Understanding dried fish value chain and marketing strategy during COVID-19 pandemic: a case study from Thailand

By

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Abstract

Dried fish contribute to the food and nutrition security of many people globally, especially in Asia and Africa. It also signifies cultural identity, tied to shared histories, tastes, and practices. Dried fish production and marketing provide livelihoods and income to small-scale fishers and their families, as well as women in coastal communities, many of whom are involved in the processing of dried fish products. The production of dried fish helps minimize fish losses and enhances the post-harvest value chain. Little is known, however, about the importance of dried fish, and the challenges facing actors in the dried fish value chain.

The thesis is based on a scoping study of the dried fish value chain conducted in Thailand, as part of the Dried Fish Matters project, funded by the Social Science and Humanities Research Council of Canada. As one of the world's major seafood producers and exporters, Thailand offers an interesting case study, especially in terms of governance, given the new fishing regulations, enacted in response to the 'yellow card' warning issued by the European Union to address issues and compliance with international standards to combat illegal fishing. The overall goal of the study was to understand the importance of the dried fish value chain and its governance, as well as the issues and opportunities related to access to resources and markets, particularly during the COVID-19 pandemic. COVID-19 has disrupted the flow of fish and seafood products in Thailand. At the same time, it has opened opportunities for dried fish vendors and processors through emerging e-commerce – an online marketing and trade. E-commerce has helped address some of the fish value chain challenges and provided livelihood, income and access to affordable food source during the COVID-19 restriction.

Dried fish production can be done in a large-scale, modernized factory or in a traditional, small-scale operation. Raw materials also come from both large-scale and small-scale fisheries. For the purpose of this study, the focus is on small-scale fisheries and rudimentary production of four dried fish products, i.e. dried anchovies, dried squid, dried shrimp, and 'kapi', a paste made from *Acetes* shrimp, commonly used in Thai cooking. These products are consumed mostly in Thailand, but a good proportion of dried anchovies is also destined for the export markets. Some dried fish producers buy raw materials from fishers, while others have their own boat. Local women are often hired to work on turning raw materials into dried products, which mostly involves boiling and sun-drying. Dried fish products are sold in local markets, as well as transported to city centers for further packaging and value-added process.

Concerns about raw materials for dried fish production are related to overfishing and regulations. The Royal Ordinance on Fisheries aims to address both problems, restricting the use of certain fishing gears, which are considered unsustainable. For instance, the use of light luring devices in anchovy fisheries has been banned, along with push netting due to bycatch concerns and habitat destruction issues. There is an ongoing debate, however, about the suitability of the regulations, especially since some of them affect small-scale fisheries more than large-scale fisheries. More research is required to investigate the impact of the new regulations on small-scale fisheries and on fisheries sustainability, broadly speaking.

On a whole, dried fish play a key role in Thai society, as part of the staple food and as main source of income for the communities. Yet, there is still a need to raise awareness about the nutritional value of dried fish and promote its consumption, which can be done through E-commerce. The research findings show, however, that dried fish online vendors face several challenges including decreased income, the uncertainty of product availability, transportation, and competition from

supermarkets. Understanding the dried fish value chain is important given its potential contribution to food and nutrition security, livelihoods, and income, especially to small-scale fishers and coastal communities.

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List of Abbreviations

ASEAN	Association of Southeast Asian Nations
B2B	Business-to-business
B2C	Business-to-consumer
B2G	Business-to-government
B.E.	Buddhist Era
C2C	Consumer-to-consumer
CEPAL	Economic Commission for Latin America
CFR	Code of Federal Regulations
COD	Cash on Delivery
COVID-19	Coronavirus disease
DFM	Dried Fish Matters
DoF	Department of Fisheries
EEZ	Exclusive Economic Zone
ETA	Electronic Transactions Act
EU	European Union
FAO	Food and Agriculture Organization
FMO	Fish Marketing Organization
FMSA	Food Safety Modernization Act
GDP	Gross Domestic Product
GMP	Good Manufacturing Practices
GT	Gross tonnage
HACCP	Hazard Analysis Critical Control Point
HLPE	High Level Panel of Experts on Food Security
ICEHR	Interdisciplinary Committee on Ethics in Human Research
IUU	Illegal, Unreported and Unregulated
LSF	Large-scale fisheries

MBRG	Marine Biodiversity Research Group
MSC	Marine Stewardship Council
MFRD	Marine Fisheries Research Department
MoC	Ministry of Commerce
MSG	Monosodium Glutamate
MSMEs	Micro-, Small and Medium-sized Enterprise
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation and Development
OTOP	One Tambon One Product
QR	Quick response
SEAFDEC	Southeast Asian Fisheries Development Center
SEASOFIA	Southeast Asian State of Fisheries and Aquaculture
SDG	Sustainable Development Goal
SMEs	Small and Medium Enterprises
Spp	Species
SSF	Small-scale fisheries
SSOP	Sanitation Standard Operating Procedures
UNCTAD	United Nations Conference on Trade and Development
UNWTO	United Nations World Tourism Organization
USA	United States of America
USD	United States Dollar
USFDA	United States Food and Drug Administration
WHO	World Health Organization

Chapter 1 – Introduction

This chapter provides the general context and the rationale for the study. It describes the dried fish value chain in Thailand and the issues and opportunities related to access to resources and markets and governance. This study is based in part on the initial scoping report conducted by the Dried Fish Matters (DFM) Project in Thailand. Since the research was conducted during the COVID-19 pandemic, the chapter summarizes the impacts of the COVID-19 pandemic on the fisheries sector as the context for the study, focusing particularly on the post-harvest of dried fish. Next, the chapter offers background information about dried fish in Thailand, where in-depth research was conducted. The chapter concludes with the study objectives, the research methods, and the thesis outline.

1.1 Importance of dried fish

Globally, about 10% of harvested fish are processed as dried products, using traditional, low technology, low-cost methods such as drying, salting, fermenting, and smoking (FAO, 2020). Fish and fishery products are an important source of nutrition and contribute to food security. For instance, in Thailand, the per capita consumption of fish reached 29.5 kg/year in 2017 (SEASOFIA, 2022). Based on data from the Food and Agriculture Organization of the United Nations, the consumption of fish and seafood products in Thailand is higher compared to the per capita consumption of other sources of animal protein in 2020 such as poultry (11kg/year), beef (1.15 kg/year), and pork (12.83 kg/year). Particularly, dried fish contribute to food and nutrition

security for people across the world, especially in Asia and Africa (Hasan et al., 2022; Belton et al., 2018). It accounts for 12% of the total fish consumption globally, but in low-income countries, dried fish consumption can be as high as 36% (Pradhan et al., 2022). Fish, in general, are high in micronutrients and essential fatty acids. Even when fish is processed through the rudimentary methods above, protein, fat, and minerals remain stable (Kawarazuka & Béné, 2011). The most important feature of dried fish is their portability, durability, and affordability. Since dried fish can be accessible to consumers in remote areas where little or no fish is available (Belton & Thilsted, 2014), they play an essential role in food security. On a whole, dried fish offers a sustainable source of affordable, accessible, and nutrient-dense food, which is crucial in maintaining healthy diets and local food and nutrition security (Thilsted et al., 2016).

Dried fish significantly contribute to the economy of many countries, supporting livelihoods and generating employment in the post-harvest value chain, while also minimizing losses of fish (PSSL et al., 2021; Belton et al., 2018). Given that half of the workforce in processing and trading are women (Pradhan et al., 2022), dried fish provide additional income for fishing households. Beyond food and employment value, dried fish are considered a cultural object in some contexts with production, trade, gifting, and consumption tying to shared histories, practices, tastes, and identities for millions of small-scale fisheries people around the world (Belton et al., 2022). Examples of these are found in Faroe islands (Svanberg, 2015), Iceland (Weichselbaum et al., 2009), India (Bagchi & Jha, 2011), Sri Lanka (Obeyesekere, 1985), Alaska (Lipka, 1994), Japan (Xuejing, 2017), Spain (Bacallado Betancort, 2019), among others.

Faced with the world's most significant challenge to feed more than 9 billion people by 2050, among others, the international community made unprecedented commitments in September 2015 when the United Nations Member States adopted the 2030 Agenda for Sustainable Development Goal (SDG) #2, with Target 2.1, about ensuring access to safe, nutritious, and sufficient food for all people all year round, Target 2.2, related to eradicating all forms of malnutrition (FAO et al., 2021). This goal and targets provide a unique opportunity to explore how to amplify the role of fisheries and dried fish in the provision of food and nutrition. Doing so will not only contribute to help achieve SDG 2, but also other related SDGs like SDG 1 (No Poverty) and SDG 5 (Gender Equality). The study of small-scale fisheries in the dried fish value chain is also directly linked to SDG 14 (Life Above Water), especially Target 14.b, which speaks to the need to secure access to resources and markets for artisanal fisheries.

With the important nutritional, economic, social, and cultural values of dried fish to many people, especially in South and Southeast Asia, dried fish has the potential to address many of the SDGs. However, they are invisible in research and policy. The Dried Fish Matters (DFM) project brings an interdisciplinary team of researchers and partners to map and understand the diverse and complex economy that produces and distributes dried fish and the challenges and threats to it. This project, 'Dried fish matters: mapping the social economy of dried fish in South and Southeast Asia for enhanced wellbeing and nutrition,' is funded by the Social Sciences and Humanities Research Council of Canada (SSHRC) under its Partnership Grants funding program. The DFM project integrates different types of data and collects data from stakeholders from all segments of the dried fish value chain in South and Southeast Asia, including producers, traders, consumers, and managers.

1.2 Dried fish value chain

The dried fish value chain is diverse and complex. Value chains are activities that enable the production and distribution of goods and services to consumers (Kaplinsky & Morris, 2000). According to Reardon (2012) and Belton et al. (2018), all value chain actors use assets to transform inputs into goods or services as outputs. Value chains are made up of three segments - upstream, midstream, and downstream (Belton et al., 2018). In the dried fish value chain, the upstream segment is where raw materials such as fresh fish are produced (mostly through fishing but can also be through gleaning from the shore, in the case of clams, mussels, and oysters, which can also be processed into dried fish products). Processing is the midstream segment, where fresh fish is transformed into dried fish. The downstream segment of the value chain is related to the distribution of dried fish to consumers (through direct sales, retails, and trades). At each level in the fish value chain – the ecosystem (pre-harvest), the capture system (harvest), and the post-harvest system – people, organisms, activities, and events are interconnected such that changes in fisheries and market structures can affect ecosystem health and vice versa (Bavinck et al., 2005).

For the most part, small-scale home-based dried fish processing is labor-intensive, using simple methods of transformation, such as filleting, salting, drying, and fermentation (FAO, 2016). It provides employment opportunities for those involved directly and indirectly in the fisheries sector (Yongo et al., 2005), and also people in the communities, especially women (Belton et al., 2022). Dried fish production may be affected by various factors including ecosystem degradation and the decline of fisheries stocks, technical problems in the value chain, and losses during processing, storage and transportation. Social concerns such as gender inequalities and dangerous or

exploitative working conditions are also prominent (Belton et al., 2022). In Bangladesh, for instance, dried fish processors and intermediaries face problems such as inadequate capital, natural calamities, lack of scientific knowledge and technology, price instability, lack of transport facilities, inadequate storage facilities, insufficient marketing facilities, and poor marketing information (Amin et al., 2012). Particularly, women processors are exposed to harsh working conditions that involves extended hours of work, poor diet, poor accommodation and sanitation (Belton et al., 2018). The poor infrastructural facilities force women vendors to remain in squatting position causing pain in the legs, head and lower back (Gopal & Srinath, 2002). The poor working conditions in the dried fish post-harvest segment are affecting women's overall health conditions and the increasing competition is also adding to the challenges they face in their workplace.

1.3 Impact of COVID-19 on dried fish value chain

When the World Health Organization (WHO) declared COVID-19 outbreak a global pandemic on March 11, 2020 (WHO, 2020), many countries worldwide faced economic downturns in all sectors (FAO et al., 2021). COVID-19 has disrupted the fish value chain (OECD, 2020; FAO, 2020a) and many fisheries-dependent people have lost their jobs and incomes. Indirect impacts of the pandemic are related to changing consumer demands, market access, or logistical problems related to transportation and border restrictions (FAO, 2020a). The effects of COVID-19 on small-scale and commercial fisheries include decrease in catch, income and limited trade, among others (Bassett et al., 2021). Seafood prices went down significantly, for instance, Japan experienced 51% price collapsed, 36% price collapse in Paris, 33% price collapse in Mexico and 32% price collapse was experienced in Maine, USA (Amos et al., 2022). While the price of seafood decreased at some

point, the sales also decreased due to delayed adaptation in sanitary controls (Vargas-Florez et al., 2021). As the effects of COVID-19 have a cascading impact on the food supply chain, each stage of the fisheries food chain must be given all possible protection (OECD, 2020).

Common measures taken to contain the COVID-19 outbreak included travel restrictions, strict border screening and quarantine (OECD, 2020; Burns et al., 2021), lockdowns (Love et al., 2021), and social distancing (Waiho et al., 2020; White et al., 2022), among others. These measures have created an environment where food could be more challenging to obtain (FAO, 2020a), contributing to an unprecedented increase in world hunger in almost all low- and middle-income countries (FAO et al., 2021). This has escalated concerns for around 3 billion people, who are already vulnerable to food and income insecurity across all regions. They are no longer able to afford a healthy diet due to high costs of healthy foods and high levels of income inequality (FAO et al., 2021). In Latin America and the Caribbean, the large increase in the cost of healthy food corresponded with a growing number of people who are unable to afford them because of declining incomes (FAO et al., 2021). Risk to jobs and incomes, and the compounding effects of inflation in consumer food prices in response to the health crisis have contributed largely to increased food insecurity globally (OECD, 2020; FAO et al., 2021).

As food consumption patterns changed during the COVID-19 pandemic, the health and wellbeing of the people were also affected. Many people buy processed products probably because they are affordable and accessible and can be kept for long periods in the home (CEPAL & FAO, 2020). The consumption of highly and ultra-processed non-perishable products was observed during the

COVID-19 pandemic with high levels of sugar, saturated fats, sodium, and calories, which can lead to overweight and obesity and its associated chronic diseases, increasing the chances of having a severe case of COVID-19, if the infection occurs (CEPAL & FAO, 2020). The COVID-19 pandemic has added to the global challenge of ending all forms of malnutrition as well as served as a warning call for future unwelcome events (FAO et al., 2021). Given the importance of fish products, including dried fish, for food and nutrition security, an opportunity exists to enhance its role in providing both macro- and micro-nutrients vital for healthy human diets, especially when eaten whole such as in the case of small fish (Thilsted et al., 2014).

1.4 Dried fish marketing and trading

Fish trade is an important downstream segment of the value chain. Local, national and international fish trade has enhanced the growth and diversification of fish consumption around the world (FAO, 2016). Many auxiliary services are heavily dependent on fish trade. In Africa, these include breweries and soft drinks industry, transportation, net manufacturing, boat building, petroleum products, packaging materials, etc. which have led to economic growth and increased household income (Yongo et al., 2005). In rural Philippines, fish trade is central in supporting livelihoods and food security of numerous local households (Fabinyi et al., 2017). The income fishers get from selling fish support the purchase of basic food such as rice which is the basis of food security in coastal communities in the Philippines.

Dried fish are usually sold in local open-air markets and grocery stores, however, dried fish are also sold through social media platforms and websites called e-commerce. E-commerce refers to transactions like buying and selling products and services on the Internet (Khan, 2016). E-commerce has become the most sought-after technology because it allows real-time and remote transactions regardless of time or geography. It also provides consumers with more up-to-date and transparent information (Intrapairot & Shrivihok, 2003). Setting up a full-service e-commerce website is similar to opening up a physical store and reaching more customers (Intrapairot & Shrivihok, 2003). The main advantage is that it offers low operating costs and low technology, which enable business and entrepreneurs to provide reasonable prices and effective service to domestic and world markets (Intrapairot & Shrivihok, 2003).

While e-commerce has already been proliferating in Asia, Latin America, and other emerging markets, the COVID-19 pandemic has accelerated its growth (Reardon et al., 2021). Many people buy more from the online market because of safety issues (Alam & Rahman, 2022). Buying online assures social distancing, helping avoid getting infected (Vargas-Florez et al., 2021). Consequently, e-commerce became one of the key vehicles providing necessary food supply to many people during the pandemic.

The scale and significance of dried fish trade are rarely acknowledged and poorly understood, as most research focuses on capture fisheries (Belton et al., 2018; Lin et al., 2022; Galappaththi et al., 2021). It is generally assumed that producers in the dried fish value chain have no or very little influence over marketing and supply. Instead, they are intensely managed and monopolized by

giant traders, brokers, and big supermarkets, whose interventions results in price distortion in the domestic market and, thereby, erodes the profitability and preference of primary producers (Hossain et al., 2022). The roles of actors and the processes in the mid- and downstream dried fish value chain segments need to be carefully examined, given its importance and potential contribution to achieving several SDGs (FAO, 2022).

1.5 Dried fish in Thailand: a brief introduction

Thailand is situated in the heart of Southeast Asia, covering a land area of 513,120 km^2 (World Bank Group & Asian Development Bank, 2021). It is bordered by Myanmar in the West and North, Laos in North and East, Cambodia in the Southeast, and Malaysia in the South (Thanyalakmetha, 2022). It is ranked as the 20^{th} most populous nation globally with an estimated population of 69,794,997 as of 2023 and having a population growth rate of 0.2% (CIA, 2023). The country's economic landscape is driven by industrial and service sectors, contributing to 90% of its GDP, while the agricultural sector, sustaining 33% of the workforce, accounts for 10% of the economy (World Bank Group & Asian Development Bank, 2021). In addition, Thailand experienced remarkable economic growth, averaging 7.5% per year from 1960 to 1996, making to a newly industrialized country (World Bank Group & Asian Development Bank, 2021).

This socioeconomic context paved the way for the fishing industry, an important part of the Thai economy. For instance, the fish farming and associated industries provide employment for more than 650,000 individuals, of which 400,00 in freshwater aquaculture, 78,000 in brackish water

aquaculture, and 184,000 in processing plants (SEAFDEC, 2022). Furthermore, the dried fish sector play an important role, representing the intersection of tradition and economic viability within the country's economic diversity. The significance of dried fish products extends to the Thai economy, with production reaching 51,954 tons in 2017 and with an estimated value of USD 161 million (DoF, 2019). In 2020, some of Thailand's major processed seafood products include salted, dried aquatic animals and fish sauce, together constituting 8% of the total production (DoF, 2021b). Processed aquatic products including dried fish are not only for domestic consumption but also exported to more than 35 countries including neighboring Asian countries such as Cambodia, China, Indonesia, Myanmar, Sri Lanka and Vietnam. In 2019, the export value of salted and dried seafood (e.g. fish, squid, cuttlefish, octopus, shrimp, prawns, and lobsters) reached an estimated value of USD 68.75 million and fish sauce at approximately USD 62.5 million (MoC, 2019). For this study, dried fish is defined based on the DFM (2019) definition, as any fish products that is neither fresh, frozen nor canned, and includes rudimentary processing of salting, drying, and fermenting (such as in the case of Kapi). The primary production areas of dried fish products in Thailand are Chonburi, Rayong, Chantaburi, and Trat Provinces on the east coast of the country (Butkhot et al., 2019; DoF, 2021).

Dried fish fisheries in Thailand face many challenges related to changes in access to resources for both commercial and small-scale fisheries, as well as fisheries governance. For instance, a recent change in the fishery regulation resulted in restrictions of gears considered to have negative impact on the dried fish value chain (Royal Ordinance on Fisheries B.E 2558, 2015; DOF, 2015). While the rule aims at stocks conservation, it affects anchovy fisheries, which are very important for dried fish production. As a consequence, fishers, dried fish processors and vendors have all been affected

and many find it difficult to maintain their fishing livelihoods and dried fish businesses. Since 2010, seafood processors especially the small- and medium-sized sector have been forced out of the industry (Prompatanapak & Lopetcharat, 2020). Together with the impact from COVID-19 pandemic, which restricted their access to markets and mobility, the social and economic consequences from the regulation on small-scale anchovy fishers, dried fish processors and vendors are severe.

The emerging e-commerce has helped address some of these challenges. Thailand is one of the fastest-growing e-commerce markets with its highly urbanized population and hectic lifestyles (Lilavanichakul, 2020). Over the past years, e-commerce has become one of Thailand's economic growth drivers. E-commerce models in Thailand come in all forms, including business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer (C2C), and business-to-government (B2G) transactions (Lilavanichakul, 2020). The B2C and C2C e-commerce models are prominent for agricultural products, including dried fish (Lilavanichakul, 2020).

1.5.1 COVID-19 and fish value chain in Thailand

Following the declaration of the global outbreak of COVID-19, the Thai government enforced the state of emergency on March 26, 2020. Subsequently, the nationwide curfew and lockdown were imposed on April 3 and 4, 2020, leading to travel restrictions across provinces and borders and domestic and international flights (MOPH, 2020). Thailand is among the countries that acted earlier and ranked very low in COVID-19 infections (Chanrachkij et al., 2020).

COVID-19 have created challenges in the country's fish value chain, affecting social wellbeing and economies and populations' food security and nutrition (Chanrachkij et al., 2020). For instance, a detection of a COVID-19 cluster of the fish markets led to strict regulation and the closure of the market and distribution centers (Thammachote & Trochim, 2021). Due to travel restrictions and the limited operations period of wholesale markets, traders and distributors could not deliver their products (Chanrachkij et al., 2020). The dwindling supply and demand of fish and the loss of income have impacted the livelihoods of small-scale fishers and their families, who have little employment options (Chanrachkij et al., 2020; Arai et al., 2022). Furthermore, the possibility of increases in COVID-19-related barriers, such as food safety concerns and production standards, affect upstream suppliers and fishers (Thammachote & Trochim, 2021).

Since many local fishers stopped fishing, several processing factories halted because of a shortage of raw materials, thus affecting most women employed in processing (Chanrachkij et al., 2020). Seafood products obtained lowest prices during the pandemic, and many fishers turned into processing their own catch to earn additional income (Chanrachkij et al., 2020). Many also participated in the e-commerce. Yet, it is still challenging to sell processed products due to limited transportation services. Moreover, tourists, who are the main customers of seafood and related products, were low in number due to suspended tourism activities (Chanrachkij et al., 2020).

Under these circumstances, small-scale fishers have focused on fulfilling their immediate needs by mainly relying on existing natural capital, financial capital, human capital, together with social capital, which helped them restore some of their income (Arai et al., 2022). The presence of many

e-commerce vendors imply a significant change in the flow of dried fish markets and value chain. Still, there is a recognition of the limitations of local fishery products from artisanal fishers who are unable to access digital markets and lack various distribution platforms (DoF, 2022c). A crucial factor leading to the growth in e-commerce is the support of the government sector, particularly towards small and medium businesses or entrepreneurs (SMEs). This study helps provide some background information of the e-commerce of dried fish in Thailand to understand some of their challenges and opportunities and guide policymakers in promoting this sector.

1.6 Study scope and objectives

The research is informed by interactive governance theory (Kooiman et al., 2005), which emphasizes the state, market, and civil society interactions (Kooiman & Bavinck, 2013). According to Kooiman et al. (2005), interactive governance is "the interactions of all governing actors taken to solve societal problems and create societal opportunities that include the formulation and application of principles guiding those interactions and care for institutions that enable them." The study recognizes that markets are social institutions and are structured and driven by human relationships and interactions. Further, governance of the post-harvest activities, which are the final stage in the fish chain, is subjected to several factors such as labor markets, quality control, labeling standards, marketing strategies, and distribution channels across spatial boundaries (Khan & Chuenpagdee, 2013). Understanding how these factors affect the dried fish value chain is imperative in improving fisheries governance. Interactive governance approach is particularly relevant when dealing with the so-called "wicked problems" (Jentoft & Chuenpagdee, 2009), which are applicable to the dried fish given the intricacies and complexity associated with

dried fish fisheries and the value chain. Broadening the understanding about the sectors and the actors involved in the dried fish value chain, especially their adaptive capacity to changing situations (Johnson et al., 2005) is imperative.

The main focus of the research is on understanding dried fish fisheries and value chain in Thailand, emphasizing access to raw materials for dried fish processing, as well as identifying patterns, changes, challenges and opportunities associated with marketing and trades. The study covers four most common products, i.e., dried anchovy, dried shrimp, dried squid, and fermented shrimp paste or Kapi.

Specifically, the research is driven by the following questions:

1. What are the trends and patterns of the fisheries associated with the main dried fish products, namely, anchovy, squid, banana shrimp, and *Acetes* shrimp? How do they impact the dried fish value chain?
2. What are the different dried fish markets and distribution channels in Thailand, particularly during the COVID-19 pandemic? How do dried fish marketing and trade contribute to the Thai economy?
3. How are the dried fish fisheries regulated? To what extent do the new fishery regulations impact the different actors in the dried fish fisheries and value chain?

4. What are the emerging opportunities for dried fish vendors in Thailand, including e-commerce, and how they contribute to addressing challenges facing fishers, processors, and traders during the COVID-19 pandemic?

1.7 Methodology

Due to the COVID-19 pandemic, field research and primary data collection were restricted. Instead, the study employed a mixed-method approach to data collection and analysis, including a desk study review of secondary sources, initial scoping study and rapid market appraisal, data mining on the Internet via Netnography, and an online survey. For the desk study research, data came from both published and unpublished sources, including peer-reviewed literature, government statistics and records, and documents available on websites.

The initial scoping was conducted by the Dried Fish Matters research team in Thailand, involving rapid surveys of wholesale and retail markets in Bangkok and vicinities, preliminary visits to several producing provinces, and speaking informally with harvesters and processors. The provinces visited were Samut Sakhon, Prachuap Khiri Khan, Ranong, Phang Nga, Phuket, Krabi, Trang, Satun, Songkhla, Nakhon Si Thammarat, and Surat Thani in the south, and Chon Buri and Rayong in the east. Data from initial scoping was compiled by the thesis author and analyzed for the study.

Drawing from the above analysis, the study on dried fish e-commerce in Thailand was conducted remotely by the author. The research involved a review of web-based resources, Internet data mining, and an online survey via Facebook chat, with follow-up phone calls, conducted with the help of a research assistant in Thailand. Netnography (Kozinets, 2015) was employed to capture social media data, particularly Facebook. The research instruments were developed according to the Memorial University of Newfoundland ethical policy requirements for research involving human respondents and were approved by the Interdisciplinary Committee on Ethics in Human Research (ICEHR).

Netnography is a qualitative research methodology that adapts ethnographic research techniques to study culture and communities emerging through computer-mediated communities (e.g., social media) (Kozinets, 2002). The method is supplemented by in-depth information on the online vendors' perspectives through remote interviews and an online survey. The social media platform is a valuable source of information on social interaction. Facebook was chosen for the study because it is the most popular online selling platform in Thailand, and Facebook dried fish vendors sell all kinds of dried fish products. The netnographic data make qualitative investigation possible for the empirical 'virtual' study, which would have been difficult to conduct during the COVID-related travel and health restrictions.

1.8 Thesis outline

The thesis consists of seven chapters. Chapter 1 introduces the problems related to dried fish fisheries and the value chain, background about fisheries governance, the impacts of the COVID-19 pandemic, and the rationale for the research.

Chapter 2 presents an overview of the theoretical framework for the study. It summarizes key literature and outlines the application of the interactive governance to study dried fish fisheries and the value chain.

Chapter 3 describes the dried fish fisheries in Thailand in terms of patterns and changes of production and gear types. This chapter also explores the impacts of the new fishery regulations on the important dried fish fisheries, namely anchovy, squid, banana shrimp, and *Acetes* shrimp.

Chapter 4 presents the key findings from the market study of dried fish in Thailand. It describes dried fish processing and distribution patterns and channels.

Chapter 5 discusses the dried fish e-commerce in Thailand as an opportunity to help fish traders and vendors during the COVID-19 pandemic.

Chapter 6 summarizes the governance structure and changes in fishery regulations of the dried fish fisheries and value chain in Thailand.

Chapter 7 discusses the thesis with a synthesis, limitations and recommendation based on the study's findings.

Chapter 8 concludes the thesis.

Chapter 2 - Theory and literature review

This chapter reviews literature about dried fish and value chain, focusing on their roles and values to society, and the challenges different actors have faced, especially during the COVID-19 pandemic. It identifies the knowledge gaps in the dried fish chain and the need to fill them. It also explores topics related to the governance of the fisheries for dried fish and the governance of the dried fish value chain. Finally, the chapter provides an overview of the interactive governance theory on which the study is based. The literature review includes peer-reviewed literature, government policy documents, and materials available on websites covering from 1980 to 2022.

2.1 The role of dried fish

2.1.1 Food and nutrition security

Fish in general, are a good source of high-quality protein, essential fatty acids, vitamins, and minerals crucial for maintaining healthy diets in many poor consumers (Belton & Thilsted, 2014; Sankar et al., 2013). In Africa, small pelagic fish such as anchovies and sardines provide nutrition for the many vulnerable and poor communities (Isaacs, 2016). In some countries, these small pelagic fish are labeled as 'low-value fish'; they have low consumer preference, have little or no direct commercial value, and are usually taken as bycatch (Funge-Smith et al., 2005). They are a primary source of raw material for fishmeal production intended for aquaculture industry. The

share of fisheries and aquaculture production utilized for reduction into fishmeal and fish oil reduction is highest in Latin America, followed by Asia and Europe (FAO, 2022).

In countries like Thailand, 'low-value fish' are used for human consumption, particularly those caught by small-scale fisheries (Funge-Smith et al., 2005). These fish are processed using traditional, low-technology methods, often done by women in fishing households and communities (Nimrat et al., 2019). For developing countries, processed fish in the form of dried, salted, smoked, or other cured products, account for about 13% of fish production (FAO, 2016; FAO, 2022). Globally, the largest proportions of fisheries and aquaculture production used for direct human consumption are fresh or chilled products (44%), frozen products (35%), prepared and preserved (11%), and cured products such as dried, salted, in brine, fermented, smoked represents 10% (FAO, 2022).

Asia and Africa have a higher proportion of seafood production preserved by salting, smoking, fermenting or drying than the global average (FAO, 2022). In North America and in Europe, approximately 75% of the fisheries and aquaculture production used for human consumption is provided in frozen, cooked and canned form (FAO, 2022). In high-income countries, more than 50% of seafood intended for human consumption is frozen, followed by cooked and preserved (about 26%), and cured form (13%) (FAO, 2022). Meanwhile, in upper-middle-income countries, about 20% of seafood production was frozen, 11% canned, and more than 60% live, fresh or chilled (FAO, 2022). In contrast, in low-income countries, only 7% were frozen, more than 20% were cured and about 70% were live, fresh, or chilled (FAO, 2022).

Based on a recent report by FAO (2022), in 2019, seafood products provided about 17% of animal protein and 7% of total global protein. For 3.3 billion people, seafood products provide at least 20% of the average per capita intake of animal protein. Seafood accounts for more than half of total animal protein in Cambodia, Sierra Leone, Bangladesh, Indonesia, Ghana, Mozambique and some Small Island Developing States (FAO, 2022). In Malawi, fish provide 70% of the animal protein for at least 1.6 million people who depend on fishing (FAO, 2022). Although the demand for fresh fish is increasing, processed fish products especially dried fish still represent most of the fish consumed by the rural populations and the low-income classes in urban areas (HLPE, 2014). Dried fish is an essential source of food and nutrition, particularly in areas where fresh fish is not readily available or unaffordable (Belton et al., 2022).

Although fillets are the most valuable in terms of protein, heads, sides, fillet cut-offs, belly flaps and parts of the intestines such as liver and eggs are particularly good sources of nutrients such as long-chain omega-3 fatty acids, vitamin A, D, B12, iron, zinc, calcium, phosphorus, selenium and other minerals (FAO, 2022). Dried fish has a high level of nutritional properties, especially protein, zinc, iron, and calcium (Banna et al., 2022). These contribute to the recommended intake of protein, iron, zinc, and calcium for children up to two years of age and for pregnant and nursing women (Banna et al., 2022). In some countries, small fish with bones are mainly dried and eaten as a snack (FAO, 2022; Thilsted et al., 2014). In Ghana, low value fish and fish byproducts are dried and powdered. They contain high amount of protein and iron and may serve as good and affordable source of these nutrients for poor and vulnerable groups. It is also microbiologically safe for human consumption (Abbey et al., 2017).

More than 400 million people in Africa rely on fish as an important source of nutrients, proteins and micronutrients essential for the development of children (Ayilu et al., 2016). In Sri Lanka, dried shrimp products are an excellent source of high quality protein for human consumption and also serve as an excellent source of minerals, to prevent bone loss and iron deficiency (Abeywickrama & Attygalle, 2015). A study in Cambodia found that a traditional daily diet of rice and sour soup made with the iron-rich small fish can provide 45% of a woman's daily iron requirements (Thilsted et al., 2014). Bangladeshi women believe that small fish have benefits such as good eyesight, vitamins, good for pregnancy and lactation, give strength and build up the blood (Thilsted et al., 2014). Fermented fish products as a staple or snacks are also rich in protein, calcium, and phosphorus. It is a year-round essential food for most people in Mekong Basin (Udomthawee et al., 2012) and globally.

2.1.2 Economic importance

Dried fish processing is an important source of income for fishing communities, especially women who are traditionally active in the processing and the marketing of fish and fish products (Singh et al., 2014). Dried fish production provides livelihood, income, and employment to people involved in the value chain, in small- and large-scale fisheries sectors, processing, and in trading segments at various scales (Belton et al., 2022). Historically, the dried fish trade has been a significant part of the economy in developing and developed countries. For instance, between 1850 and 1914, exports of cod and its related groundfish species, processed as dried fish, drove Nova Scotia's economy (Balcom, 1980). Nowadays, exporting dried fish and associated products represents a

significant source of foreign currency earnings for many developing countries (FAO, 2016; Islam et al., 2000). In the Philippines, Fabinyi et al. (2017) found that fish trading is a vital component of the livelihoods of full-time fishing households as incomes derived from the fish trade support the purchase of rice, which forms the basis of food security.

Seafood trade plays an important role as a generator of export income, employment and value creation, and as a contributor to global food security (Béné et al., 2010). It involves diverse and interlinked actors in shipping, processing, wholesale, and retail and is very important for some Small Island Developing States and fishery-dependent communities (Islam et al., 2000; Yongo et al., 2005). Seafood exports account for a large portion of the total trade in goods and gross domestic product (GDP) in these countries (FAO, 2022). The majority of fish species and products traded in West Africa, for instance, are small coastal pelagic fish, most (90%) of which are dried or smoked (Ayilu et al., 2016). In 2011, Africa's fisheries sector was worth USD 24 billion, or 1.26% of the GDP of the African countries (Ayilu et al., 2016). Seafood trade is associated with faster economic growth or GDP growth, which helps reduce poverty and improve prosperity (Ayilu et al., 2016).

2.1.3 Cultural value

Cultural property highlights the cultural value of natural resources to communities that have lived adjacent to and harvested local living resources (i.e., fishing and fish consumption) over many generations (Lam & Pitcher, 2012). Taste for fish is considered a cultural attribute (Belton et al.,

2022), and in earlier times, Greeks and Romans considered salt consumption a distinctive trait of civilized life (Carusi, 2018). Thus, dried fish is of cultural value since dried fish production, trade, gifting, and consumption is tied to shared histories, practices, tastes, and identities of people and communities (Belton et al., 2022).

Dried fish shows that economic relations are not only concerned with material matters such as output, profits, and wages, but also with meaningful activities that can only be understood socially. These meanings and relationships are central to the economic behavior of the dried fish value chain (Thrift et al., 2022). The taste of dried fish varies from region to region, and the gastronomic differences in these foods serve as markers of group identity (Thrift et al., 2022). In Sri Lanka, it is important to give dried anchovy powder as soon as the baby can eat solid foods (Thrift et al., 2022). They mix the dried anchovy powder into the rice and lentils. Even if the baby is born and raised in another country, for instance, in Canada, the family ensures that the baby can eat this traditional food. It is a claim of identity as indicated by taste (Thrift et al., 2022).

Some fish, such as Bombay duck, are first dried to become a valuable food item (Thrift et al., 2022). The traditional drying operation makes this fish an important economic and cultural symbol particularly in Bangladesh. The pungent odor of most dried fish distinguishes between those who consume this type of food and those who do not (Thrift et al., 2022). The taste of dried fish can also be rooted in kinship rather than personal or cultural identity. For example, if a person who does not eat dried fish marries a person who does eat dried fish, they acquire the taste of dried fish through marriage or migration (Thrift et al., 2022).

2.2 Dried fish fisheries: stock status and challenges

In recent years, small pelagic species have contributed the most significant proportion of global fish production (Derrick et al., 2017). One of the most important small pelagic species is the anchovies targeted for food and non-food uses, processed as dried or fermented into fish sauce in the Southeast Asian region (Anh et al., 2012). Regarding global production, Peru holds the world's biggest fishery with landings of anchoveta (*Engraulis ringens,* Engraulidae) amounting to 7% of all global marine landings over the last 64 years (FAO FishStatJ, 2020). In Thailand, the anchovy fishery developed in 1981 due to the discovery of lucrative markets for boiled-dried anchovies (Supongpan et al., 2002) and most of the raw materials for dried fish processing are sourced from the Gulf of Thailand (Nimrat et al., 2019).

On the other hand, squid fisheries, although relatively small compared to fish in terms of contribution to world production, the catch of cephalopods is increasing (Arkhipkin et al., 2015). A commercially exploited squid species must be of suitable size (medium/large) and have a good flavor and texture (Arkhipkin et al., 2015). Meanwhile, the *Acetes* spp., one of the sergestid shrimp species that live in estuaries and shallow waters of tropical and subtropical regions (Stephenie et al., 2021), is also an important dried fish fisheries often processed and fermented. The production of *Acetes* shrimp varies depending on the region and the season (Detsri et al., 2019), and global landings reached around 1.6 million in 2019 (FAO, 2020b). It is important to note that fish catches reflect the ocean's productive capacity and the management decisions that respond to this capacity (Barange et al., 2018).

In the Asia-Pacific, the three key issues affecting fisheries include declining resources, coastal degradation, and the threat of increased poverty in fishing communities (Funge-Smith et al., 2005). Particularly in Thailand, several problems and challenges have been raised, including depleting fish stocks and conflicts among fishers (Juntarashote et al., 1998). Fish stocks are depleted because of overfishing and environmental shifts, demand for fishmeal, and unregulated fisheries (Shelton, 2014). Based on reports, the Thai fisheries resources have been unable to reach a satisfactory level of recovery, although measures have been implemented to address problems in the Thai fishery (Juntarashote et al., 1998).

Meanwhile, marine habitats are changing rapidly because of global warming, ocean acidification, and coastal pollution (Shelton, 2014). Climate change poses a threat to fish stocks, which is likely to cause changes in fish distribution and could create new or exacerbate existing conflicts between users within countries. Because when the distribution of essential species changes across boundaries, it will affect the neighboring countries and the high seas (Barange et al., 2018). Climate change can be seen as a stressor that adds to various stressors and uncertainties from anthropogenic problems (Barange et al., 2018; Merino et al., 2014), such as overfishing, pollution, habitat loss, competition for space, and environmental variability, which influence the aquatic ecosystem health (Bavinck et al., 2005; Barange et al., 2018).

The world's fish stocks within biologically sustainable levels has decreased from 90% in 1974 to 68.6% in 2013, although notable progress can be observed in some areas (FAO, 2016). Governments, non-government organizations (NGOs), and stakeholders have implemented

programs to protect and conserve marine resources to address this. However, ongoing debates exist on the effectiveness of management sustainability efforts in marine conservation toward food security and social justice. Marine conservation efforts often focus on the biological aspect and ignore the social part, often fail. Fabinyi et al. (2017) argued that the relationship between fish and food security must be considered in greater depth if marine conservation aims to address food security.

In Thailand, marine fishery resources and ecosystem degradation is caused by overcapacity, illegal, unreported, and unregulated (IUU) fishing, and habitat destruction, among others (DoF, 2018). Given the limited and declining status of global fish stocks, more effective governance at multiple scales is required to ensure that large numbers of poor people who rely on capture fisheries for livelihoods, food, and nutrition can continue to enjoy the right to do so (Belton & Thilsted, 2014). Fisheries governance, effective management, and control on all dimensions of the fish value chain ensure the fisheries sector's sustainable future (DoF, 2018).

2.3 Dried fish production and trade

Typically, fish is a perishable food, but it is preserved through different methods of processing (FAO, 2020b). With the declining fishery resources, the main goals for fish processing are to minimize food waste, to extend shelf-life, and to add value to the fish value chain. Large-scale fish processing is intensive, geographically concentrated, vertically integrated, and linked with global supply chains (FAO, 2016). In Thailand, fisheries and seafood processing industries contribute

significantly to the economy through job creation and trade (FAO, 2016), and generates about 0.72% of the GDP in 2019 (SEAFDEC, 2022). The production and value-addition in the fisheries sector have grown steadily in recent years, generating economic dividends and contributing to sustainable economic growth (FAO, 2022). Small-scale, home-based processing, on the other hand, carried out predominantly by women, has given women a degree of economic independence (Gordon, 2005). It provides livelihoods and support to many people in coastal areas and is an essential component of rural economies.

Trade in fish and fishery products has been expanding considerably in recent decades, fueled by increased fishery production and high demand due to globalization. Reports show that about 78% of seafood products are traded in international markets (FAO, 2016). In Asia, the share of fisheries production and trade has increased from 21% in 1950 to 70% in 2015, with a significant contribution coming from small-scale and artisanal fishers and fish farmers (Barange et al., 2018). More recently, developing countries have increased their share of international fish trade – from 38% to 54% of total volumes between 1976 and 2018 (FAO, 2020b). In the case of Thailand, one of the largest exporters of fishery products, such as squid and cuttlefish (FAO, 2016), fish trade and dried fish production play a key role in securing livelihoods and income, especially for small-scale fishers and their communities.

Besides the vital role it plays in income generation, employment, food security, and nutrition, fish trade represents a significant source of foreign currency earnings for many developing countries (FAO, 2016; Islam et al., 2000). Fish trading also boosts tourism sector, particularly increasing the

total production value of fish especially traded by restaurants (Bevilacqua et al., 2019). Increased trade means increased foreign exchange, enabling imports of capital goods and accompanying increased production capacity (Shamsuzzaman et al., 2020). As production increases, technological progress in production accelerates (Mohsin et al., 2015; Shamsuzzaman et al., 2020).

One of the biggest challenges in the post-harvest sector is food loss. It happens after landing, either in quantity or quality due to handling during transport, storage, processing, on the way to markets, or in markets waiting to be sold (HLPE, 2014). Another post-harvest challenge is cross-border fish trade. In West Africa for instance, this include taxes and bribes along the fish trade corridor (Ayilu et al., 2016). Seafood processing challenges also include lack of access to credit for working capital, poor sanitary conditions in processing facilities, and the use of outdated processing equipment (Ayilu et al., 2016). Often the production sites are far from important markets, and even when they are nearby, poor access roads and inefficient transportation systems result in high transportation costs (Ayilu et al., 2016).

Often, traders complain that obtaining permits requires complicated and time-consuming administrative procedures (Ayilu et al., 2016). The process of national certification of seafood export, to certify that the fish products comply with the required sanitary and phytosanitary procedures, is always delayed and often involves exorbitant fees and charges (Ayilu et al., 2016). The process of inspecting seafood before export can cause delays at borders and reduce fish quality (Ayilu et al., 2016). Inspections also have fees, resulting in exorbitant export costs (Ayilu et al., 2016). In some cases, post-harvest challenges include lack of knowledge of local trade rules and

regulations. Traders often lack information about the trade rules they must comply with when trading across borders (Ayilu et al., 2016). In some cases, traders are harassed, including roadblocks and checkpoints along trade corridors, leading to bribery (Ayilu et al., 2016). Most of fish trade can be informal and run by women which are the most disadvantaged and still facing marginalization (Ayilu et al., 2016; Kusakabe, 2004).

In some cases, traditional dried seafood products are produced under unhygienic processes causing food contamination (Nimrat et al., 2019). In addition, due to the unsaturated fatty acids and high protein content of some fish, the quality is likely to change during storage and can affect dried fish processing. Further, the use of salt has been found to be problematic. For instance, the high salt and low moisture content characteristics of traditional dried seafood products contribute to the propagation of pathogenic halophilic and halotolerant bacteria (Nimrat et al., 2019). Compared to other fish, anchovies are suitable for drying that requires little salting and can be stored for six months in cold places without spoilage (Park et al., 2018). In Indonesia, anchovies are processed by cooking in salt water (3-4%) and air drying for 4-5 hours depending on the amount of moisture required by the importing country (Dewi, 2002). The low-salt treatment in processing dried anchovy may have an impact on the yield but overall, the product is acceptable to consumers and has no significant impact to the physical attributes of the dried product (Widiastuti et al., 2022).

The expansion of the global marketing, trade and consumption of fish products in recent decades has been accompanied by a significant development in food quality and safety standards, improved nutritional attributes, and loss reduction (FAO, 2020b). Recently, dried seafood products have

been confronted with stringent criteria enforced by regulatory authorities to ensure high-quality production (Nimrat et al., 2019). Measures have been adopted at the national, regional, and international levels based on the Codex Code of Practice for Fish and Fishery Products (Codex Alimentarius Commission, 2021), creating challenges, particularly for small- and medium-scale businesses in terms of compliance. Its guidance to countries is on practical aspects of implementing good hygiene practices and the Hazard Analysis Critical Control Point (HACCP) food safety management system to meet food safety and quality standards and ensure consumer protection (FAO, 2020b).

2.4 Impacts of COVID-19 on fisheries and dried fish value chain

The COVID-19 pandemic has had a major disruption to the global fisheries and seafood supply chains, including dried fish value chains (FAO, 2021). Lockdowns, travel restrictions (UNWTO, 2020) and decreased demand have reduced production and sales, resulting in losses for fishers, traders, and processors, particularly the small-scale fisheries sector (Bassett et al., 2021). Several processing plants are closed due to labor shortages (FAO, 2020b), affecting the availability of fish and seafood products such as dried fish. The decreased demand in many countries led to a decline in exports (FAO, 2021). Seafood prices have been fluctuating making it difficult for fishers, traders, and processors to predict future earnings (Amos et al., 2022).

In some cases, COVID-19 has increased the cost of producing and distributing seafood due to decreased availability of cargo planes and ships and increased transportation costs (FAO, 2021).

The travel restrictions have also led to significant loss in international tourists (UNCTAD, 2020) who are the primary consumer of seafood products (OECD, 2020). The pandemic has prompted changes in consumer behavior, including shift to a healthier eating habit (Belton et al., 2021). This has led to increased demand for fish products, including dried fish, in some markets (Belton et al., 2021). However, the increased demand is far from universal, and the economic impact of the pandemic such as reduced income and accessibility to seafood products has caused many consumers to consume less seafood (OECD, 2020).

The COVID-19 pandemic has shown how unwelcome events can significantly impact all the actors in the fish chain. The outbreak affected the economy and tourism, decreasing buying power, particularly for local products, affecting small-scale fishers and local entrepreneurs (DoF, 2022c). The global small-scale fisheries communities facing multi-faceted vulnerabilities worsened during the COVID-19 pandemic (Islam & Chuenpagdee, 2022). Indeed, both small-scale fisheries and commercial fisheries in Thailand experienced impacts of COVID-19. The impacts include decreased number of market channels, the price of fish, and revenue from catch (Chumchuen et al., 2022). To maintain livelihood and income during the pandemic, fishers and vendors turned to online marketing or e-commerce. However, limited access to digital markets and lack of various distribution platforms hindered artisanal fishers and vendors to participate in e-commerce (DoF, 2022c).

2.5 Interactive governance theory

Fisheries are complex socio-ecological systems involving interactions between natural resources, social aspects, and governance structures (Chuenpagdee & Jentoft, 2009). There are several theories commonly used to study fisheries. One is ecological and biological theory which focuses on the dynamics of fish populations and the fishing impacts on marine ecosystems (Walters & Martell, 2004). Then, there is the common-pool resource theory which highlights the challenges of managing common resources such as fish stocks (Ostrom, 1990). Another one is institutional theory which helps explain how governance structures such as regulations and community norms influence the behavior of fishers and fishing communities (Pomeroy & Berkes, 1997). Also, political ecology theory which examines the power relations, access to resources, and political structures that influence the distribution of benefits and risks in fishing communities (Jentoft, 2007). Then, resilience theory explains how management measures such as adaptive co-management and ecosystem-based management can improve the resilience of fishing communities and ecosystems (Allison & Ellis, 2001). More recently, the bioeconomic theory which explores the bioeconomic advantages of effectively managing fishing effort in a coexisting scenario involving both small- and large-scale fisheries (de Azevedo et al., 2021). It analyzes the dynamics to demonstrate the potential benefits of strategic effort management in sustaining fish stocks and ensuring long-term economic viability for both types of fisheries (de Azevedo et al., 2021). Taken together, these theories address the ecological and biological dynamics of fish populations, challenges in managing shared resources, understanding the role of institutions and governance structures and the political and economic context of fishing communities, resilience, and other aspects of fisheries.

On the other hand, value chain is an important part of fisheries. It involves the processes and actors in the production, processing, and distribution of fish products (Belton et al., 2022). Understanding value chains is important in fisheries governance as it allows to better recognize how value is created and distributed along the chain. There are several theories that are commonly used to study fish value chains including transaction cost economics (e.g. Swinnen & Vandeplas, 2010), resource-based view (e.g. Pedroza-Gutiérrez & Hernández, 2020), institutional theory (e.g. Govindan, 2018), global value chain analysis (e.g. Hamilton-Hart & Stringer, 2016), and network theory (e.g. Pedroza-Gutiérrez & Hernández, 2020). Altogether, these theories examine the factors that shape fish value chains, including the structure of the chain, the resources and capacities of the various actors, the role of institutions and cultural norms, power dynamics and governance structures, and relationships between actors within and around the fish value chain.

One significant aspect of the fisheries value chain involves social interaction among various groups and actors along each segment of the chain which includes activities such as harvesting, processing, packaging, transportation, distribution and marketing (Kooiman & Bavinck, 2013). In literature, the study about dried fish differs significantly from the general fisheries literature because it focuses on processing, nutrition, and health (Belton et al., 2022). But it is also focused on the involvement and interaction of various chain actors (Belton et al., 2022). All of the different factors that shape the fisheries and fishing communities, and the dried fish value chain can be examined through interactive governance theory. As defined by Kooiman et al. (2005), interactive governance is “the totality of interactions that take place to solve social problems and to create social opportunities. It includes the formulation and application of principles guiding those

interactions and care for institutions that enable and control them." In summary, interactive governance helps to understand the social interactions taking place in the dried fish economy.

Fisheries governance is inclusive and involves state and non-state actors such as civil society (Chuenpagdee & Jentoft, 2009). Effective governance requires an understanding of the interactions between the actors involved within and around the fish chain and the structural constraints on these interactions, thus an interactive process (Kooiman et al., 2005). Governability provides a conceptual basis for assessing and improving the governance of social systems, in this case, fisheries and value chain (Kooiman & Bavinck, 2013). However, governability is a challenge (Kooiman & Bavinck, 2013), as fisheries and coastal systems are inherently diverse, complex and dynamic, lacking simple solutions and single management tools to address problems – a 'wicked' problem (Jentoft & Chuenpagdee, 2009).

The 'wickedness' inherent in fisheries system requires participatory and communicative governance, or interactive governance. Interactive governance allows stakeholder partnerships and a co-management approach to arrive at a 'win-win' agreement (Jentoft & Chuenpagdee, 2015). Interactive governance further allows the identification and development of values, principles, and goals through interaction between public and private governors. In interactive governance, the goals are negotiated, constantly changing, and may vary according to the relative strength of the stakeholders; thus, the actors involved must be flexible, creative, and ready for the risks and uncertainties the process entails (Jentoft & Chuenpagdee, 2009).

Chapter 3 - Overview of the fisheries in Thailand: status and challenges

This chapter describes the state of the fisheries, particularly looking into the patterns of production and where production takes place. The data illustrates how catches are distributed on the three coasts of Thailand. The trend in fishery production in the past ten years is presented to highlight issues, challenges, and opportunities in the capture fisheries. This includes recent changes in fisheries governance and how it impacts fisheries, especially the small-scale fisheries sector. The chapter emphasizes the key fisheries that are the focus of the study, i.e., anchovies, shrimp, squid, and *Acetes.*

3.1 Characteristics of fisheries in Thailand

Thailand is one of the top five fish producers in Southeast Asia and ranks 12th among the world's top producers (FAO, 2022). But reports show that the fisheries production in the country is declining. Fish catches from 2006 until 2019 in particular have declined at an average rate of 3.4% annually (SEASOFIA, 2022). Thailand's main fishing areas are the Gulf of Thailand and the Andaman Sea, with the sea areas divided into fishing zones (Fig. 3.1; DoF, 2022b). In addition to territorial waters some fishing zones are shared with neighboring countries to the east, the west and the south. Its exclusive economic zone (EEZ) covers 420,280 km^2 , about 304,000 km^2 of which are in the Gulf of Thailand and 116,280 km^2 in the Andaman Sea (Fig. 3.2; Janekitkosol et al., 2003).

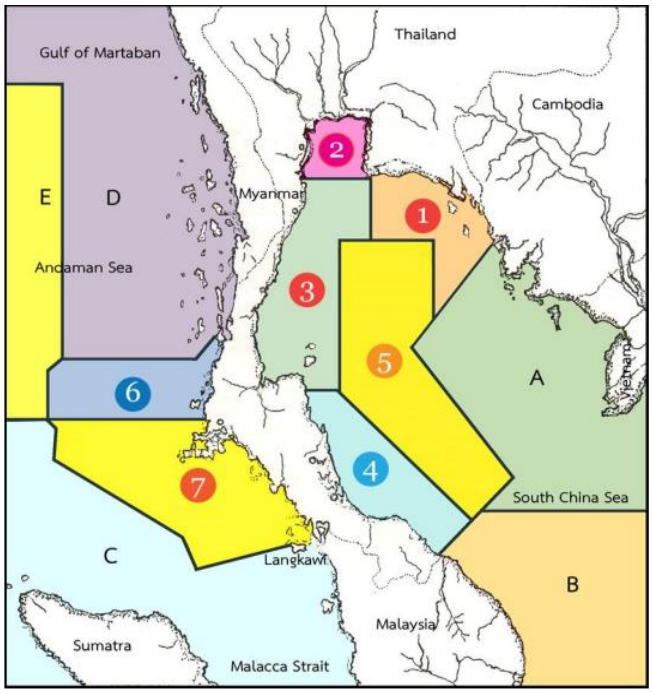

Figure 3.1. *Thailand's major fishing areas and fishing zones. Source: DoF, 2022b)*

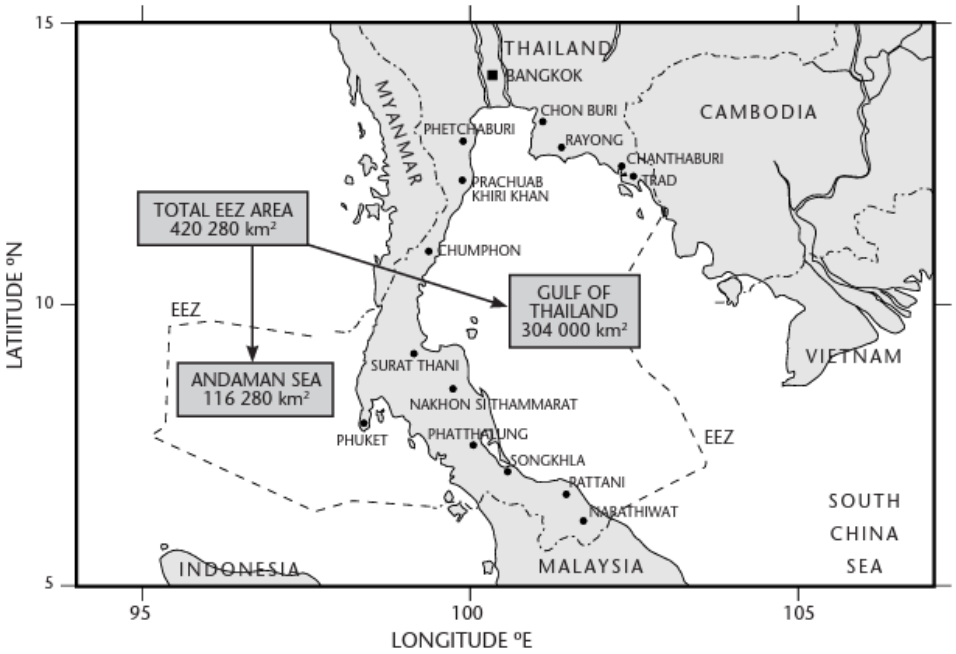

Figure 3.2. *Expanse of Thailand's exclusive economic zone (EEZ). Source: Janekitkosol et al., 2003*

Until the early 1960s, Thailand's fisheries were largely driven by their own internal dynamics. This was reflected in the concentration on small pelagic fish species, which were primarily caught by artisanal fishers who used fixed fishing gears, and supplying local markets (Pauly & Chuenpagdee, 2003). The succeeding development of Thailand's fisheries is greatly influenced by the global market. It is reflected, for instance, in the development of purse seine fisheries in the 1980s targeting pelagic species such as anchovies (Lymer et al., 2008). Like most countries, Thailand has two main fisheries sectors: the capture fishery sector which includes marine and inland fisheries, and aquaculture (Lymer et al., 2008). While aquaculture production has the potential to address the shortfall in fish and shellfish supply in Thailand (either for fresh consumption or processing), it is imperative for policymakers and key fishery stakeholders to assess the long-term environmental implications of this approach (Sampantamit et al., 2021).

Most fishers in Thailand are small-scale or artisanal, often characterized using fishing vessel size of less than 10 GT (DoF, 2015; Chuenpagdee & Juntarashote, 2011). Fishing vessels that are 10 GT or larger are considered large-scale or industrial (DoF, 2015). In 2015, there were 42,215 fishing vessels in Thailand, of which 78% were small-scale (DoF, 2015). Given this majority, the contribution of small-scale fisheries in alleviating poverty and ensuring food security must be considered in fisheries management (Chanrachkij et al., 2020).

3.1.1 Small-scale fisheries

Small-scale fisheries play an important role in food and nutrition security. They provide culturally diverse, highly nutritious fresh and processed fish to many people in coastal communities worldwide (Belton & Thilsted, 2014). Globally, small-scale fisheries contribute about half of the global fish catches which are usually for their consumption. Aside from food provisioning, small-scale fisheries in Thailand contribute to poverty eradication and help sustain coastal livelihoods. Catches from the small-scale fisheries support more than 2,500 fishing villages in rural coastal areas of Thailand. They also provide the economic mainstay to small-scale fishing families and producers who sell their products to local markets. Women in the small-scale fishing communities in Thailand are involved, not only in the processing and marketing like in other countries, but also in the harvesting (Chanrachkij et al., 2020).

The diversity and variability in the nature and the characteristics of the small-scale fisheries create some challenges for management and governance. Because most of them are in rural areas and remote locations, they are often marginalized and disadvantaged in policy and decision-making, and while also being vulnerable to natural disaster and social risks (Chuenpagdee et al., 2006; Jacquet & Pauly, 2008; Jentoft et al., 2011). As shown in a recent study by Satumanatpan & Pollnac (2019), Thai small-scale fishers are facing high risk and vulnerability as they heavily depend on fishery resources that continue to decline due to overfishing, habitat loss, and pollution. This, in addition to the long-term pressure and competition from industrialized fishing, coastal development, and globalization (Chuenpagdee & Juntarashote, 2011) affects small-scale fisheries.

The global phenomena of unequal distribution of government subsidies (Schuhbauer et al., 2020) also affects small-scale fisheries in Thailand, causing ongoing political and economic marginalization.

3.2 Fish production and trend in Thailand

In 2020, Thailand's production from marine capture fisheries was 1,472,009 tons, with anchovy and squids as the most important species caught (DoF, 2022a). However, reports show that fishery production in Thailand is declining from 2006 until 2019. It has an average declining rate of 3.4% annually mainly because of the yearly decreases in the production from marine capture fisheries (SEASOFIA, 2022).

3.2.1 Anchovies

One of the most important fisheries in Thailand is anchovy, a small pelagic, schooling fish that are filter-feeders and serve as forage fish for larger marine animals (Canales et al., 2016; Alder & Pauly, 2006; Free et al., 2021; FAO, 1999). According to Sinanun et al. (2012), the dominant species of anchovy found in Thailand are *Encrasicholina heteroloba, E. punctifer,* and *E. devisi.* They are mostly caught at night using purse seine, equipped with light luring device. In 2019, Thailand was the main producer of anchovies in Southeast Asia, contributing 143,218 metric tons or 51.68% of the total catches (SEASOFIA, 2022). Globally, Thailand is the 10th leading country

in anchovy production, contributing 130,680 metric tons or 2% of the global anchovy catches in 2021 (FAO FishstatJ, 2023).

In the past ten years, anchovy production in Thailand has been fluctuating, showing a decreasing trend (Fig. 3.3). In 2012, catches were at 146,330 tons followed by an 11% decrease in 2013 before a slight increase of 8% in 2014. The anchovy fishery in Thailand showed a 15% decline in 2015, losing about 20,585 tons to its annual landings. The fluctuating trend of anchovy catches can be contributed by many factors. Climate change is one of the biggest threats to anchovy fisheries, as they are sensitive and vulnerable to variabilities in ocean temperature (Checkley et al., 2017; Asiedu et al., 2021; Schreiber et al., 2011). One prominent example is the Peruvian anchovy fishery, the largest production in the world, which collapsed in 1972 due to El Niño (Schreiber et al., 2011).

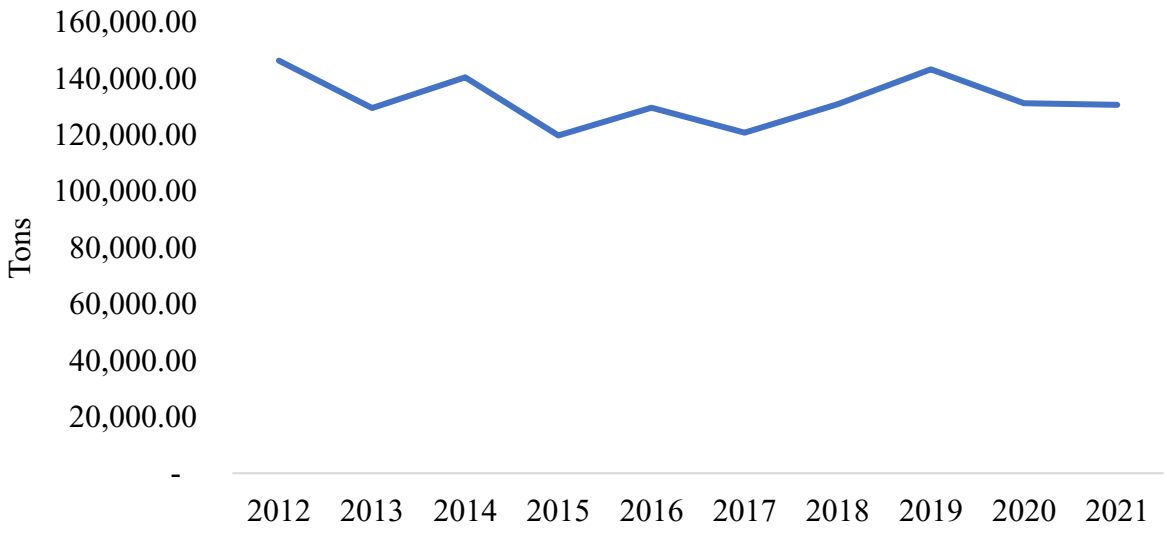

Figure 3.3. *Anchovy production in the past ten years, 2012-2021. Source: DoF*

Both large-scale and small-scale fisheries target anchovies, with the majority of catches coming from the large-scale, industrialized sector (97% in 2021) (DoF, 2016; DoF, 2021; www.seaaroundus.org). As shown in Fig. 3.4, Thailand's anchovy fisheries started off with most of the catches from the small-scale fisheries. Over the years, small-scale fisheries catches have been fluctuating and large-scale fleets have started to dominate in terms of production. In the past ten years, large-scale anchovy fisheries contribute 94% of the total production. Meanwhile, catches from the small-scale fisheries dropped significantly and have remained low until the present. In 2020, the total value of anchovy landings in Thailand was 2 billion baht (USD 54 million). The average landing price of anchovy per kilogram increased significantly from 12.86 baht (USD 0.42) in 2012 to 18.34 baht (USD 0.55) in 2017 (DoF, 2022a).

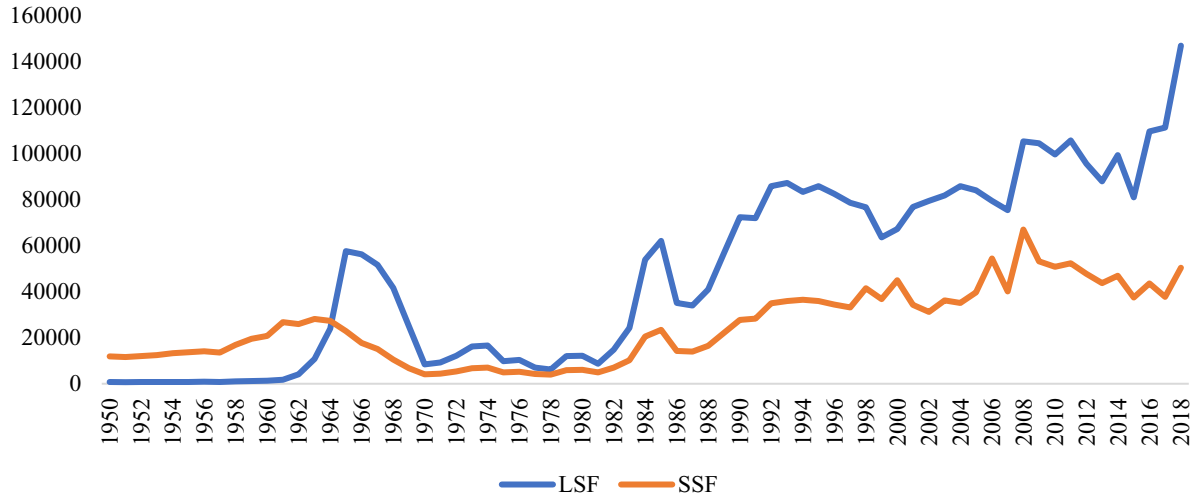

Figure 3.4. *Thailand's anchovy catches from large-scale fisheries (LSF) and small-scale fisheries (SSF), 1950-2018. Source: Sea Around Us Project*

Anchovies are caught mostly using purse seine and falling net (Fig. 3.5). Purse seine and other gears are large-scale, while falling net is small-scale. Falling net is a specific type of fishing gear

derived from squid fishing, that employs finer mesh nets, measuring 0.6 cm, and features a semi-rectangular shape (Supongpan et al., 2000). Anchovies are also caught by several other fishing gears that target mackerels, sardines, and squids. Anchovy fishing can take place during the day or at night. For night fishing, which yields higher production, artificial lights are equipped in the boat to lure fish into the nets. The light-luring device is the most efficient method to capture fish such as anchovies (Nguyen & Winger, 2019), but, there are ongoing debates about environmental concerns with this fishing method. Due to concerns about bycatch and overexploitation, night fishing using artificial lights has been prohibited in Thailand under the 2015 Royal Ordinance on Fisheries (DoF, 2015). The ban on night fishing has affected the livelihoods of many fishers not only in Thailand but around the world (Nguyen & Winger, 2019). Small-scale fishers in Thailand in particular argue that they have been using this method since their ancestors and that it is not destructive. Their argument is supported by the study by Solomon & Ahmed (2016), as well as by Nguyen & Winger (2019), with the latter providing further evidence about how light luring fishing reduces bycatch of unwanted species because it attracts species-specific fish depending on the light intensity.

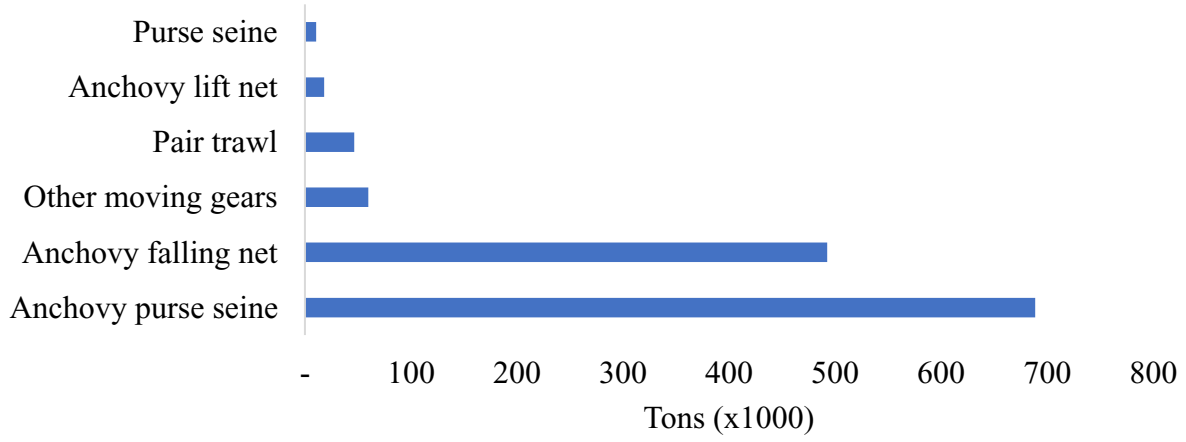

Figure 3.5. *Main fishing gears used to capture anchovies in Thailand. Source: DoF*

3.2.2 *Acetes* shrimp

Acetes shrimp belong to the genus *Acetes* which are also called sergestid shrimps. These tiny shrimps occur abundantly in coastal waters of Southeast Asia and in some South American and African countries (Deshmukh, 1991). *Acetes* shrimp are exploited economically and are used as raw materials for shrimp paste (Satumanatpan et al., 2019). They are caught using traditionally operated gears like push nets, or scoop net or 'hand' push net (Table 3.1). Traditional push net fishing entails scooping or seining, typically conducted near the bottom in shallow waters found in estuarine regions, mangrove creeks, shallow bays, and littoral areas (Morgan & Staples, 2006). With the advent of fishery industrialization, certain push net fisheries have advanced beyond non-motorized or handheld operations (scoop netting or hand push netting). Since 1970, there has been an improvement in the efficiency of this traditional equipment through the adoption of motors, replacing manual labor (Morgan & Staples, 2006).

In the past ten years, *Acetes* shrimp production in Thailand has increased (Fig. 3.6). *Acetes* shrimp is abundant from March to June (Arunrojprapai & Keaw-Khaeiw, 2004), during night time especially in areas with coarse-sand flats, mangroves, open water, muddy flats and seagrass beds (Detsri et al., 2019). The common species of *Acetes* recorded in the Gulf of Thailand are *A. japonicus, A. erythraeus, A. vulgaris,* and *A. indicus,* with *A. japonicus* being the most abundant species in all habitats (Detsri et al., 2019). In 2021, the total production of *Acetes* shrimp was 25,891 tons with a total value of 19.4 million baht (around USD 590,900). Generally, *Acetes*

shrimp production is mainly contributed by the small-scale fisheries sector with its production reaching 40 million baht (USD 1.1 million) in 2015.

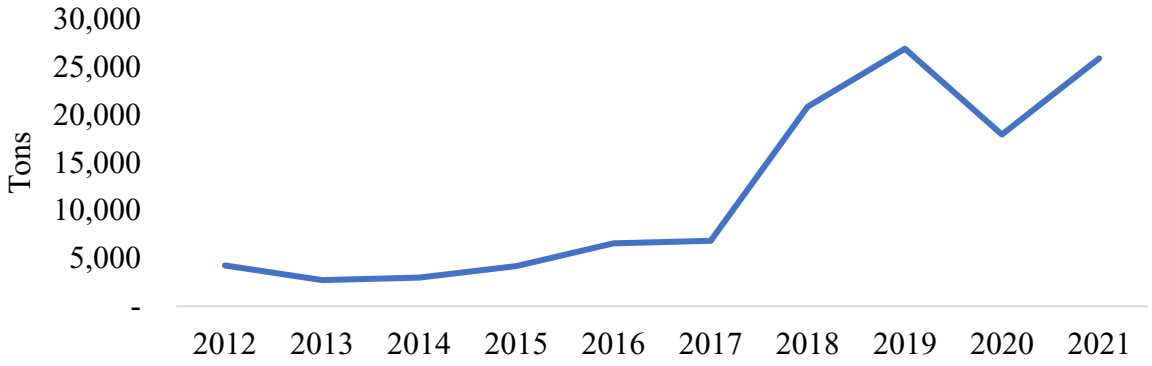

Figure 3.6. *Acetes shrimp production in Thailand in the past ten years, 2012-2021. Source: DoF*

Table 3.1. *Fishing gear used to capture Acetes shrimp in the past ten years. Source: DoF*

Fishing gears	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Hand push nets	●	●	●	●	●	●	●	●	●	●
Push nets	●	●	●	●						
Bamboo stake trap			●							
Crab gill net										●
Gill nets										●
Lift nets	●	●	●	●						
Mackerel gill net					●			●		
Other gill nets	●									
Other moving gears	●	●	●	●						
Other nets	●	●	●	●	●	●				●
Otter board trawl		●								
Set bag net	●	●	●	●						

Records show that most of catches (89%) are contributed by a type of push net called ‘krill push net or hand push net or scoop net’ and a tiny amount of bycatch from mackerel gill nets and other gears. It is worth noting that in 2015, Thailand implemented an important fisheries management

measure that restricts the use of push nets, except krill push net (Suebpala, 2021). The new regulation was implemented to address the 'yellow card' issued by the European Union (EU) to Thailand for breaching the illegal, unreported, and unregulated (IUU) fishing regulations (SEASOFIA, 2022). Motorized push nets are mainly operated by large-scale fisheries and are described to cause damage on benthic communities although information is limited (Suebpala, 2021).

The krill push net or the hand push net is artisanal, low-impact fishing gear and it resembles the regular push nets banned under the new Royal Ordinance on Fisheries (Satumanatpan et al., 2019). According to the local people, *Acetes* or krill scoop nets have long been used to catch *Acetes* shrimp and they argue that it is highly selective. Unlike other bottom-touching gears, the *Acetes* scoop net has little or no bycatch or discards (Chuenpagdee et al., 2017). Although, a few studies have qualitatively described the impacts of push nets on seagrass beds, coral reefs, and benthic communities (Suebpala et al., 2017), yet, information on habitat damage is generally limited.

3.2.3 Banana shrimp

Banana shrimp (*Penaeus merguienseis*) is one of the most commercially important species in tropical and subtropical Indo-West Pacific region (Vance & Rothlisberg, 2020). They produce abundantly but are short-lived and have a complex life history, including offshore spawning, mangrove-rich coastal nurseries, and migration between these habitats. That is why a healthy ecosystem is important for a healthy banana shrimp population, which includes coastal seas, bays,

estuaries, and land-sea interfaces. In Thailand, besides the wild capture fisheries, banana shrimp is also one of the important cultured shrimp species along with black tiger shrimp (*P. monodon*) which started taking off in 1986 in mangrove areas along the inner Gulf of Thailand (Sahavacharin, 1995).

In the past ten years, banana shrimp production in Thailand is decreasing (Fig. 3.7). In 2012, Thailand's total banana shrimp production was 20,256 tons, followed by a decline of 6,211 tons in 2018. Although catches have shown signs of recovery towards 2021, it is still low compared to catches in 2012. It is targeted by both large-scale and small-scale fisheries. In the past ten years, catches from both sectors are almost proportional, however, in 2021, most of the catches (88%) are contributed by the small-scale fisheries sector. Shrimp trammel net is the main fishing gear used (65%) in banana shrimp fishery and the rest are caught using beam trawl, otter board trawl, push nets, pair trawls, and other gill nets. A study conducted by Lunn & Dearden in 2006 found that shrimp trammel net fishers, mainly operated by small-scale fishers, have the longest fishing days 10 ± 3 hours per day compared to other fisheries except for trap fisheries.

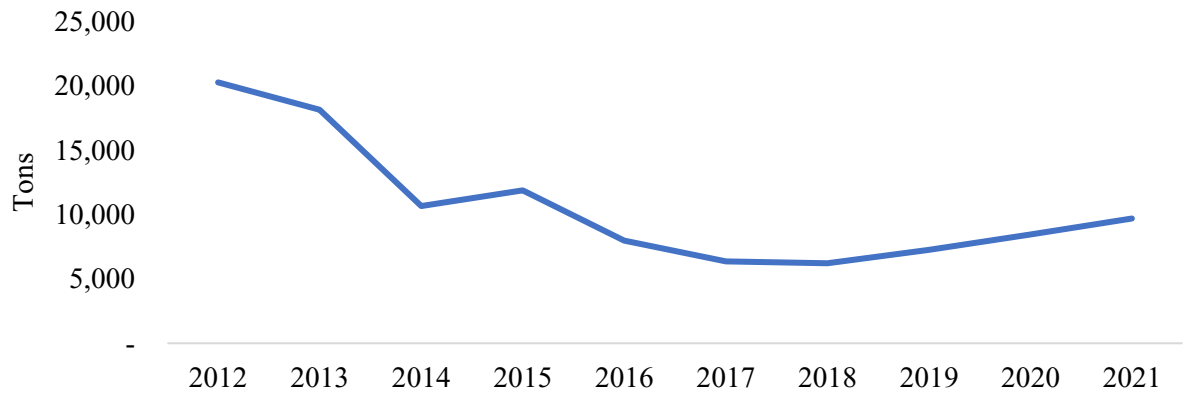

Figure 3.7. *Banana shrimp production in the past ten years, 2012-2021. Source: DoF*

Same with other fisheries mentioned earlier, the Gulf of Thailand is the main fishing area for this fishery (76%). Banana shrimp are often not the dominant species in terms of volume in catches, but they are the largest contributor in terms of economic value (Vance & Rothlisberg, 2020). In 2020, banana shrimp production in Thailand was valued at 377 million baht (USD 11.1 million) of which 347 million baht (USD 10.5 million) is landed in the Gulf of Thailand and 29 million (around USD 879,000) from the Andaman Sea. Banana shrimp is a high value species with landing value ranging from 220 baht (USD 6.67) to 257 baht (USD 8.29) per kilogram from 2017-2022. In 2021, about 88% of banana shrimp production (8,522 tons) is from the small-scale fisheries sector and the rest comes from the large-scale fisheries. As shrimps are generally robust and are able to withstand challenging environmental conditions or stressors, particularly in the wild, they can be sustainable. Sustainable shrimp fisheries can provide a viable livelihood for small-scale fishers while protecting the country's rich coral reef ecosystem (Lunn & Dearden, 2006).

3.2.4 Squid

Indian squid (*Loligo duvaucelii*) is a high value marine fishery resource of the world and especially in Thailand (Kaewnuratchadasorn et al., 2003; Petsut & Kulabtong, 2013). They spawn year-round and reach maturity within months, meaning they are abundant. Like the banana shrimp, squids can provide a sustainable livelihood to small-scale fishers in Thailand. Since the development of commercial fisheries in the 1960s, remarkable progress has been made in the development of new fishing techniques such as squid fishing using lights in 1970s (Chotiyaputta

et al., 2002). The squid resource in the Gulf of Thailand has been fully exploited since 1981 (Chotiyaputta et al., 2002).

The squid production in Thailand has decreased in the past ten years from 110,101 tons in 2012 to 65,115 tons in 2021 (Fig. 3.8). Squid is targeted by both large-scale, commercial fisheries and small-scale fisheries, although most catches are from large-scale fisheries about 76%. The most common fishing gear used for catching squid are squid falling net, pair trawl, otter board trawl, and to a lesser extent purse seine, handlines and pole and lines, which can be large-scale or small-scale (Fig. 3.9). In 2021, pair trawl was the most used large-scale fishing gear for squid fishery followed by squid falling net which is mostly small-scale and common in the Andaman Sea.

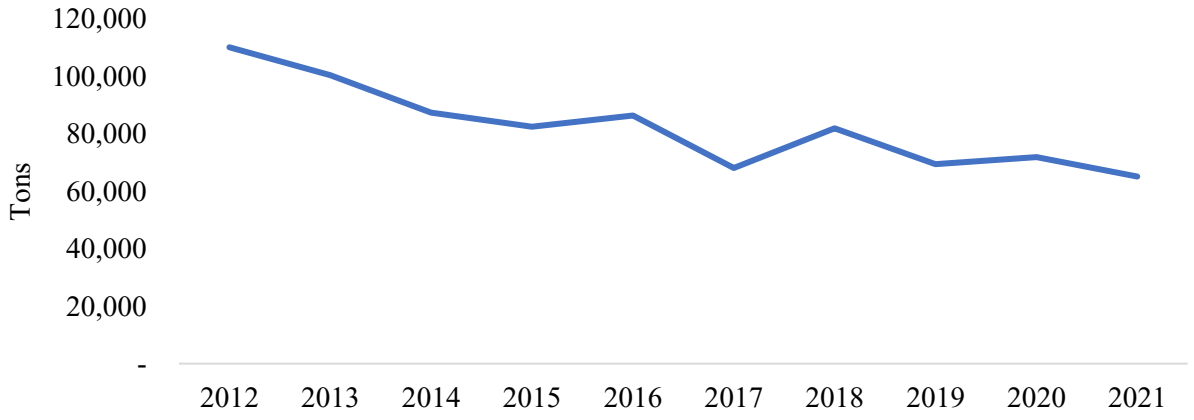

Figure 3.8. *Squid production in the past ten years, 2012-2021. Source: DoF*

In 2020, the value of squid production in Thailand reached 8 billion baht (around USD 242 million), of which 5.1 billion baht (around USD 154 million) is accounted for landings from the Gulf of Thailand and 2.9 billion baht (around USD 87 million) from the Andaman Sea. Although

catches were higher in terms of volume in 2011 than catches in 2018, the value is significantly higher in 2018 at 10.9 billion baht (around USD 330 million) compared to 3.4 billion baht (around USD 113 million) in 2011. Thus, although squid production has decreased, price of squid has increased considerably over the years. In 2017, the landing value of squid is 92.32 baht (USD 2.80) per kilogram from 78.72 baht (USD 2.39) in 2012.

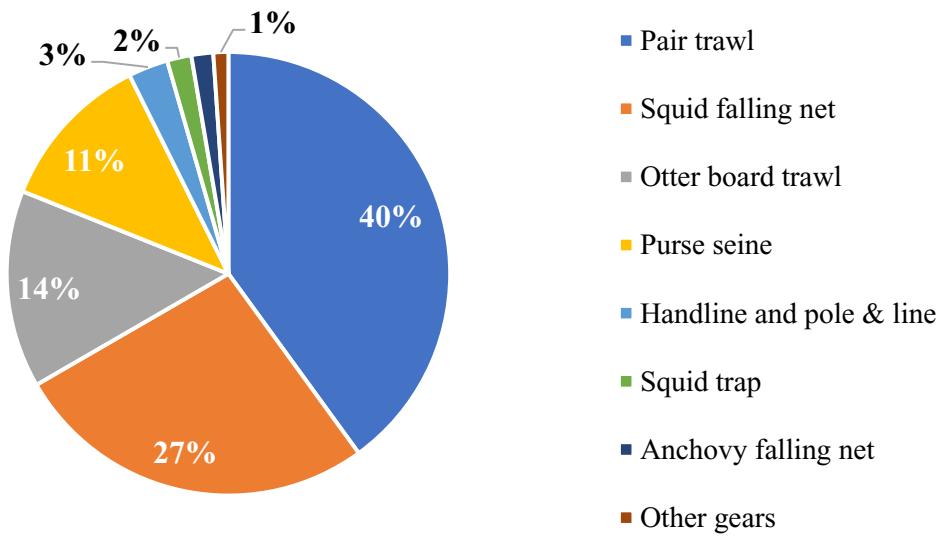

Figure 3.9. *Distribution of catches from major fishing gears used in Thai squid fishery. Source: DoF*

Another commercially valuable squid species in the Indo-West Pacific region and especially in Thailand is the bigfin reef squid (*Sepioteuthis* sp.). Not only this species provide food and livelihood to many fishers particularly the small-scale, it is a useful species in biomedical research, particularly in the field of neuroscience (Walsh et al., 2002). Like other species, its production has been fluctuating over the past ten years (Fig. 3.10). In 2012, the total catches of bigfin reef squid reached 6,548 tons, followed by an increase in 2013 with 9,718 tons and then a steep decline in 2014 with 4,350 tons but in 2021, catches increased significantly to 8,759 tons. Both large-scale

and small-scale exploits the fishery and majority of the landings (70%) in the past ten years is contributed by the large-scale fisheries. However, in 2021, about 68% of production is contributed by small-scale fisheries. Handline and pole and line, squid traps and pair trawls are the most used fishing gear to capture bigfin reef squid (Fig. 3.11).

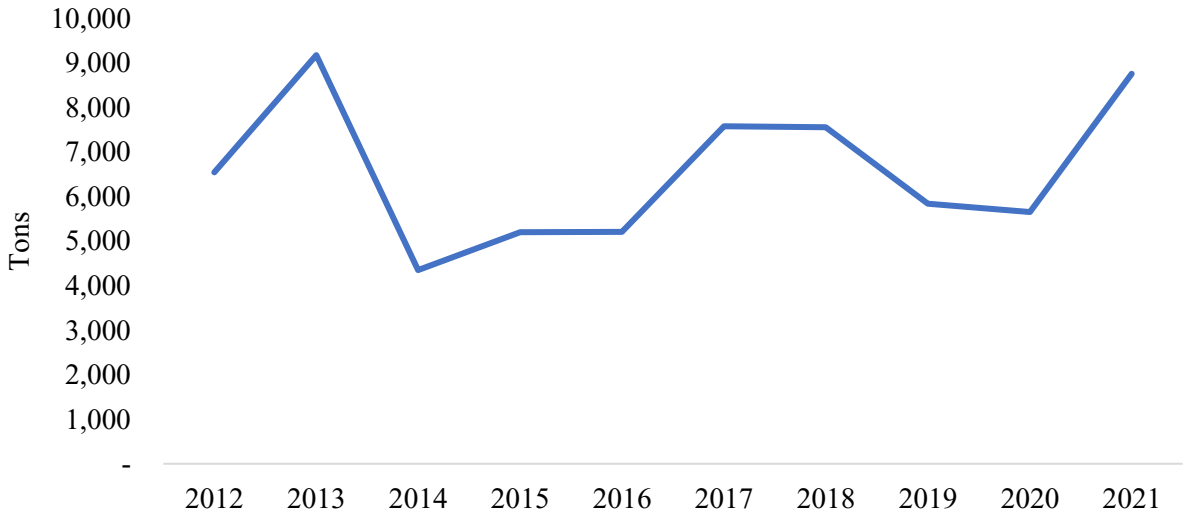

Figure 3.10. *Bigfin reef squid production ten years, 2012-2021. Source: DoF*

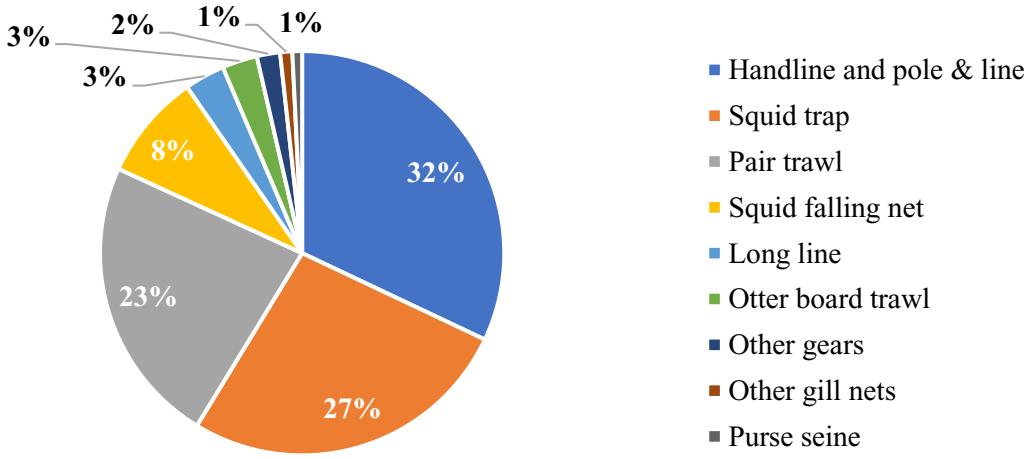

Figure 3.11. *Main fishing gear used in bigfin reef squid fishery in 2021. Source: DoF*

The Gulf of Thailand is the main fishing area for bigfin reef squid. In 2020, bigfin reef squid production was valued at 643 million baht (around USD 19.4 million) of which 551 million baht (around USD 16.6 million) from the Gulf of Thailand and 92 million baht (around USD 2.7 million). Unlike other squid species where landing value is increasing, the landing value of bigfin reef squid is fluctuating. In 2012, the landing value was 91.58 baht (USD 2.78) per kilogram in 2012 then it was followed by and increase to 104.85 baht (USD 3.18) in 2015. However, in 2017, the value decreased to 99.12 baht (USD 2.97) per kilogram probably due to an increase in production.

3.3 Catch distribution

Table 3.2 provides a summary of the distribution of landings per species by province and coastal fishing area. Anchovies are commonly landed across all coastal provinces in Thailand. In the past ten years, the highest volume of anchovies is landed in Trat province, followed by Rayong and Chonburi in the eastern coast, Prachuap Khiri Khan in the central coast and Chumphon in the western coast of Thailand. In 2020, in addition to these top producing provinces, significant number of anchovies were also landed in Phang Nga province on the western coast. Coastal fishing zones one, two, three and six recorded the highest productivity of anchovy catches in 2020.

Landings of *Acetes* shrimp were recorded on four coastal provinces in the past ten years. Highest landing recorded was in Samut Sakhon province followed by Samut Prakan, Samut Songkhram and Phetchaburi which are all on the central coast. However, in 2020, records show that landings

of *Acetes* shrimp was only in Samut Prakan and Samut Sakhon provinces both belonging to coastal fishing zone two.

Unlike the *Acetes* shrimp, banana shrimp is landed in almost all coastal provinces of Thailand. In the past ten years, the highest landings were recorded in the provinces of Nakhon Si Thammarat, Narathiwat, Surat Thani and Chumphon on the southern coast, Trat on the eastern coast, Ranong on the west coast of the Andaman Sea, and Samut Sakhon on the central coast along the Gulf of Thailand. In 2020, most of these coastal provinces remained the most productive, except for Narathiwat and Ranong provinces with 3 tons and 23 tons of landings, respectively, which is very low. Landings of banana shrimp in Samut Sakhon were also high in 2020. Records show that banana shrimp is mostly abundant in coastal fishing zones one, two, three and four.

Like the anchovies, squid fishery is common and occur across all the coastal provinces in Thailand with highest volume of landings recorded in Samut Sakhon province in the past ten years. In 2020, the highest landing of squid was recorded in the province of Phuket in the western coast of the Andaman Sea followed by Chonburi in the east coast along the Gulf of Thailand. Other productive provinces include Prachuap Khiri Khan, Samut Songkhram, and Samut Prakan on the central coast, Nakhon Si Thammarat, Chumphon, Pattani and Songkhla on the southern coast, Phang Nga, Trang, Satun, and Ranong on the western coast, and on the east coast Rayong and Trat. Squid occur on all coastal fishing zones but the highest landing by each province was recorded in coastal fishing zones seven and two.

Bigfin reef squid is also common across all coastal provinces, but the volume of landings is lower compared to squid. In the past ten years, the highest landings have occurred in Chumphon, followed by Songkhla, Ranong and Samut Songkhram. In 2020, although bigfin reef squid landings are distributed among all coastal provinces, the highest landings were recorded in Chonburi on the east coast, followed by Samut Songkhram on the central coast along the Gulf of Thailand. Both provinces belong to coastal fishing zones one and two.

Table 3.2. *Distribution of species by province in the past ten years, 2012 - 2021. Source: DoF*

			Volume (Tons)						
Fishing Area	**Coastal Zone**	**Province**	**Anchovy**	**Acetes**	**Banana shrimp**	**Squid**	**Bigfin reef squid**		
Gulf of Thailand	1	Chanthaburi							
Gulf of Thailand	1	Rayong							
Gulf of Thailand	1	Trat							
Gulf of Thailand	2	Chachoengsao							
Gulf of Thailand	2	Chonburi							
Gulf of Thailand	2	Phetchaburi							
Gulf of Thailand	2	Samut Prakan							
Gulf of Thailand	2	Samut Sakhon							
Gulf of Thailand	2	Samut Songkhram							
Gulf of Thailand	3	Chumphon							
Gulf of Thailand	3	Prachuap Khiri Khan							
Gulf of Thailand	3	Surat Thani							
Gulf of Thailand	4	Nakhon Si Thammarat							
Gulf of Thailand	4	Narathiwat							
Gulf of Thailand	4	Pattani							
Gulf of Thailand	4	Songkhla							
Andaman Sea	6	Phang Nga						**Legend:**	
Andaman Sea	6	Ranong						100,000 tons & above	
Andaman Sea	7	Krabi						50,000 - 99,999 tons	
Andaman Sea	7	Phuket						10,000 - 49,999 tons	
Andaman Sea	7	Satun						1,000 - 9,999 tons	
Andaman Sea	7	Trang						1 -999 tons	

In summary, Thailand's coastal areas are known for their abundance of diverse fisheries. In particular, anchovies, banana shrimp, squid and bigfin reef squid are common in all coastal provinces, except for the *Acetes* shrimp, which is mainly found on the central coast along the Gulf of Thailand. The occurrence of different fisheries in Thailand's coastal fishing areas provides insight into the ecological and environmental factors that influence the distribution of these

fisheries. This chapter highlights the richness and diversity of Thailand's local fisheries. This is important for the decision-making processes to ensure the continued availability of these fisheries, especially in providing adequate supply for the dried fish production.

3.4 Fish utilization and processing

Thailand, like many countries, are processing and packaging fish to optimize its use, extend shelf life and diversify products (FAO, 2020b). For instance, in 2020, around 42% of the harvested marine fish was consumed fresh, and the remaining was processed into chilled, frozen, canned, steamed, or smoked, fermented into fish sauce or shrimp paste, salted, and dried (DoF, 2022a). Anchovies are utilized in many forms, mostly dried (59%), processed into fish sauce (39%), and fish paste and fishmeal (about 2%) (SEASOFIA, 2017). Yet, there is limited information on the extent to which anchovies caught by small-scale fisheries are processed into dried fish, primarily because of the aggregated nature of statistical reporting of catch disposition. Nonetheless, often, anchovies are landed in the morning and thus sundried during the day. However, anchovies that are landed during the day or in the afternoon are parboiled and then sundried the following day. Most of the processing is done by women at home, which takes about 1-2 days (Supongpan et al., 2002). *Acetes* shrimp which are caught by most small-scale fisheries are mainly processed into shrimp paste or Kapi. Shrimp, in general, is a high value product compared to other fish products (Nirmal et al., 2020). They are generally sold fresh, but they are also processed as dried. Squids which are also high value product are utilized as fresh or processed for both domestic consumption and export.

Significant improvements in processing, refrigeration, storage, and transportation have enabled extended shelf life, long-distance and cross-border distribution of fishery products (FAO, 2022). They (the improvements) have also promoted value addition, and thus increased variety of fishery products. The improved utilization of fisheries reduces food losses and waste, while reducing the pressure on fish stocks thus, promoting sustainability in the sector (FAO, 2020b).

3.5 Issuance of the 'yellow card' and implications

In 2015, the European Union (EU) declared Thailand as having breached the illegal, unreported, and unregulated fishing. The decision was based on reports about inappropriate fishing activities by the large-scale, industrialized fishing sector. The 'yellow card' was issued by the EU to Thailand after giving a warning for being identified as a non-cooperating country in the fight against IUU fishing. The EU finally lifted the 'yellow card' issued to Thailand in January 2019 (SEASOFIA, 2022). A more detailed report on the topic is discussed broadly in Chapter 6.

Thailand has faced problems such as overfishing, depleting fish stocks, fisher competition and habitat degradation among others, with the development of marine capture fisheries since 1982 (Janekitkosol et al., 2003). More recently, the issuance of the 'yellow card' by the EU has created several changes in the fisheries governance in the country. The EU aims to champion better ocean governance based on a cross-sectoral, rules-based international approach (Tavornmas & Cheeppensook, 2020). Consequently, by issuing a 'yellow card' to Thailand, and with the Thai

government's determination to combat IUU fishing it has resulted in some fruitful reforms. However, these reforms have ignited negative impacts to affected fishers and coastal communities.

Like for many countries, studies about fisheries in Thailand have been mostly on harvesting, stock assessments, and managing fisheries and marine resources. The post-harvest part of the fish chain is under-investigated, despite the popularity of fish and seafood in the Thai culture and diet. This study serves as a pioneer in terms of studying the post-harvest sector of the fish chain, in particular the different marketing strategies of the common dried fish products in Thailand, and especially during the COVID-19 pandemic.

Chapter 4 – Marketing of dried fish in Thailand

This chapter describes the marketing of dried fish by looking at how dried fish are distributed in different markets in Thailand. Specifically, the study identifies patterns, trends, and changes in how dried fish are being marketed, especially during the COVID-19 pandemic. The synthesis presented in the chapter was based on the report of the initial scoping study conducted by the Dried Fish Matters (DFM) project team in Thailand, which involved a rapid survey of wholesale and retail markets in Bangkok and vicinities, and visits to several provinces where dried fish are processed. The challenges and opportunities were identified based on the scoping study report and the market visits.

4.1 Market share of dried fish

4.1.1 Anchovies

In 2000, Supongpan et al. reported that fresh anchovies in Thailand were processed into fish sauce (30%), dried (47%), and boiled and dried (18%), and fishmeal and other products (5%). However, more recent reports on anchovy utilization indicate that about 39% are processed into fish sauce, 59% are dried (including dried, boiled and dried and other products for export), and about 2% are processed into fish paste and fishmeal (SEASOFIA, 2017). Comparing the utilization of anchovies in the past decades to the recent report, the production of fish sauce has increased while the production of dried fish, fishmeal and other products have decreased. It is not evident whether the

change was driven by demand for the products or by the supplies (especially raw materials). Quality and size of anchovies might also be another factor. Anchovies for fish sauce are mostly caught in large volume by large-scale purse seines, while anchovies for dried fish come from smaller scale operations and are of higher quality because they are processed by hand within 24 hours of being caught. However, the quality is also influenced by specific factors such as handling and processing practices, as well as the weather conditions. Given that anchovies are used to make both fish sauce and dried fish, more investigation into the catch and utilization of anchovies is required.

4.1.2 Shrimp

In Thailand, the majority of shrimps are frozen (97% or 112,956 tons). About 2% are dried, and the rest goes into canning, processed into fish balls and fish-shrimp crackers (DoF, 2021b). Despite the small volume, dried shrimp fetch good prices due to the high demand. In 2020, the total value of dried shrimp reached 263 million baht (around USD 7.9 million). Dried shrimp contributes significantly to the local economy, especially to the top producing provinces such as Samut Prakan (57 million baht or USD 1.7 million), Samut Sakhon (46 million baht or USD 1.3 million), Nakhon Si Thammarat (40 million baht or USD 1.2 million), Ranong (29 million baht or USD 879,000) and Prachuap Khiri Khan (21 million baht or USD 636,000) (DoF, 2021b).

4.1.3 *Acetes* shrimp

The *Acetes* shrimp are mainly from small-scale fisheries and are processed into shrimp paste (Deshmukh, 1991). The production of Kapi has evolved from traditional home-based methods to being manufactured on both small and large scales (Yongsmith & Malaphan, 2016). Kapi products are common in all wholesale and retail markets across the country, both for domestic consumption and for export. Recently, community-based tourism, including homestays, has become popular among Thais and is encouraged by the Thailand Tourism Authority to revitalize the local economy and traditional ways of life. In this program, communities can introduce special products as part of tourism promotion, such as Kapi and Kapi making. Kapi making has helped local fishers support livelihoods and improve their income, as some have started a restaurant business and boast that their Kapi is the best Kapi.

4.1.4 Squid

In 2020, most of the squid landed in Thailand are consumed fresh (48.5%), processed into frozen (47%), and dried (4%), and the rest go into canning (0.5%) (DoF, 2022a). The total value of dried squid in 2020 reached 598 million baht (USD 18.1 million) with contributions from Samut Sakhon (139 million baht or USD 4.2 million), Songkhla (135 million baht or USD 4 million), Chumphon (102 million baht or USD 3 million), Surat Thani (65 million baht or USD 1.9 million), and Ranong (37 million baht or USD 1.1 million) (DoF, 2021b). In 2021, a total of 11,040 tons of squids,

including cuttlefishes, were traded in Thailand's fish markets and fishing ports, with prices ranging from 145 – 301 baht/kg (USD 4 to USD 9) (FMO, 2021).

4.2 Dried fish processing and products

Most fish in Thailand are intended for human consumption, especially the higher quality fish, while the lower quality fish are converted into feed or fertilizer (SEASOFIA, 2022). Thai people consume a high amount of fish, both fresh and processed fish in various forms. The per capita fish consumption in Thailand was 29.5 kg/year in 2017 (SEASOFIA, 2022), which puts the country at the top 59th globally (FAO, 2020b).

In dried anchovy processing, the fresh fish are washed with clean water and boiled in water heated on a big cement stove mostly using firewood, and then salt is added (Boonpienpon et al., 2015). Once it has boiled, the fish turns into white in color and floats up, then they are taken out of the pot and put in a basket to be dried (Fig. 4.1). Normally, the process takes about eight hours to complete during the hot season which takes place in March or April (Boonpienpon et al., 2015). But, during the monsoon season, more salt is added to the fish and it should be kept free of humidity to prevent spoilage. Dried fish processing requires extensive work, such that the producers must wake up early to examine the fresh anchovies for processing into dried fish, as well as check whether the sun is good enough for drying. If any procedure is overlooked or done carelessly, the product will be of low quality. As an important export product, dried fish processing follows certain methods and protocols to ensure high quality and freshness. For instance, dried

anchovies destined for European export are dried in a rack in a closed facility rather than in open-air racks. Moreover, solar energy is sometimes used to help the drying process, as part of technology innovation.

Figure 4.1. *Dried anchovies processing including A. Boiling; B. Drying; C. Sorting and D. Packing. (Photo credit: DFM Thailand Team, 2021*

Another popular dried fish product is fermented shrimp or Kapi. Figure 4.2 shows the process of making Kapi using the *Acetes* shrimp as a raw material, which is then mixed with salt and is allowed to drain overnight. The process is simple and involves sorting into size, removing the big shrimps and other fish as well as removing the shrimp heads. The sorted shrimp is then dried the next day under the sun for 5-8 hours. The dried *Acetes* shrimp is ground and then dried again, and following fermentation inside wooden tubs for 15-120 days (Deshmukh, 1991; Pongsetkul et al., 2014). Kapi making is a way to extend the shelf-life of shrimp and krill caught by small-scale

fishers. Fermentation helps enhance the nutritional and functional properties of the food, making Kapi a good source of healthy food and nutrients (Kleekayai et al., 2015).

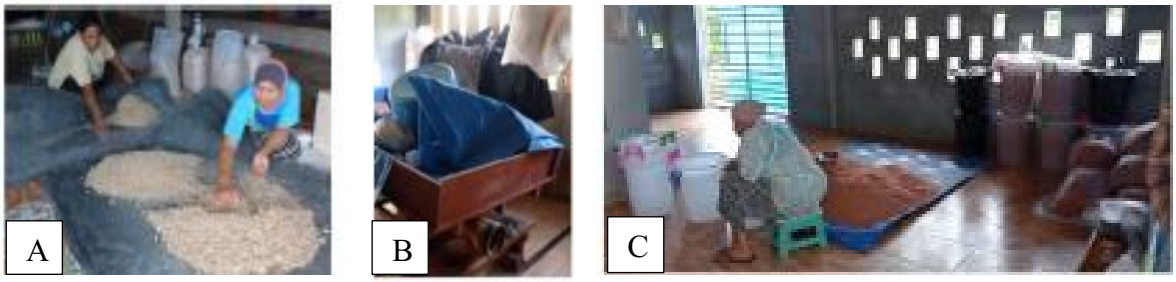

Figure 4.2. *Kapi-making process. A. Sorting after drying; B. Grinding with a simple machine; C. Flavoring and packing for bulk sale. (Photo credit: DFM Thailand Team, 2021)*

Dried fish processing is part of the Thai tradition and culture. The processing is rudimentary and mostly done at home, following processing techniques from local knowledge. Although the method is simple and low-cost, such as in the case of dried anchovies and dried shrimp which are done by boiling in a simple boiler, using firewood as a source of energy. A mechanical sorting machine may be used, in addition to a manual sorting method to expedite sorting of fish. In making of shrimp paste or Kapi, a primary grinding machine may be required for the large-scale production. While it is crucial to ascertain the extent of production in large-scale factories versus small-scale production, the available data is insufficient, necessitating further research.

In some cases, dried shrimp processors share the same drying area. In drying, the shrimps are placed on a net directly on a paved floor (Fig. 4.3). They use wooden brooms to turn the shrimp upside down to dry and use different colored baskets which indicates who the owner is. Drying shrimp involves a more elaborate process. First, fresh shrimps are cleaned, then boiled in a steamer,

using firewood. After that, the boiled shrimps are sundried or dried using an oven, then they are sorted according to sizes. Dried shrimps can be unpeeled or peeled, therefore they undergo either manual sieving or using a machine to remove the shells. Unlike dried shrimp, which involves elaborate processing methods, drying squid can be a simple process which is done by cleaning the squid first, then gutted, and then putting them to dry on the rack which normally takes one day (Fig. 4.4). The dried squid can be whole or split. Four kilograms of fresh squid would yield about one kilogram of dried squid.

Figure 4.3. *Dried shrimp processing and equipment. A. Shrimp drying in a shared area in Tha Sala, Nakhon Si Thammarat; B. Shrimp boiler; C. Sorting machine; D. Shell remover machine. (Photo credit: DFM Thailand Team, 2021)*

Figure 4.4. *Traditional drying of squid in drying racks in Bang Sapan, Prachuap Khiri Khan. (Photo credit: DFM Thailand Team, 2021)*

In Southeast Asia, dried fish (i.e., salted, dried, fermented, smoked, and including pickled) accounts for 25% to 30% of total fish consumption (Ali & Akester, 2021). Dried fish is not only famous for its familiar taste and aroma in Thai cuisine (Nimrat et al., 2019), but it is also vital to the Thai economy, with export earnings of 2.1 billion baht (USD 63.6 million). Dried and processed squid, in particular, brought in 144 million baht (USD 4.3 million), and dried and processed shrimp and lobster were worth 100,000 baht (around USD 3,000) in 2019 (MoC, 2019). The most common dried fish in Thailand are dried squid, dried shrimp, shrimp paste or Kapi and dried anchovies, which can be uncooked or cooked with different flavors and some additives. Seasoned and cooked dried fish products are labeled as "ready-to-eat" products and form an important part of e-commerce or online marketing product, which is explained further in the next chapter.

Over the past years, the number of processing plants for dried shrimp and dried squid has undergone changes. There was a decline in the number of processing plants for dried squid from 157 in 2016 to 125 in 2018. In 2019, the number of processing plants have gone up to 136, then in 2020, there were only 119 processing plants on record. On the other hand, the number of dried shrimp processing plants has gone down from 72 in 2016 to 52 in 2018, followed by an increase in 2020 with 61 processing plants recorded, likely attributed to a rise in demand within the global market.

Some dried fish products are manufactured from a community-based production, called 'One Tambon, One Product (OTOP). Launched in 2001, the OTOP program is a Thai initiative aimed

at promoting the rural development of Thai communities, supporting unique, locally produced and marketed products in each district of Thailand (Natsuda et al., 2012; Muslim et al., 2020). OTOP plays a role in promoting sustainable and inclusive economic growth while celebrating and preserving the rich cultural diversity of Thailand.

4.2.1 Fermented shrimp paste or kapi

Fermented shrimp paste or kapi is made from *Acetes* shrimp or krill, which is mostly caught by small-scale fishers. Kapi products are made by small-scale producers in their households, or by large-scale, industrial producers. The small-scale product differs and exhibits better quality compared to products made from factory because local people catch their own *Acetes* assuring high quality and freshness. On the other hand, industrial processors mainly obtain their raw materials from middlemen, although some of them may also have their own sources of *Acetes.* Many fishing villages boast that their kapi is the best and compete for that reputation. According to them, the best quality kapi are those produced in the Samut Sakhon province because of the high-quality krill or *Acetes* in the province. Samut Sakhon, often referred to as the "Bangkok Gulf", is known for its abundance of excellent quality *Acetes*.

Local producers claim that the high-quality krill or *Acetes* are associated with good and healthy habitat, like muddy habitats. In other provinces, *Acetes* live in a mixed mud and sand habitat, thus, does not result in the best tasting *Acetes* and kapi product. Well-known kapi products that are produced in other provinces, such as in the Trat province are made from *Acetes* bought from the

"Bangkok Gulf". In some cases, other vendors buy kapi products from producers in the Samut Sakhon province and put their own branding on the products to indicate that they are produced locally. Kapi are sold in three different forms, including in pre-packaged jars, in block sold by weight, or as a big round ball also sold by weight (Fig. 4.5). The taste, color, and aroma of kapi are the main selling points. Many vendors advertise their kapi as being made from "real krill", not salty and without additives (such as MSG which is used to enhance the flavor of food or food coloring).

Kapi is popular in Thailand and an important condiment used in many Thai dishes (Pongsetkul et al., 2014). It is rich in antioxidants, protein, calcium and essential fatty acid, providing nutritional and health benefits to consumers (Kleekayai et al., 2015). The fermentation process also allows for the formation of amino acids such as glutamic acid or glutamine that are not found in fresh *Acetes* (Pongsetkul et al., 2017). Glutamic acid gives the umami taste to help enhance the taste of the food. Kapi products are helping boost the local economy by showcasing the traditional way of life through food which is part of community-based food tourism being promoted in Thai provinces (Boonkumnerd, 2018). Kapi products can be stored for at least one year at ambient temperature (Kongpun & Kongrat, 2013), making it a viable food and nutrition source for locals and tourists.

Figure 4.5. *Fermented shrimp or kapi products of Khun Duen at Duen Toh Deaw Restaurant in Sakhon province, A and B. Kapi in pre-packaged jars; C. Kapi in block sold by weight in Talad Mahachai. (Photo credit: DFM Thailand Team, 2019; N. Almine, 2023)*

4.2.2 Dried anchovies

Dried anchovies are widely available in most provinces in Thailand (Fig. 4.6). The taste of dried anchovies varies from region to region depending on the quality and condition of the raw materials. For example, dried anchovies from Andaman Sea are more oily because the raw material is frozen before being boiled, unlike in the Gulf of Thailand where anchovies are typically salted, but when fried, they do not smell and taste saltier (Boonpienpon et al., 2015). Dried anchovies are also processed for more value addition, and develop a unique product using local ingredients. One of the products is called Thai crispy rice crackers with anchovies. The product aims to promote local

tourism and to create a distinctive healthy Islamic snack, particularly in Koh Yao (Yao Island) and Koh Punyi (Punyi Island) (Boonpienpon et al., 2015). The anchovy topping is powdered according to the community's traditional recipe and sprinkled on top of riceberry crackers. Another product is the "Kaho Tang Pla" or Thai crispy rice crackers with anchovies, a product jointly developed between researchers and the Panyee and Koh Yao communities (Boonpienpon et al., 2015). The products are advertised on their website and Facebook page, and through word-of-mouth advertising primarily targeting tourists.

Anchovy is high in protein and unsaturated fatty acids, so its quality is susceptible to change during storage. Studies show that the optimal shelf life for dried anchovies is three months in the refrigerator and six months in the freezer. If not refrigerated, mold may form on the surface of the product, especially when humidity is high during outdoor transportation to the markets or retailers (Suhem et al., 2022). Some dried anchovy producers have regular bulk buyers from other provinces who would order and collect their product and redistribute it to other wholesalers and retailers. Dried anchovies are sold as packaged in bulk or in smaller packaging, cooked or uncooked, with or without flavoring.

Figure 4.6. *A. Dried anchovies in one of the shops in Phuket; at the top are whole anchovies, while in the bottom plate have their heads removed and body split. B. Variety of uncooked dried anchovies sold at Talad Mahachai, Samut Sakhon province, and C. bulk display of cooked or flavored dried anchovies, in D. original, E. sesame flavor, and F. spicy herb flavor (Photo credits: DFM Thailand Team, 2021; N. Almine, 2023)*

4.2.3 Dried squid and shrimp

Dried squid and shrimp are two of Thailand's highly valuable dried fish products for export (Fig. 4.7 & 4.8). They are advertised as top quality, not salty, and cheaper than others. These products are mainly exported to neighboring countries and are sold and packaged according to size, type and color and whether it is peeled (for dried shrimp) or split or whole (for dried squid). Besides the price of fresh raw materials, these features determine the prices; for instance, the larger squid are priced higher than the medium and smaller ones. Also, the split dried squid is the most expensive, and the lighter the color of the dried squid, the higher the price. Dried shrimp and squid can be kept in a freezer for a long time for better quality.

Dried squid, or commonly known as 'Pla Muek' in Thai, are an important part of the diet of many people and is rich in nutrients. In the dried squid snack industry, the dried squid heads, which are by-products, can be a good source of nutrients, as they have high protein content, antioxidant properties, and can be used to add flavors in foods and local dishes (Sukkhown et al., 2018).

Dried shrimp is one of the main ingredients in the two most famous traditional dishes liked by both Thai and foreigners. The first is "pad Thai" or fried noodles with bean sprout, diced tofu and eggs, crushed peanuts, and dried shrimp. The second dish is "Som Tam" or spicy papaya salad mixed with tomatoes and fresh green beans, lime juice, palm sugar, fish sauce, chili, roasted peanuts and dried shrimp.

Figure 4.7. *Different varieties of dried squid on display in Talad Mahachai. (Photo credit: DFM Thailand Team, 2019)*

Figure 4.8. *Variety of dried shrimp on display at Talad Mahachai. (Photo credit: DFM Thailand Team, 2019)*

4.3 Dried fish distribution channels

The initial scoping study found that there are different dried fish value chains in Thailand (Fig. 4.9). One of the channels is that small-scale fishing families own their boats, and process their

catches in their small, family-based drying facility. This process, predominantly handled by women, is labor-intensive. The family-run processing sells their products either to local markets or to small wholesalers or collectors who come to the facilities and buy the fish directly from them. In case the raw materials are not enough for their processing, they purchase raw materials from other boats or fish traders. In the high-volume production, the processing and the distribution channels are similar, but the processors source their fish from various sources, including from their own commercial fishing boats. Given that some of their products are destined for export markets, the processing facility is more extensive, with larger space, to meet the export standards. Instead of household members, the large-scale processors hire labor forces to work in the processing plant. While some workers are locals, there is a growing trend of migrant and foreign workers joining these facilities to meet the demand for labor. However, due to the influx of foreign workers, the following problems have also arisen, such as language barriers and cultural differences that need to be overcome to ensure a harmonious and productive work environment. But with proper management, these facilities are able to bring together people from diverse backgrounds to produce high-quality products that are appreciated by consumers around the world.

Thailand's dried fish value chain is an important economic sector, generating income for fishers, processors, traders, and exporters. As shown in Figure 4.9, the value chain begins in the harvest sector with fishers including large-scale and small-scale fisheries venturing into Thailand's coastal fishing zones and offshore fishing zones to catch fish. These fishers use traditional and modern fishing methods such as nets, traps, and longlines. In most cases, the large-scale fisheries sector provides most of the raw materials for dried fish processing including both large-scale and small-scale processing facilities, but most of the large-scale catches go into large-scale production. On

the other hand, catches from small-scale fisheries are mainly processed by fishers themselves or by other small-scale, family-based processing facilities. In some cases, small-scale fisheries catches flow through brokers or traders to large processors, but the scale and volume of these are not yet known. In some instances, raw materials for processing dried fish are scarce and additional raw fish are imported from other countries to meet the demand, and the volume of these imported raw materials for both large- and small-scale processing is still unknown.

From harvesting, the fish is processed immediately to preserve its quality. For dried fish processing, there are large-scale and small-scale, family-based processing facilities. Traditionally, after the preparation is completed, the fish is laid out to dry in the sun. However, modern methods include the use of mechanical dryers such as in large-scale facilities to ensure constant drying conditions and reduce processing times. Dried fish products in Thailand are not only for local and domestic consumption but are also important export products. But most of Thailand's exported dried fish products are form large-scale processors. While most of the small-scale dried fish products are sold in the local markets, providing local food security and nutrition, a portion of their products also goes into domestic and perhaps international markets. However, the volume of export products from small-scale processors is still unknown.

Dried fish products are distributed through various channels in Thailand. They are sold locally, domestically (nationwide), in local markets, supermarkets, specialty stores, and international markets (export). Often the vendors from these markets have diversified and include an online shop to sell dried fish products. The online shops provide accessibility and convenience for

consumers to shop for dried fish products, while they enable market expansion opportunities for sellers. The 'online' marketing of dried fish will be further discussed below and more extensively in Chapter 5.

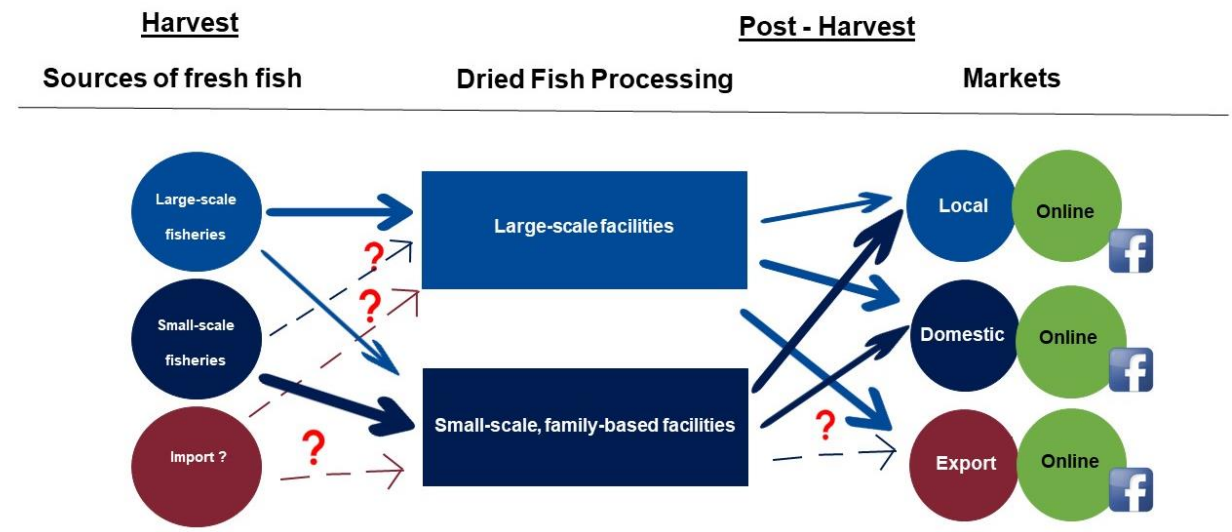

Figure 4.9. *The complex and diverse nature of dried fish value chains in Thailand. Source: DFM Thailand, 2020*

4.4 Types of markets

With the high demand for dried fish from across sectors of the society from around the country, there are several types of markets for the distribution and sale of the varieties of products. Dried fish are available as uncooked or cooked (ready to eat), at affordable prices and sold in local markets, grocery stores and convenience stores nationwide. The marketing of fishery products in

Thailand comprises different markets and traders, including primary markets, intermediate markets, and terminal markets (Kessuvan et al., 2015). The primary market takes place at the harvesting and processing stage, while the terminal market is about the sale to consumers through retail outlets. The intermediate market includes the central markets (state-operated or private) and wholesale markets.

State central markets are managed by the Fish Marketing Organization (FMO), a state enterprise under the Ministry of Agriculture and Cooperatives, headquartered in Bangkok, with several branches in the coastal provinces (Fish Market Organization, 2014). Recently, FMO has established regional distribution centers in landlocked areas in the Northeast (Nakhon Phanom province) and the North (Chiang Mai province). The expansion to these areas does not only help meet the local demand for fish and enhance food and nutritional security for people living in remote places, but also reduces the distribution cost in the supply chain, and assures the quality and safety of fishery products including fresh and dried fish. In terms of prices, the wholesale prices may vary, depending on the quality of the fresh fish and the product. High quality fish are normally more expensive and once processed, the product also guarantees a high price, while low quality fish have a low price (Boonpienpon et al., 2015; Pradhan et al., 2017).

4.4.1 Wholesale markets

Thailand is known for its wide variety of fresh seafood and fish products. Markets are an important hub for trading and distribution of seafood where fishers and traders sell their catches directly to

customers, restaurants, and retailers. These markets are known for a bustling atmosphere, vibrant seafood offerings, and opportunities to see local fishing in action. The markets offer an immersive experience to observe the trading process, interact with vendors and sample fresh seafood delicacies. They are popular with locals and tourists who appreciate the authentic taste of Thai seafood and vibrant culture. 'Talad' means 'market' in Thai. The term can be used for large-scale, wholesale markets or for local, neighborhood markets. There are three main wholesale markets that trade high volumes of dried fish, in and nearby Bangkok namely, Talad Mahachai, Talad Si Moom Mueng, and Talad Tha Tien.

4.4.1.1 Talad Mahachai

Located in the Samut Sakhon province, it is situated about 50 km southwest of Bangkok, on the Tha Chin River, near the river mouth that opens to the upper Gulf of Thailand. It is a popular destination among Thais for fish and seafood products, fresh and dried. Its proximity to the sea gives consumers an impression of the guaranteed freshness of fish and seafood. It is the largest dried fish market, with approximately 40 vendors operating for 13 years. The vendors are independent operators, not belonging to any association. Vendors are mostly local, and several have family-owned and family-run businesses. Some vendors process their fish, but the majority source the products from around the country, particularly from Petchaburi and Prachuap Khiri Khan provinces, which are close by. Figure 4.10 shows s typical dried fish stall in Talad Mahachai.

Figure 4.10. *A typical dried fish shop in Talad Mahachai. (Photo credit: DFM Thailand Team, 2020; N. Almine, 2023)*

4.4.1.2 Talad Si Moom Mueng

'Si Moom Mueng' (or Four Corners) Market was established under the 5th National Economic and Social Development Plan. Located in the Pathum Thani province about 25 km north of Bangkok, the market is the largest agricultural distribution center in Thailand, and covers an area of 350 rais or about 56 hectares (Fig. 4.11). It is the new center for trading all agricultural products from 'four corners' of the country, as per its name. While most of the products sold and traded are fresh, some dried fish vendors sell all types of products, similar to Talad Mahachai.

Figure 4.11. *The largest shop selling dried fish in Talad Si Moom Mueng. (Photo credit: DFM Thailand Team, 2021)*

4.4.1.3 Talad Tha Tien

The market was once the most prominent trading center in the 17th to 18th century. Located in the heart of Bangkok, it is in the historical district of Bangkok, near touristic landmarks like the Grand Palace and the Chao Phraya River. Although the market is not well-known among consumers, it is popular among older vendors, as one of the leading wholesale markets in the country. Today, the market remains at its primary function, as a key trading hub for dried fish products. Dried fish sold at this market are from Talad Mahachai and other coastal provinces like Samut Sakhon, Chonburi, and Rayong, as well as from the South. Some vendors go to the provinces and buy the products themselves. Aside from the regular customers, including tourists, retailers, and hotel and restaurant owners, they also sell to supermarkets and offer delivery services by post or courier for large orders. Figure 4.12 shows a typical dried fish store in Talad Tha Tien.

Figure 4.12. *Dried fish stalls in Talad Tha Tien. (Photo credit: DFM Thailand Team, 2021*)

4.4.2 Supermarkets, groceries, and convenience stores

Dried fish sold in grocery, convenience stores, and supermarkets are mostly cooked and in 'ready-to-eat' packaging. It often includes information about the product in Thai (and sometimes in English), with labels showing the ingredients, nutritional values, and an indication that they meet the required health and safety standard. Some products include a 'halal' food symbol to indicate that the food conforms with Muslim dietary laws. The cooked dried fish products often have different flavors, including spices and herbs, to meet the popular taste of the consumers, and also to be sold as 'healthy snacks.' The dried fish products found in high-end supermarkets are wrapped in attractive packaging, and sold at a higher price, compared to those sold in low-end stores. Figures 4.13, 4.14, 4.15, and 4.16 are examples of varieties of dried fish products sold in supermarkets, grocery stores, and convenience stores in Thailand.

Figure 4.13. *Cooked dried anchovies available in one of the popular supermarkets in Thailand showing the original crispy anchovies and flavored crispy anchovies (with herbs) in simple packaging. (Photo credit: DFM Thailand Team, 2019)*

Figure 4.14. *Dried anchovies in one of Thailand's niche market showing the original crispy anchovies and flavored crispy anchovies (spicy sweet and sour) in unique and attractive packaging. (Photo credit: DFM Thailand Team, 2019)*

Figure 4.15. *A. Dried shredded squid (baked) and B. flavored dried shrimp (deep fried with herbal flavor) available in one of Thailand's niche market. These products are from OTOP (One Tambon One Product) which is made by local people. C. Squid snacks sold at Thailand's most popular convenience store. (Photo credit: DFM Thailand, 2019; N. Almine, 2023)*

Figure 4.16. *Cooked dried anchovies in variety of flavors and packaging sold at one of Thailand's high-end supermarket. (Photo credit: DFM Thailand Team, 2019; N. Almine, 2023)*

4.4.3 Traditional markets

Dried fish is traditionally sold in local markets. Local markets serve as a place for people to buy produce, dried goods, and other necessities. It is also a place of interaction among people. Although the air-conditioned, large and small convenience stores and supermarkets are attractive options, local people rely on open-aired markets for their staples. The shop owners and customers in local markets are often familiar with each other and going to the market means updating each other on the family news and current affairs. During the COVID-19 pandemic, regular customers continued to shop at the local market and keep the traditional vendors going. Prices of products in local markets are negotiable. Negotiating for prices, a well-known Thai cultural tradition, is a skill developed as part of visiting the market. Figure 4.17 shows the variety of products available in traditional local markets.

Figure 4.17. *Variety of dried fish products sold in traditional local markets. (Photo credits: DFM Thailand Team, 2019)*

Some local markets are organized and managed by the municipal office. Some are run by private market associations. In either case, vendors pay a small fee to have their stalls in the market. Local

markets vary in size but carry similar items, from fresh fruit and vegetables to meat, fish, and seafood, both fresh and dried. Markets in tourist areas often have shops that sell pre-packaged, popular dried fish items to visitors.

4.4.4 Export market

Dried fish products are critical to the economy of Thailand. The main seafood products for export include fresh and frozen shrimp, squid, cuttlefish, short-necked clam, boil-dried anchovy, and canned tuna (Janekitkosol et al., 2003). Based on a report Thailand Inspection Office, the amount of dried anchovies exported from 2012 to 2015 reached 174,964 tons (Somrith, 2017). Moreover, based on a recent DoF report, dried shrimp exported in 2023 reached 0.03 tons and was valued at 10 million baht (approximately USD 303,000), while dried squid export was 47.76 tons and was valued at 25.9 million baht (USD 784,848) (www.fisheries.go.th/strategy-tradestat/). Dried shrimp (*Penaeus* spp.) and dried anchovies (*Stolephorus* spp.) exported to countries such as Nepal are sold mainly as snacks (Pradhan et al., 2017).

However, there are several challenges facing medium and small-scale enterprises, handling traditional products (such as dried and fermented fish and shrimp) in exporting their products. Traditional medium and small-scale processors are required to follow certain protocols in processing before their products can be exported. At a minimum, their products must pass a quality control based on the worldwide standard for food safety called Hazard Analysis and Critical Control Point (HACCP), which Thailand adopted since 1996 (Keerativiriyaporn, 2003).

In addition, in 2016, the Food and Agriculture Organization reported some cases of border rejections for anchovies exported from Thailand. The cases included issues with labeling (6 cases), packaging (2), *Salmonella* (1), and unfit for human consumption (1). As a result, the Thai authorities have imposed strict implementation of rules and regulations on product quality assurance so that in 2019, there were no cases of border rejections recorded (FAO FishStatJ, 2023).

4.4.5 Online market

During the COVID-19 pandemic, strict regulations were implemented, prompting many fishers and seafood vendors to turn to e-commerce to support their livelihoods. The market closures disrupted the flow of products, thus challenging the access to food and markets. Then, traditional dried fish vendors became interested in online selling during the COVID-19 pandemic. However, some vendors did not find it cost-effective due to the high level of competition. Some vendors maintained both traditional storefront transactions and online selling to gain wider reach for their products. According to the vendors, the number of vendors had decreased in the years before the COVID-19 pandemic. The travel restrictions have made transactions worse for the markets. Also, with the lack of tourists, as major consumers, vendors had to become creative and resourceful to maintain their livelihoods and income during the pandemic. A more detailed report on the state of e-commerce or online marketing of dried fish in Thailand is presented in Chapter 5.

4.5 Challenges and concerns in the dried fish production

Many studies focus on the quality of dried fish products due to health-related concerns. Without refrigeration, products can develop mold on the surface of dried fish, especially when the humidity during open-air transport is higher than the inside packaging (Suhem et al., 2022). This is the case of anchovies. Due to high protein content and unsaturated fatty acids, the quality of dried anchovies is likely to change during storage. Another concern is the bacterial contamination in some dried seafood products. Nimrat et al. (2019) found that some products may contain bacteria exceeding the allowable limit, and consuming dried fish products that do not meet health standards may pose a risk of foodborne infections. Microplastics are also becoming a global food risk issue and the presence of microplastics in kapi (Sutthacheep et al., 2021) raises health concerns and needs to be properly addressed.

Generally, food waste and food loss due to poor post-harvest quality control are the main problems in the dried fish value chain (Ali & Akester, 2021). The majority of food wastage and loss occurs during the post-harvest phase, which occurs after production and before processing, primarily due to insufficient knowledge in handling procedures. In Southeast Asia, the food loss within the fish supply chains can reach up to 25%, mainly attributed to suboptimal product handling practices. Research findings indicate that factors such as subpar storage conditions, the absence of ice or refrigeration, poor transportation systems, insufficient market infrastructure, a poor packaging contribute to this issue in countries like Cambodia and Myanmar (Ali & Akester, 2021). Dried anchovies experience rejections when they failed to meet the export standards such as in the case of Thailand in 2016. Based on FAO reports, border rejection issues on exported products include

labeling, packaging, and traces of *Salmonella* which can cause the product to be unfit for human consumption (FAO FishstatJ, 2023).

Dried fish processing can be challenging, especially for home-based, small-scale processors. Generally, they rely on the heat of the sun or firewood as a conventional way to dry the fish; however, sun drying can be problematic in the rainy season, and using firewood as an energy source is not as efficient. Moreover, using firewood comes with an environmental concern such as smoke and clear-cutting of trees. One of the challenges with dried shrimp processing is color fading. It usually happens, and it is critical during processing and packaging. In most cases, the bright orange color of dried shrimp fades and becomes unappealing to buyers. For the dried fish vendors, the challenges they face are related to the rising cost of the products, uncertainty on the product's availability, and transportation issues, such as congestion and unreliability and competition with other vendors including large-scale supermarkets.

4.6 Responses to the issues and challenges

In order to meet the food quality standard for exporting dried fish products, Thai DoF actively disseminates information about the quality standard to the processors and traders. The DoF also works closely with small and medium enterprises wanting to improve their facilities to meet the export requirements. Some recommendations have been made to prevent foodborne disease from dried fish products. For instance, a public education campaign has been organized to generate biosafety awareness and to decrease improper behaviors during dried fish preparation and handling

(Nimrat et al., 2019). Furthermore, in order to reduce food loss and waste within the fishery supply chain, Thai authorities have made significant investments in automating processes and implementing traceability systems throughout production and processing (SEASOFIA, 2022). Overall, efforts from Thai authorities have been directed towards enhancing logistics and transportation, improving packaging, and implementing advanced information technology for temperature monitoring, all of which play a critical role in minimizing food loss during distribution (SEASOFIA, 2022).

The presence of microplastics in some dried fish products needs to be addressed. In the case of kapi, the Marine Biodiversity Research Group (MBRG) at Ramkamhaeng University, which conducted a study on microplastic occurrence in kapi, is conducting a pilot project to work with local communities to improve production processes. This is primarily related to cleaning of the raw materials to reduce microplastic contamination. It is also worth considering to investigate the origin and quality of salt used in fish processing to assess its potential contribution to plastic contamination in the final products. On the issue of color fading in dried shrimp processing, several groups have come up with innovations to improve the value addition and quality of dried shrimp. For instance, community groups, including mostly women, make dried shrimp mixed with turmeric and salt (Thanthong et al., 2017). In addition, the utilization of a rectangular spouted bed for shrimp drying has been found to yield shrimp products of high commercial quality (Thanthong et al., 2017).

Several techniques have been developed to maintain the quality of dried fish and avoid health and safety issues for consumers. In Thailand, Matan (2012) experimented the use of whey protein edible film incorporated with essential oils to fight against molds. Also, Suhem et al. (2022) recommended using bamboo sachets containing *Litsea cubeba* oil emulsion instead of chemical preservatives directly on dried fish to increase shelf life and prevent the growth of mold ensuring the food safety of dried fish. In some countries, like India and Cambodia, low-cost and efficient ways of drying the fish are being studied, for instance, using solar energy for drying fish (Sengar et al., 2009; Hubackova et al., 2014). In Thailand, the interest in solar energy is increasing, with the government aiming to promote clean energy (Putranon & KMIT, 2018). Another way to dry fish is the use of microwave (Jumrat et al., 2021). By utilizing a high voltage power supply to generate a continuous microwave field, it helps with the evaporation of moisture thus reducing drying time and contamination from dust and pathogens. Another alternative for drying is by using a combination of hot air and infrared radiation to dry shrimp (Tirawanichakul & Tirawanichakul, 2011). This method has resulted in a uniform color of dried shrimp which means it could increase the quality and thus the price of the product. Although these alternative drying techniques are still under investigation and requiring increased capital investment, they can help improve product quality, and eventually lower the cost of the total production. Moreover, it can also help deal with weather uncertainties, the need for large drying areas, insect infestation, and other contamination problems (Tirawanichakul & Tirawanichakul, 2011).

Chapter 5 – Online marketing of dried fish in Thailand

This chapter describes the online marketing of dried fish products in Thailand that was rising during the COVID-19 pandemic. The study identifies the different online market channels, online marketing strategies, and tools utilized by dried fish vendors to adapt to the digital environment before and during the pandemic. The study also describes the challenges and opportunities, based on the analysis of results of the empirical virtual study on Facebook dried fish vendors in Thailand, conducted from January to May 2022 using Netnography.

5.1 Research method and data collection

The study utilized both a desk study and the empirical virtual study using Netnography, which is discussed in the next section. The desk study involved the collection of secondary data from global case studies describing opportunities in online marketing of dried fish and related fishery products. For the empirical study, a purposive sampling procedure was used to generate an initial list of dried fish online vendors, based on those listed in www.smeleader.com. This website is Thailand's popular media and news company with a focus on SMEs, franchising, e-commerce, trading, business ideas, and business opportunities. From the initial list, more online vendors were added, particularly from Facebook pages.

The empirical study aimed to identify the dried fish marketing strategies during the COVID-19 pandemic, via e-commerce or online marketing. It also described the challenges and opportunities with the use of online platforms to sell products, especially when facing constraints like those imposed by the COVID-19 pandemic. Information about dried fish online vendors in Thailand was collected based on data available on Internet. The method is a convenient means to extract relevant information for online commerce research, especially in times of the pandemic, where health-related restrictions limited in-person data gathering.

A total of 72 Facebook pages and 58 Facebook groups were found to be actively involved in dried fish marketing in Thailand. Inactive Facebook pages and Facebook groups, i.e., those not showing any recent updates since 2021, were excluded from the list. These Facebook groups and Facebook pages were monitored for the study from January 2022 to May 2022. By following and liking the Facebook pages and joining the Facebook groups, it was possible to access their posts and to observe interactions between the vendors and the buyers. However, Facebook has a rule that limits "likes" and "follows" to a maximum of 30 per day. When this limit is exceeded, the system automatically logged out the Facebook account until the next day. This restriction posed a certain challenge to data collection, given the busy traffic in the number of dried fish vendors.

The data collected consists of records of the following variables: basic facts about the vendor, such as as the year they were established on Facebook, their location, their products, prices, and how they advertise them, number of followers, and the method of payment and delivery. Because of the Thai language settings on Facebook in Thailand, translation was critical at this stage. Google

Translate (https://translate.google.com/) was used in the initial round of data collection, but the data was later validated by a local Thai translator.

The "comments" section is an important aspect of monitoring, because it shows the interaction between the vendor and the buyer. It also helps identify customer transactions and feedback, which is important for online buying and selling. The comments section serves as a review allowing the buyers to decide whether to buy from a certain vendor or a product or not. Again, Google Translate was used to help with the initial translation of the comments.

Furthermore, a remote survey was conducted to help complete the picture of dried fish online marketing in Thailand. The survey questions were developed according to the Memorial University of Newfoundland ethical policy requirements for research involving human respondents and approved by the Interdisciplinary Committee on Ethics in Human Research. It consisted of a structured questionnaire using Google Forms which was translated into Thai. The survey included questions about the vendor's demographic information (such as age, gender, and educational background) and about their experiences and perspectives on dried fish online marketing using Facebook (Appendix I). The remote or online survey was chosen because it was the most practical option to reach the target groups at the time of the pandemic.

The survey was circulated to 100 dried fish vendors through the Facebook Messenger application. They were provided with information on ethical aspects of the study, such as privacy, anonymity, and confidentiality, and were able to decide whether to participate in the survey or to allow screen

capturing of the Messenger conversation. Fifteen vendors completed the survey. While response rate is low (15% response), this was expected, given the self-selection nature of the study, the remote survey approach taken, and the COVID-19 pandemic. All data, including the list of dried fish vendors and screen-captured chat conversations, were anonymized and securely stored, following the ethical research protocols. Data was collected and transcribed in a tabulated form using Microsoft Excel for data analysis and triangulation.

5.2 Netnography

Netnography is a relatively new qualitative research methodology that adapts ethnographic research techniques to study culture in online communities (i.e. social media) (Kozinets, 2002). It enables access and analyses of social interactions, behavior, and trends, providing in-depth insights into online communities such as social media platforms like Facebook, Instagram, etc. (Kozinets, 2015). As explained by Kozinets (2002), netnography focuses on human stories and human understanding of people using these technologies, rather than studying the Internet, the devices, and the technologies with which it is associated. As a research method, netnography is faster, simpler, and less expensive than traditional ethnography, and more naturalistic and unobtrusive compared to focus groups or interviews (Kozinets, 2002), by observing social interactions and collecting data based on social media or online community posts and comments, among others. Findings are interpreted in the context of research objectives and validation through triangulation and comprehensive reporting is essential. Netnography is a valuable research method for exploring online cultures and social dynamics.

For this study, the online community I focus on is the group of Thai vendors selling dried fish on Facebook. Facebook is the most popular social media platform in Thailand, but it is also growing in popularity globally as an emerging tool for businesses. Many businesses use Facebook to sell their products and services online, to maintain businesses and reach wider customers. Netnography involved observation and analysis of online discussions, posts, comments, and other forms of online communication on the targeted Facebook groups and Facebook pages. The output of the analysis provides insight into the culture, attitudes, and behavior of individuals (including buyers and vendors) within these online communities. The netnographic data collected includes texts, images, videos, and various forms of digital content shared within the Facebook groups and Facebook pages, to identify patterns, themes, and cultural norms within the particular online communities.

5.3 Different e-commerce models and channels

E-commerce has a rich history. In the 1960s, the first electronic transaction was conducted using Electronic Data Interchange (EDI) which allowed the exchange of business documents with machines from other companies (Zheng et al., 2009). In 1984, CompuServe introduced the first Electronic Mall, allowing users to make deferred purchases in more than 100 online stores (Simakov, 2020). Although this service was not very successful, it was one of the first examples of online retail transactions (Simakov, 2020). In the 1990s, the World Wide Web or the Internet was introduced to a wider audience, paving the way for businesses to start e-commerce (Zheng et al., 2009) . The first online retail transaction was in 1994, when Netscape 1.0 released a protocol

called Secure Socket Layer (SSL), which provided the security on personal information for both the sending and receiving sides of online transactions (Simakov, 2020). Then shortly afterwards, the third-party credit card processing companies were established which significantly increased the opportunities for financial transactions in e-commerce, becoming a significant driver of e-commerce development in the world (Simakov, 2020). On August 11, 1994, according to The New York Times report, the first-ever secure online transaction was made possible by a man named Phil Brandenberger of Philadelphia who purchased a CD album by Sting which costs USD 12.48 from his computer through a payment system developed by NetMarket. This has opened opportunities to today's popularity of e-commerce giants such as Amazon and eBay (Simakov, 2020).

The term 'e-commerce' was introduced by Michael Aldrich in 1979 with the invention of e-shopping (Aldrich, 2011; Simakov, 2020). It originally meant the process of conducting commercial transactions electronically over computer networks (Simakov, 2020). With advent of the Internet, e-commerce began to include electronic trading of physical goods and of intangibles, such as information (Zheng, 2009). Zheng (2009) describes 'electronic' as referring to electronic technology, tools, equipment, and systems, including telephone, telegram, television, facsimile, email, electronic data interchange, computer, the communication network, credit card, electronic money, and Internet. In 2000, the term 'e-commerce' was defined as "the process of buying goods and services over the Internet using secure connections and electronic payment services" (Simakov, 2020). According to Simakov (2020), the largest form of e-commerce called business-to-business (B2B) had about USD 700 million in transactions in 2021, which paved the way to the dynamic growth of e-commerce worldwide.

E-commerce emerged in Asia, Latin America, and Central and Eastern Europe in the 2000s (Reardon et al., 2021). It is considered a convenient means for commercial transactions, especially since it can provide a 24 hour-a-day 'virtual' strorefront for the business. E-commerce offers a straightforward and fast way to purchase goods and services, with quick delivery and easy returns. Further, because of the global reach, it is possible to distribute products to customers worldwide, through e-commerce sites. From the seller's perspective, e-commerce is easy to participate since it has minimal startup and operating costs, especially because a physical shop is not required.

As shown in Table 5.1, there are several e-commerce models. The business-to-business (B2B) model, which is the largest form of e-commerce, describes the transaction between businesses, and it often involves a higher volume of product than other models. Business-to-consumer (B2C) is the most popular form of e-commerce, related to business transactions to end consumers (Nemat, 2011). The direct-to-consumer (D2C) model is an online retailing model applied mostly to subscriptions and online marketing via social media like Instagram, Pinterest, and Facebook. E-commerce models also include two forms that are initiated and driven by consumers. The consumer-to-consumer (C2C) model usually takes place on platforms like eBay and Etsy, while, consumer-to-business (C2B) applies to influencers offering exposures, photographers, consultants, freelance writers, among others.

During the COVID-19 pandemic, B2B and B2C e-commerce platforms have grown significantly, partly to address to food problems, for instance, in Latin America and the Caribbean, where products such as fruits, vegetables, dairy products, meat, fish, and semi-prepared foods were the

most in demand products (FAO & CEPAL, 2020). Part of the growth of the B2C e-commerce was due to the rise in social media stimulated by an increased use of mobile devices, and improvements in Internet connectivity and process innovation (FAO & CEPAL, 2020). While e-commerce was already growing quickly before the COVID pandemic in Asia and Latin America and other emerging markets, COVID-19 accelerated its growth (Reardon et al., 2021). During the pandemic, many vendors turned to online marketing to deal with the COVID-related challenges. In Argentina, for instance, a growth of 63% on real online sales was reported for the first half of 2020, with 30% growth in orders and 14% higher traffic, thus indicating an intensive use of e-commerce (CEPAL & Adenauer, 2021). In the Philippines, Facebook groups were created for buying and selling food especially within the neighborhoods (Arceño et al., 2022). Online transactions increased significantly for businesses such as Walmart and Amazon, where consumers spent 35% more to buy their essential items (Adibfar et al., 2022). In Vietnam, online shopping for food and grocery products has increased by 13% in the first quarter of 2021 and Shopee, a popular online store, recorded a 300% increase in confectionery and home-cooked food purchases (Nguyen et al., 2021).

Many countries implemented various initiatives to increase vendors' participation in e-commerce. Several examples are found in Latin America and the Caribbean where e-commerce initially emerged. Argentina launched the "SMEs Digital Assistance Network" to support vendors with resources and tools including information about payments, invoicing, sales and distribution solution to increase the vendors digital presence (CEPAL & Adenauer, 2021). In Chile, the "Cooperation COVID-19" website was set up with information and resources aimed at promoting exports (CEPAL & Adenauer, 2021). In Costa Rica, the government developed the "Buy-SME" platform, which is a smartphone application that facilitates trade among producers of agricultural,

meat and fish products, with more than 900,000 registered producers (CEPAL & Adenauer, 2021). The Dominican Republic developed a B2B platform to connect with foreign potential buyers. Similar examples can be found in Brazil, Colombia, Mexico, Panama, and Peru.

Table 5.1. *Types of e-commerce business models. (Source: desk study)*

E-commerce business models	Description
Business-to-business (B2B)	Transactions take place between a manufacturer and a wholesaler, or between a wholesaler and a retailer.
Business-to-consumer (B2C)	The most popular form of e-commerce, operating in online retailing or the same way as with B2B but in a lower volume.
Direct-to-consumer (D2C)	Commercial brands sell directly to their end-consumer, without going through a retailer, distributor, or wholesaler.
Consumer-to-consumer (C2C)	Consumer sells goods and services to another consumer.
Consumer-to-business (C2B)	Individuals sell their services or products to a business organization.

Amazon, eBay, and Alibaba are some of the top B2C e-commerce companies, globally. In Southeast Asia, Shopee and Lazada are the top B2C companies. Shopee, a subsidiary company of Sea Limited, was established in 2015 in Singapore and has expanded in Malaysia, Indonesia, the Philippines, Taiwan, Vietnam, and Brazil (Khanijoh et al., 2020). Lazada was founded in 2012 and commenced in Singapore, with products coming from Alibaba's warehouse (Khanijoh et al., 2020). Meanwhile, in Thailand, there are three e-commerce market channels (Lilavanichakul, 2020), namely social media (40%), e-markets such as Shopee (35%), and websites (25%). Social media includes Facebook (75%), Instagram (40%), and Line (29%) (Ackaradejruangsri, 2015). Based on Internet World Stats (2021), there were 46 million Facebook users in Thailand in 2019 making it the 7th of the highest number of Facebook users in the world. This is more than half of the population of Thailand in 2021 (population of 69,950,850) (United Nations, 2021). As a result,

the majority of online businesses uses Facebook as an approach to selling and connecting with their consumers (Marsden, 2011). Selling online, particularly on Facebook, ensures a wider reach to diverse customers, locally and internationally.

5.4 COVID-19 and market access in Thailand

On April 3 and 4, 2020, the Thai government imposed a nationwide curfew and lockdown to comply with COVID-19-related health protocols. The implementation of health-related lockdowns has resulted in restrictions on interstate and cross-border travel, as well as domestic and international flights (MOPH, 2020). Thailand is one of the countries that acted earlier and ranks very low in COVID-19 infections (Chanrachkij et al., 2020). Global lockdowns, social distancing, and quarantines have been implemented to prevent the spread of the virus, but they created challenges in access to markets. Many businesses, including food businesses, have struggled during the pandemic. The supply and demand for fish has declined, particularly impacting the livelihoods and income of already vulnerable small-scale fishers (Chanrachkij et al., 2020; Arai et al., 2022). As a result, during the pandemic, most small-scale fishers primarily focused on restoring their income to meet their daily needs by relying on online fish products sales. The strict regulations and market closures made access to food difficult (Thammachote & Trochim, 2021; FAO, 2020a). The market closures and social distancing have also prompted changes in consumer demand (FAO, 2020a), with people turning to processed foods such as dried fish, primarily due to their availability and low prices.

5.5 Online marketing in Thailand

Dried fish and other seafood are usually sold in shops and traditional markets. However, with the advancement of technology in the digital age, some companies have taken a step towards using online platforms to expand their businesses. In most cases, businesses combine physical stores with online shops. Online marketing has been trending in some regions, including Asia, since the 2000s (Reardon et al., 2021), but peaked during the pandemic. In the face of a crisis, vendors need to be creative and resourceful to sustain their business and revenue despite the challenges posed, for instance, by the COVID-19 pandemic. Some businesses have moved to online sales to stay in business and meet steady consumer demand. In Thailand, dried fish products are available on popular e-commerce platforms or e-markets such as Alibaba, eBay, and Amazon, mainly for the international market. On the other hand, Facebook Marketplace allows anyone with a Facebook account to buy and sell products locally.

In March 2020, when the global lockdown began, Thailand saw a 60% increase in shopping applications downloads in just one week (UNCTAD, 2021). E-commerce has become a growing business model, and many dried fish suppliers have used online platforms to buy and sell their products, serving both domestic and international markets. Based on the remote survey results, most Thai vendors sell their products online through Facebook. Some vendors also utilize a combination of various online platforms including Line, Shopee, Lazada, and Instagram. Online selling via Facebook is also referred to as Facebook commerce or "F-commerce" (Marsden, 2011).

5.5.1 Dried fish marketing on Facebook

The Facebook vendors have diversified and not only sell exclusively on Facebook, but they also use multiple online selling platforms. For example, Figure 5.1 shows that 27% of respondents sell products on both Facebook and Line, 13% combine Facebook, Shopee, Lazada, and Line, and so on. Using multiple online selling platforms ensures greater customer reach and maximizes sales.

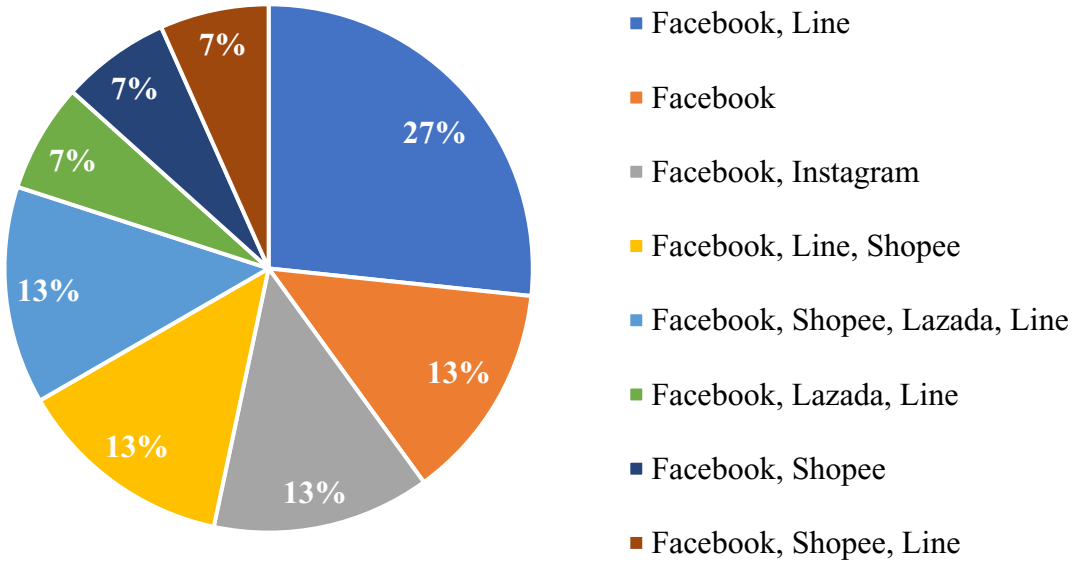

Figure 5.1 Mixture of different online platforms utilized by dried fish vendors in Thailand based on the remote survey.

The Facebook vendors in Thailand are efficient, using B2B or B2C models to serve the broader consumer market. This is backed by the nature of their business, as most do wholesale and retail. Apart from their Facebook shop page, some vendors also have physical stores, often in local markets. To get the most out of the Facebook shopping experience, they also utilize the Facebook

Live streaming application. Facebook Live was launched to users in August 2015, and by April 2016, video streaming was accessible to all Facebook users (Liao et al., 2022). Facebook Live selling is a creative step in Facebook commerce, where seller interactions and expressions are sent to customers in real-time, digitally realizing a sense of direct and synchronous communication between customers (Wongkitrungrueng et al., 2020; Chen, 2018). This is also referred to as conversational commerce or "c-commerce". Based on results from the remote survey, 18% of the respondents use live streaming to sell products. The vendors also create videos of their daily activities to encourage customers to buy their products, for instance, videos on how to make dried fish, and packing and shipping of their products. In this way, online vendors offer their customers an engaging way for their customers to follow them and support their business. In some instances, vendors share their personal stories with their followers allowing for social interactions and building connections (Wongkitrungrueng et al., 2020).

In terms of marketing strategies, the vendors usually promote the quality of their products (e.g., that they are freshly caught and processed immediately), health benefits, and whether they are halal certified. The increasing number of online shoppers and the changes in market access in the fish supply chain possibly influenced the rapid growth of online selling.

5.5.1.1 Facebook page and groups

The netnographic data obtained by following 61 Facebook vendors selling dried fish showed these Facebook vendors or pages have been around more than ten years. Since then, the number has

been increasing, for instance, in 2017, there was a 21% increase. The largest Facebook vendor in Thailand in terms of the number of followers was created in 2018 with more than 2 million followers and this is still growing. On the other hand, based on the netnographic data, Facebook groups involved in dried fish selling were created since 2012. Same with the Facebook pages, Facebook groups are also continuously growing, for instance, in 2021, there was a 40% increase (Fig. 5.2).

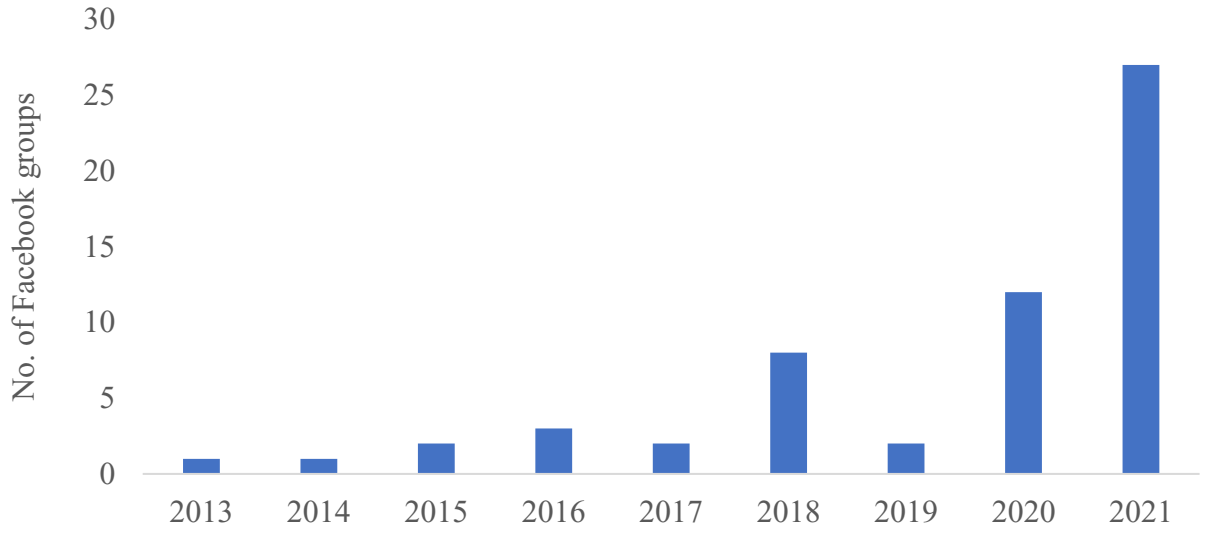

Figure 5.2. *Growth of Facebook groups created for dried fish online selling in Thailand based on the netnographic study.*

A Facebook group can be public or private, it is a place where members can communicate about shared interests; membership in a Facebook group is usually free of charge. However, a private Facebook group require membership approval in order to become a member. In some instances, the group administrator sometimes requires a membership fee so that the members can post their products in the group. The membership fee however varies greatly depending on the group rules

imposed by the administrator. For example, one group asks for 99 baht (USD 3) per year, some require 2,500 baht (USD 45) per month. Once the member has paid the membership fees, all their recent and upcoming product posting will not be deleted nor blocked from the group and posting could be unlimited.

5.5.2 Dried fish sold online

As one of the leading producers of seafood, Thailand offers a wide range of seafood products whether fresh, frozen, dried, salted, smoked, or fermented. From the netnographic data, it was found that the most popular dried fish products are dried squid, dried shrimp, salted fish (mackerel, tilapia, etc.), dried fish, and kapi. These products can be found at almost any Facebook online shops. This was supported by the result of the online survey where the most popular is dried squid (27%), dried fish (22%), dried anchovies (19%), dried shrimp (16%), shrimp paste or kapi (8%) and dried Mollusca or bivalves (8%) (Fig. 5.3). About 30% of the Facebook vendors sell dried squid, exclusively.

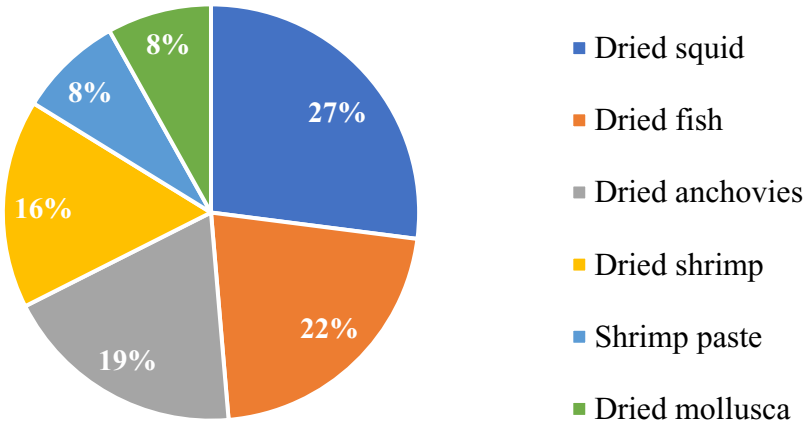

Figure 5.3. *Common dried fish products in Thailand based on the remote survey.*

5.5.3 Sales, prices, modes of payment and logistics

During the pandemic, the costs of most products have increased. While other vendors claimed that their sales (including online and traditional selling) have increased during the pandemic, the cost of products has become more expensive. As a result, most of the vendors during the survey claimed that their sales declined during the COVID-19 pandemic. Based on survey results, dried fish prices vary depending on product type, size and quality. For dried anchovies, a 70 g pack costs around 25 baht (USD 0.76) and a 100 g pack costs around 60 baht (USD 1.82). Dried squid and dried shrimp are usually more expensive than any other dried fish products. Smaller dried squid (1 inch in size) is around 750 baht per kilogram (USD 20), medium-sized (3 inches) costs around 850 baht per kg (USD 26), and bigger sizes (5 inches and above) can go around 950 to 1,500 baht per kg (USD 45). The prices are based on observation of Facebook posts during the research period.

Payment is preferred in cash for both vendors and buyers. Bank transfers are also widely used (50%) (Fig. 5.4), as they protect sellers from customer non-payment issues. This method of transaction is often done using a mobile app and scanning through a QR code provided by the vendor. Some buyers still prefer cash payment, as it ensures the delivery of their order. The method of paying cash for online sales is called 'cash on delivery (COD)', where cash is collected upon delivery. Some vendors also offer credit to regular customers. Credit means payment is deferred for 14, 30, or 45 days depending on their agreement.

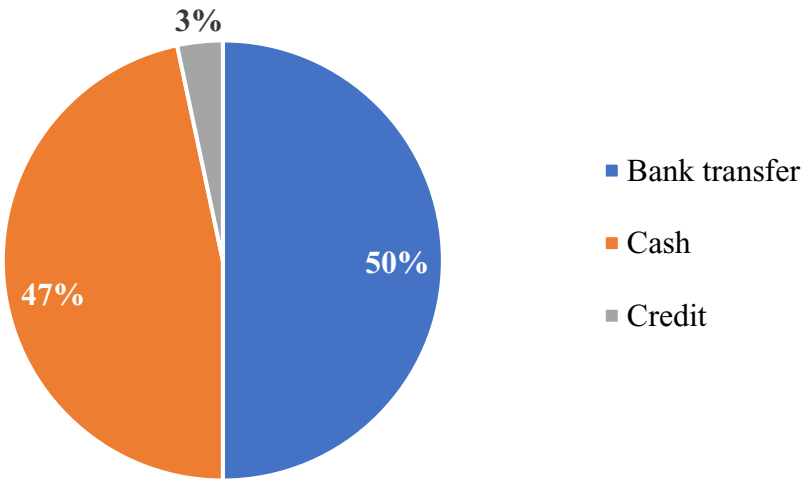

Figure 5.4. *Preferred payment options for buying dried fish online in Thailand, as determined by the remote survey.*

5.6 Challenges in dried fish marketing

Most vendors surveyed in this study claimed that online selling is good for their business. However, like any traditional business, online marketing faces problems and challenges including

expensive advertisement cost, customers unable to find their online stores, fewer customers because of competition, and logistic issues (Fig. 5.5). The vendors argue that there is a problem with expensive advertising cost. Boosting ads on online platforms is crucial to attract new and regular customers online. Vendors need to improve their online presence, otherwise customers will not find them. Survey results also show that logistics issues are a major challenge for online vendors. Logistic issues include product handling, delivery and arrival periods, which is usually out of their control. Proper handling of the product during shipping is crucial to maintain the quality of dried fish products. Packaging is another consideration, as are food safety and traceability standards. Then, the lack of consumer protection laws that accommodate digital trade makes e-commerce participants vulnerable to abuse (CEPAL & Adenauer, 2021).

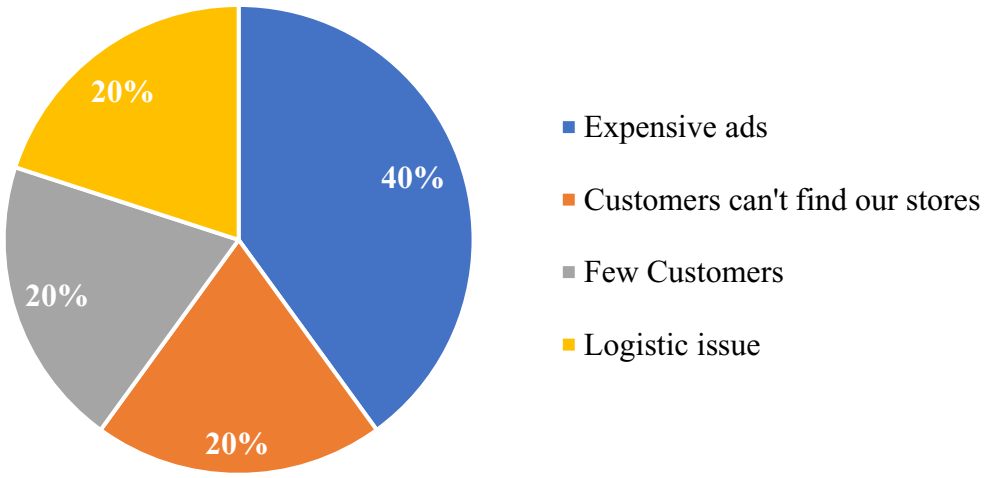

Figure 5.5. *Challenges on online selling of dried fish through Facebook in Thailand based on the remote survey.*

5.7 Online vendors

Results from the remote survey show that the majority of the dried fish online vendors on Facebook were in middle age. About 46% between ages 25 to 35, 40% were in the age group 36 to 46, and the rest belong to the age group 18 to 24 (7%) and 47 to 55 (7%). Of the total, most online dried fish vendors are women (67%). The majority have obtained a bachelor's degree (60%), completed a master's degree (20%), and finished secondary education, vocational certificate, or post-graduate degree (20%). Many of them have only relied on selling dried fish for their livelihood and income (73%), while 13% are also working as general employees, office employees (7%), and engaged in real-estate business (7%). About 53% of the respondents are sole proprietors of their business, and the rest have business partners.

Most of the vendors are from Samut Sakhon, Chonburi, Rayong, Nakhon Si Thammarat, Pattani, Prachuap Khiri Khan, and Samut Prakan. About 60% of the business were established more than five years ago and the rest were recently established, even less than one year from the time of the survey. Dried fish businesses continue to flourish in Thailand despite the many challenges in the value chain. It was not explicitly established whether the vendors themselves process the products; nevertheless, they indicated that they source their products from different provinces, not relying on only one source. Based on the survey, most dried fish products are from the South region, composed of provinces such as Chumphon, Krabi, Ranong, Yala, Songkhla, Pattani, Narathiwat, Phang Nga, Surat Thani, Phatthalung, Satun, and Nakhon Si Thammarat, and the rest are from other provinces as shown in Figure 5.6. Interestingly, Yala and Phatthalung in the South region

are not coastal provinces, which means they do not have direct supply of fresh fish; and it was not known whether they have dried fish processing plants, thus the issue needs further study.

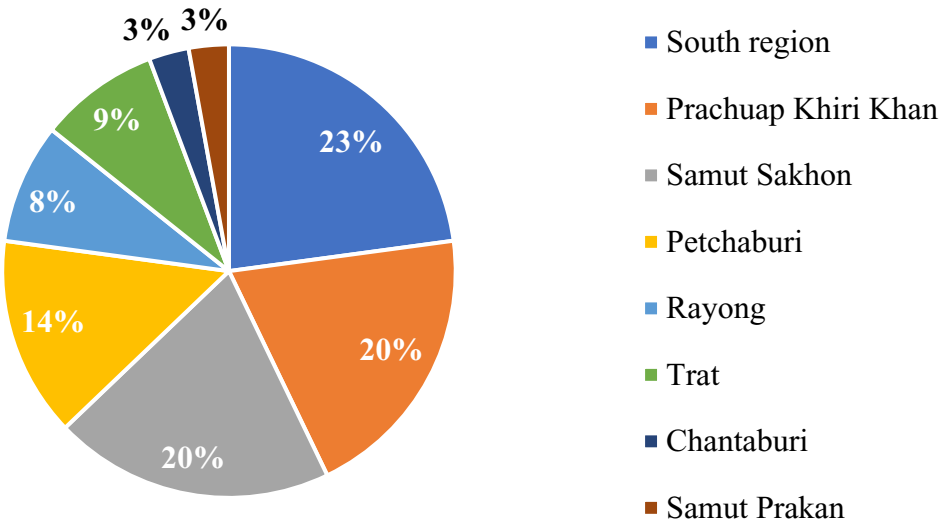

Figure 5.6 *Distribution of dried fish product source in Thailand based on the remote survey.*

5.8 Online consumerism

Online shopping is a growing market globally, having grown significantly during the COVID-19 pandemic, primarily to fill gaps in basic food supplies (FAO & CEPAL, 2020). Before the pandemic, the online consumer market was estimated to have reached an average of 17% of the population in Latin America and the Caribbean (Bravo-Peña, 2018), and in other regions worldwide. Social network shops like Facebook are preferred by most businesses and consumers for their popularity and convenience. Factors that influence consumers when shopping online include reasonable prices, store reliability, product quality and payment system security (Ackaradejruangsri, 2015).

According to a Thai online consumer survey, on buying ready to eat healthy food on Facebook, conducted by Laochariyakul (2014), the majority of online shoppers are female (80%) and male (20%), aged between 25 and 35 years old. They have bachelor's degree (59%), master's degree (41%), and an average monthly income of 25,001 baht to 35,000 baht (USD 757 to USD 1,060) (41%). Indeed, in Thailand, online shopping is popular among young working professionals, mainly women, probably because they spend more time on the internet. However, in some countries, like Mexico and in some parts of Central America, men are, on average, more active on the internet than women (CEPAL & Adenauer, 2021). In some cases, less educated women in rural areas are less likely to own a mobile phone than men. This creates a degree of gender gap in access to internet connectivity and preventing some women from participating and reaping the benefits of e-commerce (CEPAL & Adenauer, 2021).

The Thai online vendors claimed that most of their online shoppers are individual customers. Besides the individual customers, some retail stores (35%), other traders (24%), local restaurants (22%) and hotels (19%) also buy dried fish products online. Customers are coming from different parts of the country, mostly from Prachuap Khiri Khan, Samut Prakan, Samut Sakhon, Phetchaburi and Rayong. They also have foreign customers that are living in Thailand and Thai people who are living in other countries. These customers buy dried fish products in Thailand and bring them to the country where they currently live. The majority of the dried fish online vendors (80%) said they do not export their dried fish products and only sell to the local market.

5.9 Government responses

The government has imposed several programs to support Thai SMEs especially during the COVID-19 pandemic, including consumers. Government programs include tax credits, soft loans, cash benefits, and spending cuts for households and businesses. A government program called the "half-man project", which is primarily aimed at increasing domestic spending (Kiatsarapipp et al., 2021) was implemented. This project supports and revives the foundation economy by lightening the burden of the public expenditure and increasing the liquidity of Thai retailers. Foundation economy refers to the essential and fundamental economic activities that provide the basis for a stable and functional society. However, during the remote survey, dried fish online vendors said that they did not receive any government support, especially during the COVID-19 pandemic.

5.10 Implications and recommendations

E-commerce has become a growing business model for dried fish products, serving domestic and international markets. The emergence of many e-commerce businesses means a major shift in the dried fish market flow and value chain. There is a need to improve the ability to trade online, especially for small-scale fishers and micro, small and medium enterprises (MSMEs) (Chanrachkij et al., 2020), and sufficient government support is needed, while ensuring all stakeholders are aware of these programs. The pandemic has exposed many critical gaps in the food value chain. Lockdowns, entry and exit requirements for food carriers, and road disruptions have made it difficult for food to move from producer to consumer, resulting in significant food losses for both

fresh and perishable produce (CEPAL & FAO, 2020). It also resulted in difficulties in accessing food. However, dried fish products are an ideal substitute, since they have longer shelf life and are easily accessible, an affordable source of micronutrients crucial in maintaining healthy diets in times of crisis. Businesses in general, especially MSMEs, need government assistance to improve their business and deal with various challenges they are facing. Governments could develop a general framework of incentives that include smart demand and supply subsidies which is more targeted, efficient, or data-driven approach to subsidy allocation and management, support for incubators, accelerators, innovation clusters and better access to appropriate financial products for MSMEs and service providers (FAO & CEPAL, 2020).

Chapter 6 – Governance

The chapter focuses on the fisheries regulations in Thailand, highlighting the new Fisheries Act, how it was enacted and what are the provisions particularly relevant to the small-scale fisheries. The study discusses the changes in fisheries regulations and how their implementation impacts the different actors within the dried fish value chain. This chapter also discusses the governance in the post-harvest sector at the level of processing and quality standard and marketing and trade. This chapter provides an understanding of the governance issues, challenges, and opportunities in the dried fish fisheries and value chain in Thailand and identifies potential areas of improvement.

6.1 The new Fisheries Law and its provisions relevant to the dried fish fisheries

Generally, the high-priority issue in the marine fisheries in Thailand is the illegal, unreported, and unregulated (IUU) fishing, leading to overfishing and overcapacity, especially by commercial fishing fleets (DoF, 2015). In 2015, a 'yellow card' was issued by the EU to warn against IUU fishing that is happening in Thailand's fisheries sector. If unresolved, the imposition of a 'yellow card' signals a potential trade ban on the country's fishery products. To address this issue, the Thai government enacted the 2015 Royal Ordinance on Fisheries under the emergency decree (Kadfak & Linke, 2021). Because fish and seafood are major export products for Thailand, the government had to oblige and take an imperative emergency to combat IUU fishing and other sustainability and labor issues related to its fisheries sector. In January 2019, the EU finally lifted the 'yellow card' status, after the Thai government conformed to the warning.

The new fisheries law provides the principles and objectives for the governance and development of marine and inland fisheries in Thailand (*Royal Gazette* 2015). The new law, however, does not contain specific regulations directly related to the processing and marketing of dried fish; instead if focuses solely on regulation pertaining to harvesting. One of its important provisions includes the protection of spawning stocks and juveniles through closed seasons and areas and reducing the efficiency of fishing gear, according to the requirements for suitable mesh sizes for purse seines, anchovy purse seines, trawls, anchovy lift nets, and the bans on certain fishing gears, including push nets, which is the main gear used for the *Acetes* shrimp (DoF, 2015), a raw material for kapi.

6.2 Dried fish value chain governance structure and actors

The dried fish value chain governance structure in Thailand includes various actors and mechanisms that facilitate coordination, interaction, and cooperation at different stages of the value chain. First, in the harvest sector are the producers of raw fish who are mainly small-scale fishers. They engage in catching fresh fish and delivering them to the next stage of the dried fish value chain, processing. Dried fish processors receive raw fish from producers and process them using a variety of traditional or modern methods to wash, gut, and ferment or dry the fish to produce dried fish products. They can be large, industrialized scale, or a small-scale, family-run businesses operation. After processing, either processors sell them directly to the markets, or traders collect the dried fish products for further distribution to wholesalers, retailers, and export markets. Traders play a key role in the dried fish value chain, linking producers and processors to downstream markets and, often, they have extensive networks and knowledge of market

requirements, as they facilitate the flow of products and information. On the other hand, wholesalers and retailers serve as important intermediaries in the distribution of dried fish products. Typically, wholesalers buy dried fish products in bulk from processors and supply it to retailers and food service markets, while retailers sell directly to consumers in markets, grocery stores, supermarkets, and various online selling platforms. Then, exporters facilitate in developing the international markets by working with processors or traders to ensure compliance with export regulations, quality standards and buyer requirements. They handle logistics, documentation, and market information for the international markets. Exporters, traders, and processors have distinct roles within the dried fish value chain, each contributing to different stages of the production and distribution process. The certification of exporters, traders, and processors usually entails meeting specific standards, regulations, and requirements set by relevant authorities which can be influenced by international trade agreements or industry norms.

Various government agencies and institutions establish and enforce regulations related to fish production, processing practices, food safety and quality, and trade. It includes the Ministry of Fisheries, the Ministry of Agriculture and Cooperatives, the Food and Drug Administration and the Customs Department. Another important actor in the fish value chains are associations and cooperatives which represent the interests of stakeholders, enabling knowledge sharing, capacity building and collective actions. Its aim is to address common challenges and promote sector development in terms of quality standards, marketing and collaboration among different actors within the value chain. Finally, research and academic institutions also play a role in the governance of dried fish value chain, through research, training, and technical assistance.

6.3 Governance of harvest sector for small-scale fisheries

The 2015 Royal Ordinance on Fisheries explicitly recognized the "protection of special interests of artisanal fisheries and local fisheries communities" and prioritized general welfare conditions and workplace safety for fishers. Moreover, the new law defines small-scale fisheries as non-commercial fishing activities taking place in coastal seas, with or without a vessel. In which case, small-scale fishers are required to apply for a fishing license under prescribed requirements. The fisheries authority is empowered to grant such rights and issue the respective license with attached conditions and requirements (Nakamura et al., 2021). The new law also includes provisions on demarcation zones between artisanal and commercial fisheries in the coastal seas. Coastal seas are defined as areas within 3 nautical miles from the base lines, although the provincial fisheries committee can adjust this as appropriate. However, where they operate is a recurrent issue; thus, Thailand has established special zones for small-scale fisheries extending up to three nautical miles (Nakamura et al., 2021).

6.4 Governance of post-harvest sector

In the post-harvest sector, meeting various quality control standards is essential, alongside government assistance for SMEs. Policy documents governing the quality of dried fish products, intended for either domestic consumption or export, are particularly relevant. Take fish processing and manufacturing, for example, where adhering to good manufacturing practices (GMP) that includes controls on the condition and cleanliness of production and equipment, control of personal

hygiene, control of pests, among others and HACCP stands as a primary requisite (Keerativiriyaporn, 2003) Also, Thailand continues to develop and improve the fish and fishery products as mandated by importing countries, including Marine Stewardship Council (MSC) and the Food Safety Modernization Act (FMSA) of the USA (Suwannapoom, 2019).

6.4.1 Processing and quality standard

HACCP or Hazard Analysis and Critical Control Point, becomes well known when developed countries like USA as well as the European Union have incorporated it into their food regulations (Keerativiriyaporn, 2001). The new HACCP regulations, 21 CFR 123 of the USFDA and the directive 94/356/E.C. of the EU, impose fish processors to be responsible for identifying hazards that are likely to occur and for establishing critical control points to prevent or reduce contamination. As a result, Thailand has adopted the HACCP program and made it mandatory for its export-oriented fish processors since 1996 under the Department of Fisheries (Keerativiriyaporn, 2001). Although HACCP principles can be challenging to apply effectively at the early stages because they require training to understand the process better, it should not be seen as a trade barrier. The Department of Fisheries then is responsible for the inspection and export certification of fish products (Keerativiriyaporn, 2001).

According to Keerativiriyaporn (2001), the traditional fish products plants, which are dominated by medium and small-scale enterprises, have difficulties implementing HACCP principles because most of the requirements are still not yet in place, especially for most small-scale sectors. While

the small-scale sector is facing these challenges, the medium-scale sector is generally more ready to implement HACCP. In conclusion, the traditional product sector is the last group to join the implementation of HACCP, with an increasing number that effectively implementing HACCP for export purposes (Keerativiriyaporn, 2001). As the small-scale establishments face difficulties in achieving food safety requirements due to their limited financial abilities and technical knowledge, the government through the Ministry of Industry and the Small Industry Finance Corporation launched a project in 1992 to provide financial support to the industry. The project was successful as shown by the increasing number of small-scale establishments that have been granted HACCP certification (Keerativiriyaporn, 2001).

In addition to the international strategies such as HACCP, the Southeast Asian Fisheries Development Center (SEAFDEC) has developed strategies to improve the quality, marketing, and trade of traditional fish products in the Southeast Asian region. Through the Marine Fisheries Research Department (MFRD), the Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 states that "production of and preserving the diversity of traditional fish products should be promoted by assisting producers in securing stable supplies of quality raw materials, meeting food safety requirements and improving product identity, nutritive value, and marketing." With these provisions, MFRD developed HACCP plans for traditional fishery products and the improvement of local processing industries. The mechanization of the processing industry as well as automation of the production line will increase productivity. MFRD

implemented good manufacturing practices (GMP) and sanitation standard operating procedures (SSOP) (Pongsri et al., 2015). They also helped small and medium enterprises (SMEs) implement the said programs through Quality Assurance Systems for Small- and Medium-sized Fish Processing Establishments. The project developed necessary quality assurance systems for the SMEs that incorporate GMP/SSOP programs as the first step towards implementing HACCP systems and eventually helped SMEs meet safety and quality assurance requirements (Pongsri et al., 2015).

6.4.2 Marketing and trading

Traditionally, dried fish products are sold in local markets but with global technological improvements, businesses diversified and ventured into e-commerce or online marketing and trading, which peaked during the COVID-19 pandemic. In Thailand, e-commerce is governed by the Electronic Transactions Act (ETA) and the Direct Sale and Direct Marketing Act (Chaisiri, 2019). Both enacted in 2002, the laws apply to all commercial and civil transactions that use electronic means, except for specific contracts excluded by the Royal Decree. Generally, all e-commerce businesses are considered direct marketing and are required by law to register with the Ministry of Commerce, whether they only exist online or without a physical location where customers can examine the products.

For consumers, the Consumer Protection Act of 1979 applies to electronic transactions, stating that businesses should provide descriptions of the products they offer on websites, as all consumers have the right to comprehensive product information (Chaisiri, 2019). According to Chaisiri (2019), there are problems related to consumer protection in the case of Facebook Live sales. Based on the report, it was found that under Thai laws, consumers of Facebook Live sales are not protected because product and seller information is sometimes vague and lacking. Chaisiri (2019) proposed that Facebook vendors formally register their business with local business registry or government agency responsible for business registration before starting their online business. A specific regulation should also be enacted for foreigners operating sales on Facebook Live (Chaisiri, 2019). Meanwhile, there are certain exemptions to the registration requirement, such as in the case of a small or medium enterprise being registered under the Small and Medium Enterprises Promotion Act B.E. 2543 (2000) (Bunruangthawor, 2021). The Act aims to promote and strengthen SMEs in Thailand and align them with international standards (Government Gazette, 2000).

In addition to the national regulations, products sold on Facebook must comply with the commerce policies and Facebook's Community Standards which state that buyers and sellers are responsible for complying with applicable laws and regulations (Bradford et al. 2019). Failure to comply with policies may result in the removal of listings and other content, rejection of product tags, or suspension or termination of access to any or all Facebook commerce surfaces or features. Additional actions will be taken if vendors repeatedly post content that violates the policies. Facebook administrators further state that they reserve the right to reject, approve, or remove any listing for any reason at any time, at their discretion.

6.5 Governance challenges in the harvest and post-harvest sector

Overall, some regulations are considered too stringent, while others are incompatible with conservation and sustainability goals. For example, the ban on push nets and the closure of the upper Gulf of Thailand to gillnets with mesh sizes less than 5 cm are considered too stringent (Satumanatpan et al., 2019). Both conservation and sustainability goals are important, but fishers felt that gear bans should not be applied indiscriminately without sufficient data to support them. Example of regulations that may be considered too lax include the use of light luring devices in falling nets and lift nets, and the use of beam trawls, which target shrimps. These fishing methods are claimed to be harmful and destructive. Fishers were therefore confused as to why these fishing gears were allowed to remain in operation (Satumanatpan et al., 2019).

The drafting and adoption of the new fisheries law under the Emergency Decree has been completed in a very short period compared to the normal process. As such, implementation faced difficulties, as stakeholders could not be properly consulted. New fishing regulations such as gear restrictions pose a challenge, especially for the small-scale fisheries sector. The changes to certain fishing gear, in particular, are impacting the ability of small-scale fishers to catch fish, thus impacting their livelihoods and incomes and the overall dried fish value chains. As the majority of small-scale catches such as anchovies and *Acetes* shrimp are processed as dried products, thus, a disruption in the harvest sector impacts the production sector and the whole dried fish value chain, in general.

The request by key actors to change or revise the fishing regulations is ongoing work. During the COVID-19 pandemic, the socioeconomic wellbeing of fishers was severely affected (Chumchuen et al., 2022). In order to identify the government support for small-scale fisher, the Department of Fisheries emphasized that more than 12 regulations had been modified to become more appropriate to the fishers, including the expansion of prohibited inshore areas for squid falling net operations for small-scale fisheries, as well as the changing of fishing gear information in the fishing license for large-scale, industrialized fisheries (Chumchuen et al., 2022). Many of the requests from fishers are still under consideration, and the revisions or improvements to the present fishing regulations should be gradually and carefully considered concerning the socio-economic condition of fishers and fishery resources status in Thailand (Chumchuen et al., 2022). Additionally, it will relieve the impacts of the COVID-19 pandemic on fisheries and enhance fishers' resilience.

Meanwhile in the post-harvest sector, the products from home-based, small-scale processing could not easily compete with those produced by the modern processing industry in terms of quality and quantity, undermining the socio-economic advantage that could be derived from the small-scale, home-based fish processing industry (Pongsri et al., 2015). Undermining the small-scale processors' potential according to Pongsri et al. (2015) include insufficient raw materials and the low quality of the raw materials, the outdated processing and preservation technologies, low-quality packaging, and unappealing marketing practices that have seem unreasonable. Furthermore, there are several criticisms surrounding most processors of traditional fish products in Southeast Asia. For instance, processing used bycatch or low-value fish as raw materials, processors not well-educated, inadequate knowledge of preservation and processing techniques, and little access to skills development and information on food hygiene. These factors contribute

to the difficulty in complying with safety and quality standards and requirements of fishery products traded in the world market. Dried fish actors face various challenges related to changes in fisheries regulations and exacerbated by the impacts of the COVID-19 pandemic. Understanding the importance of the dried fish value chain and its governance, and the issues and opportunities related to access to resources and markets, particularly during the COVID-19 pandemic is important, especially to identify potential areas of improvement and in achieving the Sustainable Development Goals.

Chapter 7 – Discussion and recommendation

This chapter presents a summary of research findings from the literature review, an initial scoping study, and a rapid market appraisal. It also provides a synthesis of the data collected from two additional sources, i.e., the Internet using netnography and the remote surveys. It further discusses the limitations of the study and the main lessons learned, the chapter concludes with potential areas for research, and provides policy recommendations based on the research findings.

7.1 Declining fisheries production

Over the past decade, Thailand's fisheries production has greatly fluctuated, with a declining trend in the total production, particularly in anchovy, squid, and banana shrimp, which are the main raw materials for dried fish production. Thailand is one of the world's largest anchovy producers, with most of its catches coming from the large-scale fisheries sector, which contributes significant value to the Thai economy. Squid and banana shrimp are high-value commodities, especially when dried. The banana shrimp fishery, mainly caught by small-scale fisheries, shows an increasing trend in recent years, but catches are still low, when compared to the past ten years. Similarly, for *Acetes* shrimp which are caught only by small-scale fisheries, there has recently been a slight increase, although the production volume has been fluctuating over the last ten years.

There are several factors that contribute to the decline in fisheries production in Thailand including climate change, overcapacity, overfishing, and habitat degradation. IUU fishing is also contributing to the declining catches. The fluctuating trend in Thailand fisheries production, both in large-scale and small-scale fisheries, has direct impacts on the dried fish value chain since they provide the raw materials for dried fish processing.

7.2 Dried fish production

The production of dried fish can be done on various scales, e.g., in large-scale processing plants or at home using rudimentary processing methods. In both cases, women do most of the processing. Not only does dried fish provide a good and healthy food source, it also provides an income and livelihood for many people, especially women, in coastal and non-coastal areas. For instance, dried anchovies contributed 2.1. billion baht (approximately USD 61 million) in 2020.

Dried anchovies are extremely popular among Thai consumers, who consider them 'healthy snacks,' because they are packed with important health benefits for food and nutritional security. Although the majority of squid and shrimp are either sold fresh or frozen uncooked, the dried products are high-value export, often categorized into different sizes and types, and are sold at different prices accordingly. The number of processing plants for dried squid and dried shrimp in Thailand has been declining over the past decade. The same trend occurs in neighboring production countries such as Myanmar and Cambodia, where only a few primary processing facilities exist. This could be related to the decline in the fisheries, and consequently, the increase in prices,

making them unaffordable to many people. Dried squid, in particular, are mostly used in special occasions, like during Chinese New Year.

While the rising price of dried squid and dried shrimp deter some consumers, the demand for kapi is fairly stable since it is a key ingredient in Thai cooking. Kapi is a product of cultural significance and symbolizes a community, as different communities have different preferences for kapi products. Because *Acetes* shrimp fisheries (the source material) and kapi production involve small-scale fishing communities, they contribute significantly, not only to food and nutritional security, but also to support local livelihoods and household incomes.

Several countries in Southeast Asia, including Thailand, are working to raise consumer awareness about the importance of fish in human nutrition and promoting the use of inexpensive and diverse fish species such as anchovies, squid and shrimp in their diets (SEASOFIA, 2022). However, SMEs that produce traditional products such as dried fish, fermented fish, and shrimp paste are struggling to meet global food safety and quality control standards. At this point, although DoF helps SMEs upgrade their facilities to meet seafood export requirements, the government still needs to do more to support these fisheries-based SMEs in overcoming the challenges and improving their business.

7.3 Dried fish marketing and challenges during COVID-19 pandemic

Traditionally, dried fish products are sold at local markets, where people buy fresh produce, dry goods, and other necessities. A local market is not only a place where basic goods are bought and sold, but also where people socialize, interact, including through bargaining and price negotiation. When the COVID-19 pandemic hit in 2020, countries adopted several approaches to complying with health-related protocols, including closing public spaces, limiting social gatherings, and imposing lockdowns and quarantines. Pandemic-related restrictions have caused significant disruptions to major supply chains around the world, including in Thailand especially for the fish and seafood markets. The COVID-19 pandemic impacted the seafood sector as consumer demand, market access and logistical issues have changed, leading to challenges in food supply and marketing. In addition, a shortage of tourists during the COVID-19 pandemic posed a major challenge to the consumer market, as tourists are one of Thailand's largest seafood consumers. Meanwhile, the consumption of processed foods increased during the pandemic, creating an opportunity for dried fish products to provide food security to many people, not only in Asia where seafood consumption is high, but also in other parts of the world.

During the pandemic, seafood prices increased, and incomes decreased, which affected the people's buying power. Even in the years before the COVID-19 pandemic, the number of dried fish vendors in local markets had started to decline. While some vendors still prefer selling in local markets in a traditional way, many fishers and seafood traders have switched to e-commerce, in order to continue to earn a living during the pandemic.

The most popular e-commerce tool is Facebook, particularly in Thailand. Online sales through Facebook have enabled small-scale fishers and dried fish producers and traders to restore their income and meet their daily needs during the pandemic. E-commerce has become a growing business strategy, used by small-scale fishers and vendors to sell their products on domestic markets. But there are challenges in the e-commerce sector that need to be addressed to make it more viable and sustainable. For example, less educated women living in rural areas may likely not own a mobile phone or have access to Wi-Fi or Internet connectivity, which prevents them from participating and reaping the benefits of e-commerce (CEPAL & Adenauer, 2021). As previously mentioned, government support is essential for the success and continuity of SMEs. However, not all online dried fish vendors are aware of any government support, and many have not received any support, especially during the COVID-19 pandemic. Online vendors also face challenges such as high advertising and logistical costs. Improvements in the production and marketing of dried fish must include the handling, delivery, and packaging to ensure the safety and quality of dried fish products. Expansion of dried fish distribution channels is critical as not only will it ensure meeting local fish demand and improving food and nutrition security for people in remote areas, but it will also reduce distribution costs in the supply chain and improve seafood quality and safety. Despite the challenges, most online dried fish sellers are young and middle-aged people, with university degrees. These younger generations of vendors hint at a progressive and sustainable future for dried fish marketing and trading.

In terms of sales, some online vendors say sales have decreased during the pandemic, while others say the opposite. However, product costs are becoming higher, making it difficult to maintain their income. Vendors do not rely only on one supplier and would collect dried fish products from

different processing sources in several provinces of the country. Yet, the uncertainty about product availability, transport problems, and competition from other suppliers, including large supermarkets, threaten small-scale fishers, small-scale dried fish producers, and local seafood vendors.

7.4 Impacts of the new fisheries regulations

One of the challenges in the dried fish sector is the availability and the quality of fresh fish for dried fish processing. An adequate and stable supply of fresh fish is important for the sustainability of the dried fish value chain. The recent ban on the use of light-luring devices in anchovy fisheries has raised a heated debate between fishing communities and the government. The ban of certain fishing gear could affect the supply of fresh fish for processing of the country's important export products such as dried anchovies. At the same time, push nets, also banned, have posed a threat to the production of Kapi, since it can disrupt the supply of fresh *Acetes* shrimp. While most fisheries regulations focus on promoting fish stock conservation and ecosystem protection, they can have a negative impact on fishing-dependent communities. For instance, the new fishing gear restrictions could result in fewer fish available for processing or drying. This leads to a reduction in the overall supply of fish, driving up prices and impacting the profitability of the dried fish industry.

The introduction of the new fishery rules faces many challenges in the implementation, due to the lack of proper consultation with fisheries stakeholders. Discussion is ongoing about the revision of the Royal Ordinance on Fisheries, especially the articles related to small-scale fisheries,

including the definition of small-scale fisheries. Clear definition of small-scale fisheries is essential in governance to guide policy formulation, resource allocation, regulatory frameworks, data collection, capacity building, international cooperation, access to support services, and monitoring and evaluation for the sustainable development of this sector. Fisheries governance must be inclusive (Chuenpagdee & Jentoft, 2009) and effective governance requires understanding of the interactions between the actors involved (Kooiman et al., 2005) in all stages of the value chain. Ultimately, it is important that appropriate consultation processes with all the stakeholders be implemented at all stages of the decision-making process.

7.5 Limitations of the study

Since the study was about Thai fisheries and the author does not read or speak Thai language, there are several limitations in the research. Initially, Google Translate was used to translate documents, online data, and survey questionnaires. However, Google Translate has limitations and does not always provide accurate translations. Therefore, it is important to have the original texts and initial translations validated by a native Thai speaker. The local translator signed a confidentiality agreement, which is an important means of keeping the translation and transcription process confidential, accurate, complete, and fair. By signing this agreement, the translator has agreed to maintain the privacy and security of all translated and transcribed materials. The confidentiality agreement was developed and approved in accordance with the Memorial University of Newfoundland ethical policy requirements for research involving human respondents. This

ensures that the research follows strict ethical guidelines to protect the rights and welfare of the human participants involved in the study.

Additionally, recruitment activities are extremely difficult as the COVID-related restrictions were still in place during the research period. Sending the survey using the Facebook Messenger application was the best available option. However, there is a certain limit to the use of Facebook since after several postings, Facebook detects you as spam. For this reason, recruitment was difficult, and the empirical data involved only 15 online vendors, which may not represent the opinions and perspectives of Thailand's dried fish e-commerce population.

7.6 Policy recommendations

- Understanding the dried fish value chain is crucial for supporting sustainable small-scale fisheries, processors, and vendors.
- Raise awareness about the nutritional value of fish especially dried fish, and promote regular fish consumption across income levels (Piumsombun & Dey, 2002).
- Supporting and consuming dried fish serves as an additional source of livelihood for families engaged in small-scale fishing, production, and marketing.
- Policy makers can contribute to a positive environment for the dried fish value chain through education, awareness campaigns which includes displaying nutritional information on dried fish products, and collaboration with health professionals to advocate for dried fish consumption as part of a healthy diet.

- Collaboration with culinary experts, food bloggers, and restaurants can encourage incorporating dried fish into traditional and contemporary recipes. This will help change perceptions in some consumers who may consider dried fish as low value food, and stimulate interest in dried fish as a healthy and flavorful food. It is important that consumers become familiar with dried fish and that they understand the health benefits of dried fish to overcome misconceptions and barriers to consumption.
- Investment in research and development, including exploring new processing, fish handling techniques, packaging and e-commerce technologies (Chanrachkij et al., 2020), can lead to more appealing dried fish products.
- Compliance with processing and quality standards may pose challenges for SMEs, and government support is crucial in improving implementation of support programs.
- Improvement of online marketing and e-commerce facilities for dried fish requires further study to determine sustainability.
- Government support, coupled with adaptive skills such as flexibility and learning ability, is critical for the viability of small-scale fishers, producers, and vendors, especially during crises like COVID-19 pandemic (Arai et al., 2022b).
- Recognize the significance of the dried fish sector, encompassing all stages from harvesting to post-harvest, as a crucial contributor to the Thai economy.
- Government assistance is needed for dried fish value chain actors to improve operations and overcome challenges, including the development of a general framework of incentives that include smart demand and supply subsidies, support for incubators, accelerators, innovation clusters, and better access to appropriate financial products and services (FAO & CEPAL, 2020) for improved productivity, viability, and sustainability.

Chapter 8 – Conclusion

The complex dynamics of Thailand's dried fish value chain are deeply linked to the challenges and fluctuations of the fish production industry. The decreasing trend in total production, particularly in anchovy, squid, and banana shrimp, poses a direct impact on the dried fish value chain, which relies on these raw materials. Despite the challenges faced by the small-scale fisheries sector, dried fish production remains a vital source of sustenance and livelihood, notably for women engaged in processing. Dried anchovies considered 'healthy snacks,' and dried squid, dried shrimp, and kapi contribute significantly to the Thai economy, emphasizing their cultural and economic importance.

The COVID-19 pandemic has further illuminated the resilience and adaptability of the dried fish sector, with a shift towards e-commerce, particularly through social media platforms like Facebook. While online sales have provided a lifeline for small-scale fishers, producers, and vendors, challenges such as technological accessibility and government support remain crucial considerations. The impacts of new fisheries regulations, including bans on certain fishing gear, highlight the delicate balance needed to sustain the supply of fresh fish for dried fish processing. Effective governance, clear definitions of small-scale fisheries, and inclusive consultation processes are imperative to navigate these challenges.

Policy recommendations underscore the importance of understanding the dried fish value chain, promoting awareness of nutritional benefits, and supporting sustainable practices. Collaboration

with stakeholders, including policymakers, health professionals, culinary experts, and the government, is essential to create a positive environment and overcome barriers to dried fish consumption. Investments in research and development, compliance with quality standards, and improvement of online marketing facilities are crucial for the viability of small-scale fisheries, and the overall dried fish value chain. Ultimately, government assistance and a comprehensive framework of incentives are pivotal for the continued productivity, viability, and sustainability of the dried fish value chain, ensuring its crucial role in the national economy.

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Appendix I Sample Research Instrument

Survey ID #:

Date:

Part 1: General Information

1. Age/age range
2. Gender
3. Education
4. Area / province

Part 2 E-commerce

5. When did you start your dried fish online business?
6. What other online selling platforms do you have?
7. How long have you run this dried fish online business?
8. Aside from selling dried fish, do you have other livelihoods?
9. Where do you source your dried fish products?
10. Who are your customers?
11. Where are they from?
12. Which dried fish product is selling good in your stores?
13. What methods do you use for customers to make payments?
14. What are the delivery options?
15. Do you use Facebook Live in selling?
16. Do you have a business partner?
17. Do you export dried fish products? If so, which country?

Part 3 Challenges during COVID-19 pandemic

18. What are the challenges you face with selling dried fish online?
19. How does COVID-19 pandemic impacted your business?

Part 4 Governance

20. Did you receive any government support especially during the pandemic?
21. Are there any regulations or policies in selling dried fish online?

Is there else you would like to add regarding the topics covered?