor when it became available again. All interviews were face-to-face interviews, two took place at a local café, one at the participant's home, and one at the participant's fish farm. During

the debriefing, both researcher and the assistant co-supervisor wrote down relevant findings of interest. The interviews were conducted at a time and location of the participant's preference. This allowed the researcher to examine both written and verbal forms of the data. The data collection took place between July and August 2022. Focus groups are often held with According to Steven, structured interviews ask each participant a specific number of questions. It is generally one-on-one and suitable for sensitive topics or those that require deep research. Focus groups are frequently conducted with 8 to 12 members as the target group when interactions and consensus perspectives on a subject are desired (Tenny et al., 2022). There were two depth interviews and two focus group discussions with a total of 14 participants. Individual, 40–45-minute-long in-depth interviews were conducted. There were six people in the focus group, and the conversations lasted for 45 to 50 minutes. All participant interviews for the study were conducted in person.

At first, the researcher had planned to conduct between 6-7 in-depth interviews, thus because of timesaving and to be able to explore even more experiences between the participants as the discussion goes along. The FGDs were held while the fishermen were not on duty. This was done to gather as many fishermen as possible at the same time. Consequently, this resulted in some interruptions during the FGDs, as one 1 of the fishermen had to leave the FGDs for some urgent reason. Using Sony PX370 Voice Recorder, 2 focus group discussions were audio recorded. The participants received both written and verbal information about the FGDs being audio recorded, and the primary researcher conducting the interviews received the participants' consent on this. The communication was held in Vietnamese. Moreover, the two in-depth interviews were conducted without recording. The reason for this is that the participant did not want to be recorded but could provide us with the interviews by taking good notes. This was also expected as individual interviews can lead to more sensitive information (Tenny et al., 2022). For this, the assistant co-supervisor and the researcher were taking notes during the interviews. In addition, the researchers ought to include fishermen with various areas of responsibility to be able to comprehend as many different experiences and perspectives as possible.

Prior to the interviews and discussions starting on the day of the IDIs and FGDs, the principal researcher present provided the participants' verbal information. They were informed that participation in the study was voluntary so the exit would not have any negative effects. They were also told that they would have access to the research findings before they were published. It was emphasized by the assistant external co-supervisor who participated in the IDIs and FGDs that she wasn't only there to help the researcher. There won't be any testing, judging, or evaluation

of the fishers. There were no right or wrong responses. They were also allowed to ask questions vocally. The participating fisherman gave their verbal and written agreement before the researcher started the IDIs and FGDs.

Table 1. An overview of the interview type, total participant, and profession status:

Interview type	Total participants	Fisheries scale/status
Focus Group 1 (FGD1)	N=6 Participants (P1-6)	Small scale fishers
Focus Group 2 (FGD2)	N=6 Participants (P1-6)	Small scale fishers
Individual depth interview (IDI 1)	N=1 Fish farmer	Fish farmer
Individual depth interview (IDI 2)	N=1 Shipowner	Shipowner

With opening questions into the fishermen's overall viewpoints on seafood and their first understanding of climate change. The issue of seafood availability, quality, and how climate change affects their day-to-day work was discussed. In addition, they were asked about their experiences and perceptions of their current working life and how these may affect their health, well-being, and future. Furthermore, they were asked about their understanding of, awareness to, and personal experiences with environmental and climatic change. The fishermen were then asked about how they utilize and capture seafood in their area, about any equipment they may use, about the benefits and challenges of this form of fishing, and about how environmental and climatic change could affect their current process. In order to elicit more information, elaboration, or clarification from the fishers, follow-up questions were used. For example, can you tell me more about your experiences with climate change? How does it affect your daily life? How does it affect your daily work? How does it affect your health? In addition, to make the debate flow and seem as natural as possible, the focus group discussions and interviews were not always conducted in the order specified by the question guide.

2.2.6 Question guide

During the focus group discussions and interviews, a semi-structured questioning guide with open-ended questions (Appendix C) was used to evoke detailed responses about the fishers' perceptions and experiences of how environmental and climate change may have influenced the

quality, availability, and sustainability of seafood in Nha Trang. The researcher permitted participants to bring up any other topics that may have come up during the discussion, even though the questions in the guide had already been developed prior to the FGDs. For the two individuals interviewed, answers were answered directly to the researcher. For the focus group discussions, a total of 12 participants, divided into two FGDs, were encouraged to connect with one another by asking questions. In the first discussion, they responded with a few words and brief sentences. Moreover, the duration of the first FGDs was 44 minutes. The primary researchers decided to slightly modify the question guide in order to collect more information from the participants and stimulate a discussion between them. New questions were added to the guide. The participants were questioned on their thoughts on food security and how they felt it may affect people's health. There were also a few probes included in the questions. The researcher who attended the focus group discussions noticed changes in the conversations as a result of the addition of new questions and probes to the question guide. There was increased interaction among the fishermen, who elaborated on their previous statements. Additionally, the length of the second FGDs discussions increased from 40 min to 54 minutes.

2.2.7 Data saturation

Transcribing and analysis began after the focus groups and interviews so that any required changes to the research could be made while data was still being collected. According to Braun and Clarke (2013, p. 115), "data collecting does not contribute anything new, and the range of viewpoints appears to be thoroughly covered" when there is a saturation of data. The researcher and the assistant could observe that the informants' statements were repetitive, and no new codes emerged throughout the analysis of the data from the two focus groups and two interviews (Clarke & Braun 2013, p. 115; Braun & Clarke, 2021). Then, the data-collecting process was over.

2.3 DATA ANALYSIS

In this section, the data analysis strategy is described. It describes the transcription of the data, how the researchers became familiar with the information acquired, how the information was coded, and how the themes emerged.

2.3.1 Introduction to data analysis

The researcher will constantly consider her positional roles as a scientist, student of global health, Vietnamese/Norwegian, health worker with a strong interest in climate change and its effects, a mother, etc., by taking into account how these aspects of her identity affect the analytical process and affect the collection of data. The collected data was sorted and categorized into categories and main themes and patterns were discovered. To make sure all viewpoints were classified, the researcher went over the transcripts several times. Themes on the environment, climate change, and its effects on food security were connected to existing literature and relevant theories.

Thematic analysis was performed on the data from the individual interviews and FGDs using Braun and Clarke's (2006) six-step framework for thematic analysis (TA), a method for "detecting, analysing, and reporting data patterns (themes) inside data" (Braun & Clarke, 2006, p. 6).

When qualitative data are analysed, the data are transformed into findings (Patton, 2002).

TA is described as a flexible and easy-to-learn analysis technique, suitable for those with little experience in qualitative research, including student projects (Clarke & Braun, 2013, p. 177). The six-step guide of Braun and Clarke (2006) for TA includes the following steps: 1- Familiarization with the data, 2- Generating initial codes, 3 - Searching for themes, 4 - Reviewing themes, 5 - Refining, defining, and naming themes, 6- Finalizing the analysis and producing the report.

2.3.2 Transcription and data familiarization

The researcher verbatim transcribed the audio recordings and notes made by her and the assistant external co-supervisor while conducting the interviews and FGDs on the same day or the next.

As stated by Clarke and Braun (2013, p. 164), our memory after participating in an interview and FGD is typically clear for just a few days, and then details fade, thereby making the transcription on the same or the next day, useful. The recorded interviews were translated as necessary and then

translated into English. The first step in the analysis process, according to Kvale and Brinkmann (2009, p. 186), is transcribing, which prepares the data for the subsequent analysis (Clarke & Braun, 2013, p. 134). Interviews recorded were translated as needed and transcribed into English. To ensure anonymity, the names of the participants were not obtained. A Sony 3PX370 audio recording device was used during the interviews. The audio recordings were transferred from the external digital audio recorder to the main researcher's institutional Microsoft Office 365 account for temporary storage and were later deleted from the audio recorder. During the transcription, the process involved multiple playbacks to ensure that all verbal content from the recordings was transcribed. During the FGDs, there was some background noise (traffic noises and people talking in the cafe). In addition, some of the informants were talking over one another, which led to some interruptions in the audio recordings, and therefore some parts were difficult to transcribe. According to Kvale and Brinkmann (2009, p. 162), it is not uncommon that the transcriptions of FGDs appear a bit messy, as a result of group interaction. In addition to verbal communication, the transcripts also included nonverbal communication by notes. This was performed to get familiarised with the data and ensure that everything was included in the transcripts. The assistant who did not transcribe the FGDs reviewed together each transcript to verify the quality of the transcripts and to complete inaudible words and sentences encountered by the researcher.

2.3.3 Initial codes

After becoming familiar with the data, the material from the collected data was coded. The primary researcher utilized Microsoft Word's transcription function within the university's institutional Office 365 account to facilitate her verbatim transcription of all the interviews. To help the researcher get a proper overview and structure of the data, as well as to make it easier for them to reorganize and reorganize codes, the transcribed files were transferred and used as tables in Microsoft Word.

A systematic coding approach was used, which involves categorizing all data relevant to the study subject (Clarke & Braun, 2013, p. 206). A code is a term or brief phrase that expresses the essence of why you think a certain piece of data may be important, according to Clarke and Braun (2013, p. 206). Data extracts were coded, and then all of the extracts with the same code were collected (Braun & Clarke, 2006).

2.3.4 Searching for and reviewing themes

Multiple codes were used as the organizing factor for the development of a theme (Braun & Clarke, 2006). The researcher made sure that each grouping had a unique primary organizing principle that the data extracts were able to capture. Following the coding process, the codes and the collected data pertaining to each code were evaluated to establish the overlapping and similarity between codes (Clarke & Braun, 2013). Not only did the themes identify the most prevalent aspect of the data, but they also conveyed something essential and important to answering the research question (Braun & Clarke, 2006). During the phase of searching for themes, the researcher frequently created mind maps with paper and pen, which assisted them in gaining a thorough overview of potential themes. Furthermore, potential themes were identified by the researcher. The identified themes were carefully considered by the researcher, as well as together with the assistant external co-supervisor. Throughout the analysis process, themes were continuously revised and refined in relation to the research topic (Braun & Clarke, 2006).

2.3.5 Refining, defining, and naming themes

The themes were compared to the codes and the collected data to make sure they were suitable for the dataset. Further, coded data was moved in and out of the themes as well as the themes were slightly rebalanced to improve theme fit (Clarke & Braun, 2013). The identified themes were coherent, clear, and relevant to the study topic, the researcher realized at last. They also represented the meaning of the data (Braun & Clarke, 2006). The researcher made an effort to name the themes in a clear and informative manner in order to convey the essence of the data set (Braun & Clarke, 2006). Additionally, the dataset was reviewed using the themes to make sure that the data correctly answered the study question (Braun & Clarke, 2006).

2.3.6 Finalizing the analysis and producing the report

Data extracts from the informants were chosen to describe each aspect of the themes once the researcher came to an agreement on the definitions of the primary themes and the subthemes that followed afterward (Braun & Clarke, 2006). When publishing the project's findings, the researcher used these examples to highlight the different themes and sub-themes.

2.3.7 Data security

Only the researcher could unlock the data since only she knew the password. The files were encrypted before being posted to a private OneDrive map that was only accessible by the researcher and the assistant co-supervisor who were taking part in the project's fieldwork. The participating fisherman was not required to provide names or other traceable, personal information; thus, these details were removed from the interviews and focus groups. The transcripts used the fisherman's occupation and a unique identification number to identify them. The notes and audio recordings were password-protected, kept separate from any work related to the thesis, and only the researcher conducting the IDIs and FGDs in Nha Trang had access to them. The audio recording device's recorded data were deleted after the transcripts were finished and properly examined by the researcher. The written consent forms will be secured and kept excluding any thesis-related activities. The data is only accessible to the researcher conducting the IDIs and FGDs in Nha Trang. The transcripts will be safely saved online in encrypted form. Following the rules of *Datatilsynet* (2019), the written consent forms and encrypted transcripts will be deleted after the end of the study.

2.4 ETHICAL CONSIDERATIONS

This chapter describes the ethical aspects of the study, including study assessment, approvals, participant information and consent, and risk assessment.

2.4.1 Study assessment and approvals

Approval was obtained from the NSD (Appendix A). Furthermore, permission was obtained from the University of Nha Trang (NTU). A contact person from the University of Nha Trang assisted in guiding and recruiting the informants who were participants in the current study.

The study does not aim to generate knowledge about any individual's medical history or the medical or health effects of climate change and food availability. Rather, the aim is to gain insight into the effects in each context, at the community level. Written informed consent was obtained from fishermen and fish farmers prior to participation and all data was anonymized.

2.4.2 Participant information and consent

Before the data collection, the fishermen were provided verbal information regarding the project's purpose, procedure, potential risks, benefits, confidentiality, voluntarism, ethics, and contact information from the researcher. The rights of the participants to withdraw their consent and participation in the study were communicated to them. The researcher received both verbal and written informed consent (Appendix B) from everyone that participated in the study. Participation was entirely optional.

3 FINDINGS

A description of the fishers who participated as informants for the study introduces this section. The findings of the current research are then presented in the chapter.

3.1 DESCRIPTION OF THE STUDY PARTICIPANTS

All fishers who participated in the study were citizens of Nha Trang. The fishers worked in various scales within fisheries, as fishers, fish farmers, or fish who also owned ships. The fishers worked with different types of fishing methods such as longliners, divers, netting, and trolling.

Table 2. The participants varied by gender, age, and years of experience.

A profession within Fisheries	Number and Gender	Age Range	Years of Experiences
Fisher	8 Males	35 - 58	10 – 30
Fish farmer	1 Male	45	25
Fisher who also owns ships	5 Males	42 - 60	20 – 35

3.2 PRESENTATION OF THE FINDINGS

In light with the topic and research question: what factors are associated with fishermen's perceptions of impact on the quality, availability, and sustainability of seafood in light of climate change in Nha Trang, Vietnam, the thematic analysis of the collected data revealed two main themes:

- 1) Beneficial factors concerning quality, availability, and sustainability of seafood under impact of climate change:
- 2) Challenging factors concerning quality, availability, and sustainability of seafood under impact of of climate change

The reported beneficial factors concerning quality, availability, and sustainability of seafood under impact of climate change:

- Easy access to seafood and economic profit, affiliation and secure livelihood, technological support (Windy app and Vn Bao), and adaptation techniques.

Furthermore, the reported challenging factors concerning quality, availability, and sustainability of seafood under impact of of climate change:

- Higher costs and lower profit, Pressed price and lack on demand of assured quality seafood, Lack of sufficient equipments, Overfishing and illegal fishing, Poorer and polluted water, less seasonal period of catch, storm and unforeseen weather, and lack knowledge, higher risk, reduced health and well-being.

Table 3. Overview of the themes identified through analysis.

Main themes	Sub-themes
Beneficial factors concerning the quality, availability, and sustainability of seafood under the impact of climate change	<ul style="list-style-type: none"> ● Easy access to seafood and economic profit ● Affiliation and secure livelihood ● Technological support <ul style="list-style-type: none"> ○ WINDY app ● Adaptation techniques
Challenging factors concerning the quality, availability, and sustainability of seafood under the impact of climate change	<ul style="list-style-type: none"> ● Higher costs and lower profit ● Pressed price and lack on demand of assured quality seafood ● Overfishing and illegal fishing ● Poorer and polluted water ● Less seasonal period of catch ● Storm and unforeseen weather, and lack knowledge ● Higher risk, reduced health and well-being

3.3 BENEFICIAL FACTORS CONCERNING THE QUALITY, AVAILABILITY, AND SUSTAINABILITY OF SEAFOOD UNDER THE IMPACT OF CLIMATE CHANGE

Through thematic analysis, three sub-themes linked to the first main theme were identified, describing beneficial factors concerning the quality, availability, and sustainability of seafood in light of climate change. The following sub-themes include easy access to seafood and economic profit, affiliation and secure livelihood, technological support (“WINDY app” and “Vn Bao”), and adaptation techniques

3.3.1 Easy access to seafood and economic profit

In the interviews and focus group discussions, the fishermen emphasize how easily seafood can be accessed in Nha Trang, which also ensures the availability of food. They also discussed the uncertainty that comes with it:

“I’m now retired as a fisherman but own a ship and recruit people to go on catching tour... Sometimes we come with a big catch and make a high economic profit, sometimes we lose... We are very blessed to live in Nha Trang with such a big resource when it comes to seafood. The sea is deep and endless for us as we are a coastal city...” (FGD 1, P6)

“To live in Nha Trang which is a sea city, we are lucky to have a deeper sea, and the marine ecosystem has been good, despite the city moving and taking over.” (FGD 2, P3)

“The first investment was when I took a loan at the bank in 2013, I could harvest at least 15 tons each time. For us who lives in Nha Trang and could have a boat then, we manage to harvest a lot of seafood... And I manage to repay the loan from the bank within 3 years. The sea in Nha Trang is deep and there are a lot of big fish and other types of seafood available for us who live here. After many bad years of harvest lately, I have wanted to sell the boat, but my wife doesn’t want to.” (IDIs 1, shipowner)

“I still dive and catch all kinds of seafood - from fish, shrimps, and snails. In Nha Trang, we are lucky to have such a big resource of seafood... But it has been a bad year this year... There is not enough to meet the needs of the distributors these days.” (FGD 2, P2)

3.3.2 Affiliation & secure livelihood

Furthermore, in addition to easy access to seafood, there were several expressions of pride and security of belonging among the fishing community, despite challenges and difficulties, they are a fairly close group who always support each other, and this is what they do for a living. and most have worked with this for 10 - 30 years. They can't imagine doing anything else.

“You are right... We have known each other for a long time and have been through a lot of things together. We have workers that are still fishing, people that have retired already, and him who now owns a ship and hires and recruits fishermen for the catch tour... I'm still working and have been working as a fisherman since I was 15 years old. So, I have 30 years of experience as a fisherman... It's the same here for almost everyone...” (FGD 1, P1)

“Sometimes when I don't have any work to do, I always pass by here to look for my colleagues to join for a morning coffee... We are like a small community.” (FGD 2, P3)

“As fishers, we do help each other when it comes to supporting, and for the instant when someone encounters difficulties...” (FGD 2, P4)

“Everyone knows each other in this fish farm village, and I have a lot of network and connections since my main income is sales to restaurants in the city. Despite resettlement to another place in Nha Trang with a poorer environmental marine ecosystem than before, I still carry on doing this here... And we still do this for our livelihood.” (Fish farmer)

“As a shipowner, I am very picky about the selecting of ship manager and workers... To hire employees for the boat, I have to be very picky and concerned about many factors such as health problems... But I can be helpful in helping with health issues, dependency issues, and high profit, health is important for employees so that they are motivated and can secure their livelihood, a rule is non-alcohol during the trip. I fire anyone who is

frivolous.... And the manager of the ship is always held responsible for it... We`ll be like a small family... ” (IDIs shipowner)

3.3.3 Technological support (WINDY App & VN Bao)

During the interview and focus group discussions, there were mentioned a lot of weather patterns due to climate change. They all shared how they use weather predictions such as the WINDY App and VN Bao, to be able to predict and plan better for their catch trip. This is for them considered beneficial because it can help them to prevent losses and is a tool for their safety. In addition, other less affordable technology and equipment were also presented in the interviews and focus group discussions:

“I usually update with the news of the weather via APP VN Bao, Windy, and the news to predict rainfall.” (IDIs, shipowner)

“We just follow the app Windy to check the weather and the wind to avoid going out fishing... This is safety for us, but for some of us, we just see on the day whether the wind or strong or not... Or what kind of wind it is...” (FGD 1, P1)

3.3.4 Adaptation techniques

Next to the technological support weather predictions Apps, the farmer talked about their own experience and their own adaptation strategy as an advantage to be able to protect seafood from negative influences. In light of ongoing climate change, this has been a major advantage for the fishermen to gain and adapt self learn techniques to cope with the challenges, especially the farms:

“... Some kinds of fish and seafood generally cannot live with each other, and their needs are different. Therefore, I have developed my own modifications to be able to increase the efficiency of my farming. This is a technique that I usually do not share with others, but it involves modifying the equipment to the region and depth.” (IDIs 1, fish farmer)

3.4 CHALLENGING FACTORS CONCERNING THE QUALITY, AVAILABILITY, AND SUSTAINABILITY OF SEAFOOD UNDER THE IMPACT OF CLIMATE CHANGE

According to the findings of the current study, there were several difficulties and challenges associated with the impact on seafood quality, availability and sustainability on seafood in light of climate change. During thematic analysis, the perceived were divided into seven sub-themes from the main themes: higher costs and lower profit, pressed price and lack of demand of assured quality seafood, lack of sufficient equipment, overfishing and illegal fishing, high acidification, and polluted water, less seasonal period of catch, storm and unforeseen weather, and lack knowledge, higher risk, and reduced health and well-being.

3.4.1 Higher cost and lower profit

The majority of fishers in the focus group discussion and the interviews underlined how much the economic benefits have changed because of various factors that will be further outlined. The fishers could tell and discuss different factors that are related to the higher cost, the requirement of supplies and maintenance, lower profit, increased petrol and fuel prices, demand, quality, and quantity of seafood catch:

“... For bigger ships, we are longer away and can be out for 2-3 weeks away depends on weather and supplies. We used ice to handle and maintain the catch before we get to land where it is sold to distributors and then to the consumers. And the cost for one trip now is higher because of the higher oil prices...” (FGD 6, fisher and ships owner)

“The cost is higher and..it requires a lot of resources such as workers, gasoline, lamps and lights, ice cubes to be able to maintain the catch...” (FGD 6, fisher and shipowner).

In the same perspective, several fishers also mention the higher price of petrol and fuel:

“Because of the higher price of petrol and fuel, I have considered solar cells, but mine is a smaller boat so I can't use solar cells. But have considered this...” (IDIs 2, fisher and ships owner)

“This year has been difficult for us to go fishing and for catching fish, and the high petrol and fuel price makes it no longer profitable to go to sea. It’s difficult...” (FGD 4, fisher).

“When the quality is no longer counted, we can't bear to spend so many resources on it. As fuel prices have become much higher, it is no longer so profitable to go to sea.” (FGD 1, fisher)

Consequently because of the higher cost and reduced cost effectiveness which leads to lower profit that several participants mention and were comparing the earlier years' income then and nowadays:

“... It was good to be a fisherman back those years where the fish could be up to 25-30 kg per fish... The quality of the fish was better, and the volume was bigger... We could come home with big catch back then and make good profit...” (FGD 2, fisher)

“We make good money those days... We could even give other fishermen private loans to go on a catch tour and they could come home to win double or triple profit... Further, it also depends on the weather to catch fish.” (FGD 6, fisher and ships owner)

3.4.2 Pressed price and lack on demand of assured quality seafood

In addition to higher costs and lower profit, multiple fishers discussed that the depressed price from distributors and consumers is an ongoing factor that has an impact on both the quality and most of all the availability of the seafood because the pressed price results in higher demand:

“It's difficult with this high price and the buyers are pressing our prices... And yes, even if one fish is better than others, they only have one price...” (FGD 3, fisher)

“... The retail price has been reduced due to pressured price from buyers.” (FGD 4, fisher)

“Just a few years ago we could get a higher price for fish by its quality and size... Now the distributors press our price to the same because they are going together to decide the prices and press us to sell the same price...” (FGD 1, fisher)

“If they succeed to buy for a lower price, they still tell us that other sales for that price and the word of mouth goes quickly among the distributors.” (FGD 5, fisher)

Moreover, some participants emphasized the COVID-19 pandemic and how the pressed price has occurred and can be a factor that impacts the quality and availability despite the closed-off world:

“Despite the COVID - 19 pandemic, we have seen even more pressed price... We thought when tourism no longer exist, it would be better for us... But no ... The prices are even more pressed now, the quality doesn't matter that much anymore.” (FGD 3, fisher)

“I thought that the COVID-19 pandemic will reduce my delivery especially the restaurant, but no... It was enough for me to live... Despite other factors like higher fuel prices, I guess the demand for food for the local people will still be there... People need food and especially when everything was locked down...” (IDIs 2, fish farmer)

3.4.3 Overfishing and illegal fishing

The fishers discussed overfishing as a factor for the impact of quality, availability, and especially the sustainability of seafood in Nha Trang, several fishers could tell us as they mention is a bit sensitive information, but they wanted to be honest and provide us with relevant information:

“The catch of seafood has also decreased... While the methods that are assumed to be most profitable when it comes to quantity, Gia Cao, still the quantity is decreased, I guess because of overfishing...” (IDIs 1, fisher ships owner)

“Likely, I know that many fishers still use underwater bombs and illegal toxic to catch the fish” (IDIs1, fisher ships owner)

“Many years ago, we could see more quality in the seafood and various types of seafood in our catch... And you know Nha Trang has been known for coral reef, and it seems like tourism also can have an impact on this...but also the illegal fishing... We know this...” (FGD 4, fisher)

“If I can compare the method, Gia Cao, then and now the amount has also decreased because the overfishing has reduced the ground far too much and the way the fishers do this have had an impact as well...” (IDIs 1, ships owner)

“I also work to rebuild coral, but according to experience with this... It's dependent on the flow of the water... We must have enough oxygen” (FGD 2, fisher 3)

“Before we used Cyanide, poisonous substances... This is prohibited by the authority” (FGD 2, fisher 1)

“This has now been replaced with an electric underwater gun... This is not really legal but is used. If they are caught, they can pay the fine to buy a new gun...” (FGD 2, fisher 6).

3.4.4 Poorer and polluted water

Poorer and polluted water were stated by the fisherman and farmer as causation of poorer quality and availability of seafood as well. As evidence and an indication of this, they shared stories based on their, observation, and experiences:

“As for the quality and the quantity has been reduced considerably since 2012 the water is more polluted.... It was better before all the storms lately...” (FGD 3, fisher)

“The water here is bad due to less oxygen and flow of the water... The quality of the seafood is poorer as well because of this, the water stays in one place and its blocked. Therefore, the water environment is more polluted.” (Fish farmer)

“Yeah, that’s true, the storm in 2017... Temperature is cold, muddy water, it's difficult for us to see and to work... So, this limits our work and prevents us from being able to perform diving” (FGD2, P3).

3.4.5 Less seasonal period of catch

In light of the environment and climate change, the fishers could tell that in the latest years after the big storm Damray in 2017 there has been a shifting pattern of unpredictable weather,

something that has caused a less seasonal period of catch and farm for the fishers and the farmers. This has impacted a lot on most the availability of seafood, as they cannot meet the demand because of no catching due to the storms in addition to the other finding of factors:

“In A year we have been working for 8 months. from 1-9-10, while this year because of bad weather still in April and May months, this is really affecting us who is living of fisheries.” (FGD 1, P2)

“Its... Difficult for us... This affects our working period. Especially this year, there are limited working months.” (FGD 1, P4)

“Southeast wind is best for catching as it is quieter, but now it is still northwest wind and monsoon, the water is muddier because of this and makes it especially challenging for us to work.” (FGD2, P1)

3.4.6 Storm and unforeseen weather

The fisherman reported that they have seen and still experience heavy changes in climate changes, especially storms and unforeseen weather something they also discussed and included this factor as a response to the statement about challenges concerning the quality, availability, and sustainability of seafood. In context with the topic, there were discussed and shared numerous stories linked to the environment and climate change.

“It's like the storm in 2017 when we could not go to sea because of the big storm then... It was a big storm Damray... Everyone remembers that year.” (FGD 1, P6)

“... When it's like this, it's almost impossible to have a good sight underwater. Everything is like a storm under the water, and we cannot see anything. The climate change has to be stopped, or else the seafood is no longer enough for us...” (FGD 2, P2)

*“To better cope with this unforeseen weather pattern and my earlier experiences of a long period of rainfall, I have been shifting to another fish feed from Indonesia... The seafood grows faster, and I avoid losses when the weather is bad, and the water is polluted.”
(Fish farmer)*

“In order to get as much catch as possible, we are dependent on the water quality and oxygen...Because of the polluted water and bad unforeseen weather and storm its stops us to goes to sea and therefore they will have an impact on both the quantity and the quality of fish of course...” (IDIs 1, shipowner)

“It is difficult for us... This affects my and our work. Especially this year, there are limited working months. The southeast wind is best for catching as it is quieter, but now it is still the winter northeast monsoon, and the water is muddier than before” (FGD 2, P3)

“80% is the reason the storm and climate change, as I see it...” (FGD 2, P2)

3.4.7 Higher risk, reduced health and well-being

Additionally, the fishermen shared their experiences and insights about their safety, health, and well-being. In addition, they shared a lot of perceptions and experiences with strong stories regarding the high risk as a fisher, how these have impacted their health and well-being, and worries about how it will be in the future for the next generation. This was told and discussed as a connection between the quality, availability, and especially the sustainability of seafood that is under the pressure of environmental and climate change:

“For those who have lost their lives... It could be that the storm has taken them or that they have miscalculated...” (FGD 1, P4)

“For us, as fishermen its physical strain, but most of all it affects our mental health and for everyone in the family, especially those who are ashore...” (FGD 1, P1)

“From the age of 14 to the age of 22, I was a diver, but saw that health was affected because of too much diving, so I switched to having a fish farm.” (Fish farmer)

“I remember one time when I was down diving, and I was almost going out of oxygen, but then I thought I can hold it for a longer time, I came up and almost lost my feeling of the legs and fingers.” (FGD 1, P3)

In addition to higher risk and reduced health they also express their concerns and worries for the availability and the sustainable skills of seafood in the future to come and next generation:

“Before we used Cyanide, poisonous substances. This is prohibited by the authority. This can affect our health as well, but we took the risk in hope to get enough food...” (FGD 1, P1)

“My kids also work with other things, we endured more than now, the youngsters give up after a couple of fish catching tour now...” (FGD 2, P6)

“For the next generation I worries... My son says he will not be a fisherman... I want to work at the office...” (FGD 2, P2)

“I think almost every young people now is thinking about working at land... My children learned English and Chinese to work in tourism’... Because it’s easier to find jobs and less hard work...” (FGD 1, P3)

4 DISCUSSION

The findings discovered through data collection and thematic analysis are addressed in this chapter and discussed in the context of the study objectives in addition to previous research and theory. Furthermore, the methodological aspects of the study are also discussed.

4.1 DISCUSSION OF THE FINDINGS

This study aims to explore and get insight into local fishermen in Nha Trang, Khanh Hoa, experiences, and perceptions of factors and how the impact of environmental and climatic change concerning quality, availability, and sustainability of seafood. The data collection and thematic analysis results revealed a wide range of fishermen's perceived factors and the impact of climate change concerning the quality, availability, and sustainability skills of seafood in Nha Trang, which were grouped into two main themes: beneficial factors and challenging factors. Further, these two main themes were analysed and categorized into different sub-themes.

4.1.1 Availability and access to seafood for better or for worse

The current study's findings demonstrated that fishers living in the coastal city of Nha Trang, are considered to have some beneficial impact, one of which is greater its easy access to seafood. According to the fishers, this has resulted in positive outcomes such as seafood availability and economic profitable opportunities. This can strengthen the FAO report which stated that aquaculture can be the solution for food security in the future, especially for countries that are depending on this sector.

Despite that in Nha Trang, there are no actions limiting small-scale capture and fishery capture, therefore, wild fish is open access. This leads to a spread of small scale along the seaside and increases the escalating stress on nearshore fish stock. Although the majority of fishermen in this study claim that having access to seafood is a benefit, there is also evidence to suggest that without restrictions, there would be an increase in the number of unsustainable fishing activities, which would ultimately result in a decrease in the availability of the seafood. The small-scale fishers could tell about higher competition for seafood, distributors have more to choose from.

This has ripple effects that the fishermen also share, such as pressured prices from the distributors. From the perspective of a farmer, he could tell that the availability and quality of the seafood harvest is almost halved due to poorer water caused by the storms and pollution. Further the shipowner could tell from the availability, there is a lot in the deeper sea, but for more restrictions, they are not allowed to fish everywhere, because of the protected area and they have to be aware of the border to other countries, such as China and Philippines. In addition, he mentioned the illegal fishing method on the deepest ground over big areas, is the most harmful to aquaculture and is almost draining out the sea of seafood. This was also a bit sensitive to share though the participant wanted to be honest and tell from the perspective of a deeper sea fisherman. Availability of capture is the most concerning issue among the fishers. They were concerned if there will be enough for us in the future, as they shared a story about considering other jobs for livelihood. However, most of the fishermen still have hope for better years to come.

Another aspect of availability, impacted by climate change, since this is a coastal location with easy access to seafood, it can also be more easily exposed to climate change, which in this research is determined to be very vulnerable to the environment and climate change. Most fishers expressed their concern and worries regarding the availability of seafood in the future, as a range of factors related to the environment and climate change such as polluted and poorer water caused by storms and pollution. According to the fishers, factors that are directly related to climate change are storms and unforeseen and unpredictable weather which hinder them to work and harvest and give them less of a seasonal period to catch. Further, the fishers discussed and stated that these factors are well-linked and threatened their livelihood and health as well. As predicted by IPCC (2019), climate change will be a risk that endangers socioeconomic growth, as well as the livelihoods of the fishermen community. Furthermore, according to the fishermen, climate change-related factors is not only the one to blame for the reduced availability of seafood. Other factors could be human made, such as overfishing and illegal fishing. Further, there are factors such as higher costs, that in light of climate change.

Moreover, the study participants have gained knowledge and experiences both beneficial and challenging when it comes to vulnerability. The benefit they were talking about, is their knowledge of experiences they have after a long career as a fisherman, as most of them had more than 10 – 30 years of experience. They were able to use this experience and knowledge to modify and adapt their own techniques to the way they fish and farm. These experiences and knowledge

towards access and vulnerability are considered beneficial aspects to easily cope with the impact of climate change concerning the availability and sustainability of seafood.

These findings of the fishermen are very likely to be found in the study of (Alexandra et al., 2020) that also result that fish farmers have important knowledge about climate change, and this can gain the development of climate change adaptation strategies further (Alexandra et al., 2020). In addition to challenges on how climate change is impacting the natural resources and their availability of seafood, it was clearly a sense of pride and belonging among the fishers that could indicate that they are having a positive affiliation and secure livelihood.

4.1.2 The balance of quality and sustainability

The fishermen shared different factors, adaptations techniques, and modifications they have been involved in and done concerning how environmental and climate change have impacted the sustainability and quality of the seafood. Consequently, the higher cost leads to lower profit several participants mention comparing their experiences of earlier years' income. Cost-effectiveness depends on many factors, according to the fishermen in this study such as requirements for supplies and maintenance of the catch, increased petrol and fuel prices, and demand for quality and quantity of seafood catch. In addition to higher costs and lower profits, the fishermen and farmers stated that the pressured price from distributors and consumers is a continuous factor that affects both the quality and most of all the economic benefit.

Most of the fisherman's income is dependent on the demand for seafood, which also could lead to economic benefits. Fishers in this study recognized that the lack of quality assured seafood and depressed prices from distributors make it less profitable. This factor is a stress factor for their income and livelihood. These findings support other studies (Farmery, 2022) that indicate that climate change can be seen to a greater extent as an unavoidable risk that endangers socioeconomic development and puts more pressure on the demand and supply of food as well as the farming community's livelihood. According to the fishers, this is a growing problem, as quality no longer counts for price. The distributors pay the same for both bad and better-qualified fish. As a result of the lack of demand for assured quality, this can lead to even more unsustainable fishing and draining of the ocean supply. In the findings, many fishers expressed concern regarding the lack of sustainable seafood in the face of environmental and climate change impacts. This is evidence that can increase the chances that the suggested expected decline in catch rates by 2030 according to the Vietnam Fisheries Development Strategy may be real.

Further, overfishing and illegal fishing have been mentioned as a reason for reduced capture and for lower quality of fish, which leads to a big threat to the sustainable skills of seafood. Use of electricity guns and toxic underwater, detriment of coral reefs to capture fish, and illegal fishing methods near land. As highlighted in previous studies (Quach, 2018). These findings are similar to other studies in this field and need more attention. Moreover, to seek availability of food, some of the participants could tell that they were using toxic bombs and other prohibited methods, which would negatively impact the quality, availability, and sustainability of the seafood. For this, they even risk their own health as well. In addition, most of them expressed reduced well-being and mental health in terms of uncertainty and the unpredictable future impact of climate change. Despite that, they are still doing this because of the demand for food and for their own livelihood.

4.1.3 To be sufficiently prepared for changes and find solutions

The findings of the study indicate that fishermen in Nha Trang, Vietnam are experiencing impacts of climate change such as an increase in the frequency of intense storms, severe temperatures, and poorer water quality in line with CRI (2020). The fisher reported that they have seen and still experiences heavy changes in climate change, especially storm, unforeseen weather, and bad water quality, something they also discussed and included tourism and building as the most challenging factor as a response to the statement about poorer quality and availability of seafood. In context with the topic, there were discussions and shared numerous stories linked to environmental and climate change.

Likely, but unlikely from previous studies about the impacts of climate change on aquaculture (Elsheikh, 2021), these studies mostly focused on the negative impacts of climate change. However, in this study, there are attempts to explore both the negative, challenges, and positive sides of climate change in relation to aquaculture and seafood.

Thus, in the attempt to explore more of the beneficial factors, it was still to a small extent in relation to the challenging factors to be found for how climate change has an impact.

A change in the seasons has also been observed by many fishermen. They claim that the difference between the rainy and dry seasons has been hazier over the past several years. The rainy season now sees the occurrence of weather conditions that used to only exist during the dry season. Furthermore, the occurrence of northwest monsoons is stretching over a longer period than it used

to do according to the fisher. This hinders and causes less seasonal catch period, which is impacting heavily on seafood security. The occurrence of the northwest wind is also revealed in the study of (Alexandra et al., 2020). Still, this is a big problem for the fishers when it comes to the impact of climate change. Many of the fishers could also state from their perspectives that 80% of the impact on the seafood now is caused by climate change.

During the interview and focus group discussions, there were mentions several times about their use of technology support such as weather forecasts such as WINDY App and VN Bao to predict the weather. This has provided important information to be able to safely predict the weather and leads to lower losses and provides more capture. That extended access to information would guide fishers to avoid miscalculations and reduce the risks caused by the weather.

Furthermore, this can provide increased safety for the fisher's family and community. Most of the fishers valued affordable applications such as WINDY App which supplied them with knowledge and did they work more effectively and profitably. Making them more aware and providing them greater control over their health situation, thereby empowering the health of fishers and farmers. Overall, this was the most practical and cheapest way to prepare for and cope with climate change's unpredictable and shifting weather. However, other alternative adequate technologies, such as the use of solar panels on boats or LED lighting, were proposed to be more sustainable in the operation of catching. However, it wasn't a top priority and was too expensive.

Taking the safety and fishers' well-being into account when it comes to fully exploring their adaptation strategies could be very valuable to better understand what the needs are. Which in the term could lead to the development of sustainable solutions. considering the challenges they perceive. This research explored and revealed that one of the challenging factors is a higher risk which also reduced the fisher's health, mental health, and well-being. Several of the participants in this study were very informative about their health being affected, they also told the weather forecast and other adaptations to preserve health and well-being. Another adaptation caused by climate change that the farmer told is that he used a different type of fish feed to be able to harvest quickly, even though the fish feed is more expensive, it will bring more profit than the loss of catch due to pollution and changing weather. The risk is higher to lose because it takes a longer time to harvest. This supports the findings in the study by (Alexandra et al., 2020), where a shift in fish feed was one of the adaptation strategies among farmers identified in this study. Another adaptation strategy to cope with the challenges was modifying the equipment to the area and

depth. In addition, the farmer also could tell that he was considering a change to a more tolerant species. As a follow up question to this the researcher asked for algae species were something that is considered, his answer where that didn't know if there are any marked for this, and if there is, he think there is to low price to be able to invest any further. This revealed that there are lack of knowledge for alternative other species. This finding supports the call for action to reach the goal of developing marine species aquaculture as a response to the decline in catches set out in Vietnam's fisheries development strategy for 2021–2030 (Directorate of Fisheries, 2021). This is also something that needs more attention.

4.2 METHODOLOGICAL CONSIDERATIONS

The methodological considerations for this study are presented in this chapter. There are considerations provided and discussed regarding the study design, data collection, analysis, and findings. Moreover, the chapter evaluates the trustworthiness of the study.

4.2.1 Research design and data collection

This study aimed to explore the perceptions of fishermen and farmers in Nha Trang, Vietnam, regarding the impact of environmental and climate change on quality, availability, and sustainability for aquaculture and seafood. However, it would have been interesting to consider the distributors' perspectives on this topic. However, this master's thesis is confined by factors such as a limited time frame and limited finances. Therefore, this could not be done at this time, although alternatives could be studied in future research.

Additionally, if the study site of the research project was a rural area as opposed to the metropolitan area that was used, the perceptions of fishermen might have yielded different results. Following the current study's inclusion criteria, the selected fishermen with three or more years of experience. According to the researcher, the informants selected for the study have yielded important information about the topic being studied (Bengtsson, 2016).

Before the in-depth interviews and FGDs, the master's students evaluated the interview question guide and practiced asking with an assistant co-supervisor, which assisted the master's student. Because the master's student speaks almost fluent Vietnamese, it was supportive to have an assistant co-supervisor. The student was initially unfamiliar with FGDs, but after practising with the co-supervisor, she felt more confident to get started. The co-supervisor was also present during the FGDs to assist the master's student. Moreover, after the first interview and the first FGD, she felt more comfortable.

For the studies researcher to ensure that each FGD included the desired number of fishers and farmers to get enough data, the discussions and interviews were held at the various facilities where the fishers and farmers belong and gathered. At the time of data collection, most fishermen were off duty, mostly due to bad weather. In addition, due to considerable travel distances, because fishers were living nearby, it was possible for most of them to attend FGDs outside of their

working hours. According to Braun and Clarke (2013, p. 121), it is important that the researcher creates a safe environment for the informant. They suggest choosing a place in which the informants are familiar. Therefore before the IDIs and FGDs, the fishers gave verbal approval of the location. In addition, before and throughout the IDIs and FGDs, the researcher observed that most fishers were engaged and eager to discuss the topics under investigation and that there was a pleasant atmosphere within all the discussions. Yet, participation in an in-depth interview and focus group discussion is highly voluntary, and no one should be forced to speak if they do not wish to, which was not the case in any of the interviews conducted for the current study (Braun and Clarke, 2013, p. 116).

4.2.2 Data analysis and findings

The interviews were conducted in places with almost no sound since it was early in the morning and we had the place in a quiet area. Thus, a limitation that interrupted the transcription, was that some of the informants in the FGDs spoke over one another sometimes. The initial analysis steps (familiarization, generating initial codes, and searching for themes) were conducted. Following this, the analyses were compared during which similarities and differences there was (Patton, 2002).

4.2.3 Reflections on the research

Prior to this study, the master's students had no experience with theme analysis or qualitative research. She was nevertheless inspired and strongly compelled to actively engage in the process of learning new things. An additional theory, methodological courses in the master's degree, and methodological theory have all improved comprehension. In addition, the master's students had a strong working relationship with the main supervisor of the study, and the local co-supervisor in Nha Trang, Vietnam. Furthermore, the research project was performed during the COVID-19 period, while there were still a lot of restrictions in many countries globally. Although most countries had recently removed their restrictions, certain countries still had travel restrictions. Unfortunately, the ongoing pandemic disrupted the master's student's initial travel to Vietnam, which forced her to reschedule for a later time. When the country opened again, she was able to travel and conduct the interviews in July 2022. Since the master's student is from Vietnam herself, she could readily relate to others and comprehend Vietnamese culture. Both the focus group discussions and the one-on-one interviews were conducted in the local language. The informants

were able to freely express themselves without restriction due to the impersonal nature of the subject of conversation, which was perceptions of climate change, which provided vast data. The local co-supervisor contributed as a research assistant during the individual interviews and the FGDs. Furthermore, during the interviews, she assisted the master's student by taking notes.

4.2.4 Study's trustworthiness

The fishermen included in the current study were chosen using predetermined criteria based on the research question. This included fishers, farmers, and ships owner in Nha Trang, Vietnam. As a result, their responses yielded rich data regarding the topic being studied (Kvale & Brinkmann, 2009, p. 251). Some of the questions during the IDIs and FGDs were repeated using reframing questions. For example, today's topic is climate change. What are your thoughts about it?' This enabled the researcher to determine whether the informants provided accurate information and consistent answers. Moreover, the researcher conducting the IDIs and FGDs also questioned the informants to find out if what she understood from their answers matched what the informants were attempting to say (Kvale & Brinkmann, 2009). Data were transcribed verbatim and accurately, and raw data from the informants were used to generate quotes to demonstrate the findings.

5 CONCLUSIONS

This study aimed to explore the perceptions and experiences of fishermen working in Nha Trang, Vietnam, regarding the perceived factors impacting the quality, availability, and sustainability of aquaculture and seafood in Nha Trang in light of climate change. To address the study's research question, which was to identify the factors influencing fishers on this topic. A qualitative approach utilizing thematic analysis was employed to analyse the collected data. This provided insight into the beneficial factors concerning how the perceived factors in light of the environment and climate change impact the quality, availability, and sustainability of aquaculture and seafood. The perceived beneficial factors of this topic include availability, access to seafood, motivation and affiliation, technologies, and adaptation according to experiences. Most of the fishermen have 10 to 30 years of experience as a fisherman. Because of their rich knowledge and expertise on this topic, they have both gained benefits and met challenges when it comes to the availability of natural resources. In addition, the fishers believed that the affordable weather forecast WINDY app has helped the fishers to be able to foresee and predict changing weather patterns. and other more expensive sustainable equipment like LED lamps, Solar cells would be a helpful technological solution to cope with changing weather patterns and higher oil prices. Other adaptation strategies mentioned in the findings could be using another type of fish feed that would increase the availability and make farming more efficient. Other modifications of equipment to region and depth were mentioned as a good strategy for farmers. In addition, changes in more tolerant species could also be a possible solution, which is also something that needs more attention.

The study revealed fewer beneficial factors being perceived by the fishermen concerning the topic. Moreover, the results revealed several perceived challenges. Although the findings in this study revealed a range of factors that are directly related to and impacted by climate change, it was some factors that were not such as overfishing and illegal fishing.

The findings included perceived factors from various fishermen, such as fishers, farmers, and shipowners. A range of factors was revealed that they perceived and experienced had impacted the quality, availability, and sustainability of seafood in light of climate change in Nha Trang. The beneficial factors are: easy access to seafood and economic profit, affiliation and secure livelihood, weather predictions APPs, and experienced techniques and modifying. The challenging

factors are: higher costs and lower profit, pressed price and lack of demand for assured quality seafood, overfishing and illegal fishing, poorer and polluted water, less seasonal period of catch, storm and unforeseen weather, and lack of knowledge, higher risk, reduced health and wellbeing. To be able to set a link to all these factors, it is evident that the climate change impacts on seafood security and human health are current and ongoing. The findings in this study are undertaken by fishermen on the front line to meet these benefits and challenges, Therefore the result of this study may address and express the needs from the perspective of the fisherman to make awareness and can be disseminated to policymakers, stakeholders, developers and implementers of adaptation strategies of what matters in light of pressure from climate change. Moreover, this study can improve existing solutions to better manage both the benefits and challenges concerning the quality, availability and sustainability of aquaculture and seafood in Nha Trang in light of climate change. This valuable recognition can be relevant for other countries as well. Furthermore, this in the term could lead to improved human health around the world and malnutrition, and poverty, particularly in the global problem area of sustainable development strategies and food insecurity.

5.1 IMPLICATIONS

The findings reveal valuable information from the perspective of fishers regarding the quality, availability, and sustainability of aquaculture and seafood in light of climate change, which is information that should be considered by stakeholders. The findings in this study can also help people understand how climate change may affect human health by affecting the safety and insecurity of seafood. In order to better create solutions for the impact of the environment and climate change, this research should be enlarged with information about the benefits and challenges that fishermen have faced, as well as how they have modified and adapted. In addition, the results will be sent to the Vietnam collaborators in Nha Trang. Moreover, the researchers are planning to arrange a meeting with Vietnamese collaborators to give them a presentation of the study.

5.2 FURTHER RECOMMENDATIONS

The viewpoint of fishermen was emphasized in this study. Future research should address the perspectives of both distributors and, in the instance of consumers, towards these solutions. By addressing the perspective of contributors and consumers, developers can use this to gain a deeper understanding of the factors that are experienced and perceived of how climate change impacts quality, availability, and sustainability, enabling them to adapt new solutions that prevent food insecurity. In addition, since the current research only explored the perspectives of fishers, future research should investigate the perspectives of fishers and farmers after they have had the opportunity to adopt new strategies for a period, which may reveal additional information.

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APPENDIX A. NSD APPROVAL

Vurdering

Referansenummer	Type	Dato
666971	Standard	12.07.2022

Prosjekttittel

Environmental and Climate change impacts on quality, availability and its sustainability skills for aquaculture and seafood in Nha Trang, Vietnam

Behandlingsansvarlig institusjon

Norges teknisk-naturvitenskapelige universitet / Fakultet for medisin og helsevitenskap (MH) / Institutt for samfunnsmedisin og sykepleie

Prosjektansvarlig

Jon Øyvind Odland

Student

Kim My Tran

Prosjektperiode

13.06.2022 - 25.11.2022

Kategorier personopplysninger

Alminnelige

Særlige

Rettslig grunnlag

Samtykke (Personvernforordningen art. 6 nr. 1 bokstav a)

Uttrykkelig samtykke (Personvernforordningen art. 9 nr. 2 bokstav a)

Behandlingen av personopplysningene kan starte så fremt den gjennomføres som oppgitt i meldeskjemaet. Det rettslige grunnlaget gjelder til 25.11.2022.

[Meldeskjema](#)

Kommentar

OM VURDERINGEN

Personverntjenester har en avtale med institusjonen du forsker eller studerer ved. Denne avtalen innebærer at vi skal gi deg råd slik at behandlingen av personopplysninger i prosjektet ditt er lovlig etter personvernetregelverket.

Personverntjenester har nå vurdert den planlagte behandlingen av personopplysninger. Vår vurdering er at behandlingen er lovlig, hvis den gjennomføres slik den er beskrevet i meldeskjemaet med dialog og vedlegg.

VIKTIG INFORMASJON TIL DEG

Du må lagre, sende og sikre dataene i tråd med retningslinjene til din institusjon. Dette betyr at du må bruke leverandere for spørreskjema, skylagring, videosamtale o.l. som institusjonen din har avtale med. Vi gir generelle råd rundt dette, men det er institusjonens egne retningslinjer for informasjonssikkerhet som gjelder.

TYPE OPPLYSNINGER OG VARIGHET

Prosjektet vil behandle alminnelige personopplysninger, særlige kategorier av personopplysninger om helse frem til 25.11.2022

LOVLIG GRUNNLAG

Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 nr. 11 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse, som kan dokumenteres, og som den registrerte kan trekke tilbake.

For alminnelige personopplysninger vil lovlig grunnlag for behandlingen være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 a.

Behandlingen av særlige kategorier av personopplysninger er basert på uttrykkelig samtykke fra den registrerte, jf. personvernforordningen art. 6 nr. 1 a og art. 9 nr. 2 a.

PERSONVERNPRINSIPPER

Personverntjenester vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen:

- om lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lenger enn nødvendig for å oppfylle formålet.

DE REGISTRERTES RETTIGHETER

Vi vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18) og dataportabilitet (art. 20).

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER

Personverntjenester legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1 f) og sikkerhet (art. 32).

Ved bruk av databehandler (spørreskjemaleverandør, skylagring, videosamtale o.l.) må behandlingen oppfylle kravene til bruk av databehandler, jf. art 28 og 29. Bruk leverandører som din institusjon har avtale med.

For å forsikre dere om at kravene oppfylles, må prosjektansvarlig følge interne retningslinjer/rådføre dere med behandlingsansvarlig institusjon.

MELD VESENTLIGE ENDRINGER

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til oss ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilken type endringer det er nødvendig å melde:

<https://www.nsd.no/personverntjenester/fyll-ut-meldeskjema-for-personopplysninger/melde-endringer-i-meldeskjema>

Du må vente på svar fra oss før endringen gjennomføres.

OPPFØLGING AV PROSJEKTET

Vi vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Kontaktperson hos oss: Markus Celiussen

Lykke til med prosjektet!

APPENDIX B. RECOMMENDATION LETTER



Fakultet for medisin og helsevitenskap
Institutt for samfunnsmedisin og sykepleie

Vår dato

Vår referanse

1 av 1

Deres dato

Deres referanse

Trondheim 12.06.2022

To whom it might concern.

Recommendation letter and confirmation of cooperation between NTNU and The University of Nha Trang.

The collaboration is based on supervision of Kim My Tran's master thesis: "Environmental and Climate change impacts on quality, availability and its sustainability skills for aquaculture and seafood in Nha Trang, Vietnam,"

Supervisor NTNU

Jon Øyvind Odland

Norwegian University of Science and Technology (NTNU), Faculty of Medicine and Health NTNU

External supervisor Nha Trang

Ngo Dang Nghia

Nha Trang University, Institute of Biotechnology and Environment

I hereby confirm that Kim My Tran's Master thesis is based on this collaboration. The project has potential to develop an extensive and fruitful collaboration in future scientific projects and public health, especially regarding the nutritional challenges following the ongoing climate change. We look forward to the collaboration.

Jon Øyvind Odland

Professor of Global Health

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Trondheim, Norway

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et, 1. etg.

Telefon

+47 73597577

Saksbehandler

Adresser korrespondanse til saksbehandlerenhet. Husk å oppgi referanse.

APPENDIX C. PARTICIPANT INFORMED CONSENT FORM

(TÔI ĐANG THỰC HIỆN DỰ ÁN TRƯỜNG CỦA MÌNH VÀ MUỐN THAM GIA VỚI BẠN).

I process your personal data based on your consent.

You have every right to complain to the Data Protection Authority

Tôi xử lý dữ liệu cá nhân của bạn dựa trên sự đồng ý của bạn.

Bạn có mọi quyền khiếu nại với Cơ quan thanh tra dữ liệu

THIS SCHOOL PROJECT WILL BE FINISH 25.11.2022

(DỰ ÁN TRƯỜNG NÀY SẼ KẾT THÚC 15.12.2022).

2. I AM ASKING OTHER TRAINEES TO HELP ME OUT TOO.

(TÔI HỎI CÁC CHUYẾN ĐI KHÁC GIÚP TÔI ĐI QUÁ).

3. I WANT TO KNOW (TÔI MUỐN BIẾT)

- IF YOU ARE HAPPY TO HELP OUT WITH MY SCHOOL WORK?

(NẾU BẠN VUI VỀ ĐƯỢC GIÚP ĐỠ CÔNG VIỆC Ở TRƯỜNG CỦA TÔI?)

- AND ALL OF THE COLLECTED DATA WILL BE DELETED BY THE END OF THIS STUDY 15.12.2022

(VÀ TẤT CẢ CÁC DỮ LIỆU ĐÃ THU THẬP SẼ BỊ XÓA KHI KẾT THÚC NGHIÊN CỨU NÀY 15.12.2022).



4. I WANT YOU TO KNOW THERE IS NO RIGHT OR WRONG ANSWERS. EVERYTHING YOU SAY IS IMPORTANT TO ME.

TÔI MUỐN BẠN BIẾT KHÔNG CÓ CÂU TRẢ LỜI ĐÚNG HAY SAI. MỌI ĐIỀU BẠN NÓI ĐỀU QUAN TRỌNG ĐỐI VỚI TÔI.

5. WHEN I DO MY SCHOOL PAPER, I WANT TO INCLUDE THE THINGS WE HAVE TALKED ABOUT.

KHI TÔI LÀM GIẤY HỌC CỦA TÔI, TÔI MUỐN BAO GỒM NHỮNG ĐIỀU CHÚNG TÔI ĐÃ NÓI VỀ.



6. I WILL HAVE LOTS OF ANSWERS FROM YOU AND OTHER TRAINEES WHO WERE HAPPY TO JOIN MY SCHOOL PROJECT.

TÔI SẼ CÓ RẤT NHIỀU CÂU TRẢ LỜI TỪ BẠN VÀ CÁC CHUYÊN GIA KHÁC VUI LÒNG THAM GIA DỰ ÁN TRƯỜNG CỦA TÔI.

7. I WILL USE MY MOBILE TO RECORD OUR CONVERSATIONS SO THAT I DON'T FORGET THE THINGS YOU TELL ME.

TÔI SẼ SỬ DỤNG DI ĐỘNG CỦA TÔI ĐỂ GHI CÁC CHUYỂN ĐỔI CỦA CHÚNG TÔI VÌ VẬY TÔI KHÔNG QUÊN NHỮNG ĐIỀU BẠN NÓI VỚI TÔI.

8. YOU CAN CHANGE YOUR MIND ABOUT JOINING IN WITH THE RESEARCH AT ANYTIME.

BẠN CÓ THỂ THAY ĐỔI Ý THỨC CỦA MÌNH VỀ VIỆC THAM GIA CÙNG NGHIÊN CỨU BẤT CỨ LÚC NÀO.

9. WHEN I DO THE PAPERWORK, I WILL MAKE SURE YOUR NAME AND OTHER PRIVATE THINGS YOU TELL ME, IS NOT INCLUDED. NOBODY WILL KNOW WHAT YOU HAVE SAID APART FROM ME AND YOU.

KHI LÀM GIẤY, TÔI SẼ ĐẢM BẢO TÊN CỦA BẠN VÀ NHỮNG ĐIỀU RIÊNG TƯ KHÁC BẠN NÓI VỚI TÔI, KHÔNG BAO GỒM. NOBODY SẼ BIẾT BẠN ĐÃ NÓI ĐIỀU GÌ TỪ TÔI VÀ BẠN.

10. PLEASE TELL ME IF YOU WANT TO SEE, CHANGE OR DELETE THE ANSWERS YOU GAVE AFTER WE HAVE FINISHED CHATTING ABOUT YOUR SELECTED PHOTOS.

HÃY NÓI CHO TÔI NẾU BẠN MUỐN XEM, THAY ĐỔI HOẶC XÓA CÂU TRẢ LỜI MÀ BẠN NHẬN ĐƯỢC SAU KHI CHÚNG TÔI HOÀN THIỆN CHẾ ĐỘ VỀ CÁC ẢNH ĐÃ CHỌN CỦA BẠN.

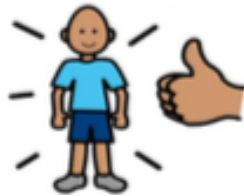
11. WHEN I HAVE FINISHED WITH MY PAPER, I WILL DELETE ALL THE RECORDINGS I HAVE ON MY MOBILE.

KHI TÔI KẾT THÚC VỚI GIẤY CỦA TÔI, TÔI SẼ XÓA TẤT CẢ CÁC BẢN GHI TÔI CÓ TRÊN THIẾT BỊ DI ĐỘNG.



12. AFTER HEARING THIS, ARE YOU HAPPY TO TAKE PART IN MY PROJECT?

SAU KHI NGHE NÀY, BẠN CÓ VUI LÒNG THAM GIA DỰ ÁN CỦA TÔI KHÔNG?



13. CAN I CHECK YOU HAVE UNDERSTOOD WHAT MY PROJECT IS ABOUT?
AND WHAT YOU WILL BE DOING TO HELP ME IF YOU SAY YES?

**TÔI CÓ THỂ KIỂM TRA BẠN ĐÃ HIỂU RÕ VỀ DỰ ÁN CỦA TÔI LÀ GÌ? VÀ BẠN SẼ
LÀM GÌ ĐỂ GIÚP TÔI NẾU BẠN NÓI CÓ?**

14. IF YOU WANT TO ASK ME ANYTHING ABOUT THE PROJECT, YOU CAN
CONTACT ME DIRECTLY OR SPEAK TO ME NEXT TIME YOU SEE ME.

**NẾU BẠN MUỐN HỎI TÔI BẤT CỨ ĐIỀU GÌ VỀ DỰ ÁN, BẠN CÓ THỂ LIÊN HỆ TRỰC
TIẾP VỚI TÔI HOẶC NÓI VỚI TÔI LẦN TIẾP THEO BẠN HẸN GẶP LẠI TÔI.**



15. IF YOU ARE HAPPY TO PARTICIPATE IN MY SCHOOL PROJECT, COULD YOU
SIGN THIS PAPER PLEASE?

**NẾU BẠN VUI LÒNG THAM GIA DỰ ÁN TRƯỜNG CỦA TÔI, BẠN VUI LÒNG KÝ GỬI
GIẤY NÀY ĐƯỢC KHÔNG?**

PRINT PARTICIPANT'S NAME _____
TÊN CỦA NGƯỜI THAM GIA

SIGNATURE OF PARTICIPANT _____
CHỮ KÝ CỦA BÊN THAM GIA

SIGNATURE OF RESEARCHER _____
CHỮ KÝ CỦA NGƯỜI NGHIÊN CỨU

DATE/NGAY _____

APPENDIX C. QUESTION GUIDE

INTERVIEW GUIDE

1. What are your thoughts about climate change and seafood?
2. What are your experiences with climate change and seafood here, in Nha Trang?
3. Can you tell me more about your experiences with climate changes?
 - How does it affect your daily life?
 - How does it affect your daily work?
 - How does it affect your health?
4. How long have you been working as a fisherman and what are your experiences in marine ecosystems?
5. What type of seafood do you harvest or catch?
6. How does climate change affect the quality of your seafood catch?
 - And what about availability?
7. Can you share your experiences in utilization of seafood harvest/catch?
 - Which knowledge of utilization is there?
 - What is it used for?
 - How do you handle the catch/harvest?
 - Is there been some changes in the seafood catch related to climate change from then to now?
8. Do you have any thoughts about how we can manage marine ecosystems in such a way that we avoid polluting them?
 - How do these factors interact to influence the delivery of the marine ecosystem?

9. Do you have any experience or acquired any new knowledge in sustainable measures for harvesting seafood?

- What has been done?

- Have you implemented or plans to implement these sustainable measures?

10. Can you please share your thoughts about how these changes can affect human health?

- Could it lead to other benefits as well?

11. In your perspective, do you have any thoughts about the quality and availability of seafood for the future and the next generation?



 **NTNU**

Norwegian University of
Science and Technology