Dried Fish Livelihoods: Women's Work and the Transformation of Processing at the Tonlé Sap

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Abstract

The Tonlé Sap, Southeast Asia's largest freshwater lake, is undergoing significant ecological transformations within Cambodia's rapidly developing economy. Over the last three decades, declining fish stocks, driven by overfishing, dam development, climate change, and agricultural intensification, have placed pressure on rural communities dependent on fisheries. At the same time, aquaculture expansion and international market integration are reshaping Cambodia's food systems, introducing new opportunities but also intensifying precarity for those working in micro-scale processing. This thesis investigates how women engaged in dried fish processing experience and respond to these intersecting transformations, situating their labour within wider processes of agrarian change.

To understand these transformations, this thesis draws on ten months of fieldwork that took place between November 2022 and July 2024, across multiple fish processing locales. A total of 42 surveys and 145 interviews were carried out at markets and villages, with a focus on Kampong Khleang commune. Field sites were selected based on known information about their production of fish products. Using primarily convenience sampling, the research included semi-structured interviews, market surveys, and participant observation to examine how gendered norms, ecological decline, and economic priorities converge to reshape women's livelihoods. Findings show that women's processing work, while central to household survival and local food economies, is persistently undervalued and rendered invisible. Within the forage fish value chain (FFVC), differentiation is growing, reflecting unequal access to natural and financial capitals. Particularly among micro-scale processors, some are exiting independent production to take up wage labour, while others adapt to resource scarcity by shifting processing techniques, diversifying income sources, or selling forage fish as aquaculture feed. These strategies provide short-term coping mechanisms but reduce women's autonomy, deepen class differentiation, and reinforce structural and gender inequalities.

Although farmed fish plays a crucial role in maintaining Cambodia's fish supply as wild-caught fish from the Tonlé Sap declines, those working on the margins, processing dried fish, are being overlooked in policy and governance. Development programs target the dried fish and aquaculture sectors in ways that drive growth and maximize profit, focusing on medium and large-scale enterprises. Uneven development in this emerging bimodal system illustrates how rural micro-scale processors will not benefit from current fishery development strategies. This uneven bimodal structure raises concerns about the commodification of resources, derived from a collapsing ecosystem and what this means for the future livelihoods of micro-scale fish processors and small-scale fish farmers.

The thesis argues that development strategies must move beyond broad economic objectives to recognize how governance, ecological change, and gendered divisions of labour interact to reshape roles and livelihood security in the FFVC. In doing so, it contributes

to scholarship on agrarian transformation, gendered labour, and sustainable livelihoods by showing how global, national, and local drivers of change are experienced through the everyday work of women. What's happening at the Tonlé Sap shows us that dried fish economies are not just about markets and profit, but about gender, power, and environmental sustainability. Women's labour is central, yet undervalued, and development strategies must confront these inequalities and support fish processors in ways that align with their own livelihood goals and priorities.

Khmer Translation of Abstract

អត្ថបទសង្ខេប

បឹងទន្លេសាប
ដែលជាបឹងទឹកសាបដ៏ធំបំផុតនៅអាស៊ីអាគ្នេយ៍កំពុងស្ថិតក្នុងការបំប្លែងប្រព័ន្ធអេកូឡស៊ីដ៏សំខាន់នៅ
ក្នុងសេដ្ឋកិច្ចដែលកំពុងអភិវឌ្ឍយ៉ាងឆាប់រហ័សរបស់ប្រទេសកម្ពុជា។
ក្នុងរយៈពេលបីទស្សវត្សរ៍ចុងក្រោយនេះ បរិមាណត្រីកំពុងថយចុះដោយសារ ការនេសាទហួសកម្រិត
ការអភិវឌ្ឍន៍ទំនប់ទឹក ការប្រែប្រួលអាកាសធាតុ និងការកើនឡើងនៃវិស័យកសិកម្ម
ដែលទាំងនេះបានដាក់សម្ពាធលើសហគមន៍ជនបទដែលពឹងផ្អែកលើវិស័យជលផល។ ទន្ទឹមនឹងនេះ
ការពង្រីកវារីវប្បកម្ម និងសមាហរណកម្មទីផ្សារអន្តរជាតិ
ក៍កំពុងរៀបចំប្រព័ន្ធអាហាររបស់កម្ពុជាឡើងវិញ ដោយបង្ហាញពីឱកាសថ្មីៗ
ប៉ុន្តែក៍នៅបង្កើនភាពមិនស្ថិតស្ថេរសម្រាប់អ្នកធ្វើការនៅវិស័យកែច្នៃត្រីក្នុងមាត្រដ្ឋានតូច។និក្ខេបបទ
នេះ ស្រាវជ្រាវពីរបៀបដែលស្ត្រីចូលរួមក្នុងបទពិសោធន៍កែច្នៃត្រីដៀត
និងឆ្លើយតបទៅនឹងការផ្លាស់ប្តូរប្រសព្វគ្នាទាំងនេះ
ដើម្បីបង្ហាញពីកម្លាំងពលកម្មរបស់ពួកគេនៅក្នុងបរិបទយ៉ាងទូលំទូលាយនៃការផ្លាស់ប្តូរកសិកម្ម។

ដោយផ្អែកលើការងារស្រាវជ្រាវរយៈពេលដប់ខែដែលធ្វើឡើងនៅចន្លោះខែវិច្ឆិកា ឆ្នាំ 2022 ដល់ខែកក្កដា ឆ្នាំ 2024 ក្នុងតំបន់ជាច្រើនដែលមានការកែច្នៃត្រី ជាពិសេសនៅឃុំកំពង់ឃ្លាំង។ ការស្រាវជ្រាវរួមមាន

ការសម្ភាសន៍ពាក់កណ្តាលរចនាសម្ព័ន្ធ ការសង្កេតរបស់អ្នកចូលរួម
ដើម្បីពិនិត្យមើលលើបទដ្ឋានយេនឌ័រ ការធ្លាក់ចុះនៃប្រពន្ធ័អេកូឡស៊ី និងអាទិភាពសេដ្ឋកិច្ច
បានគ្របដណ្តប់យ៉ាងដូចម្តេចក្នុងការបំលែងជីវភាពរបស់ស្ត្រី។។ លទ្ធផលបង្ហាញថា
ការងារកែច្នៃត្រីរបស់ស្ត្រី ទោះបីជាមានតួនាទីសំខាន់ក្នុងការរស់រាននៃគ្រួសារ
និងក្នុងសេដ្ឋកិច្ចអាហារតាមតំបន់ក៍ដោយ ក៍តែងតែត្រូវបានមិនឲ្យតម្លៃគ្រប់គ្រាន់
និងត្រូវបានគេមើលរំលង។ នៅក្នុងខ្សែសង្វាក់នៃតម្លៃត្រី(FFVC) ភាពខុសគ្នាកំពុងកើនឡើង

ដែលឆ្លុះបញ្ចាំងពីលទ្ធភាពមិនស្មើភាពគ្នាចំពោះមូលធនធម្មជាតិ និងហិរញ្ញវត្ថុ។
ជាពិសេសសម្រាប់អ្នកកែច្នៃត្រីមាត្រដ្ឋានតូចមួយចំនួន កំពុងបោះបង់ការផលិតឯករាជ្យ
ដើម្បីទៅធ្វើការយកប្រាក់ឈ្នួលពលកម្ម ខណៈពេលដែលអ្នកផ្សេងទៀត សម្របខ្លួនទៅនឹងកង្វះធនធាន
ដោយផ្លាស់ប្តូរបច្ចេកទេសកែច្នៃ បង្វែរប្រភពចំណូល
ឬលក់ត្រីដែលរកបានជាចំណីសម្រាប់ការចិញ្ចឹមត្រី។។
យុទ្ធសាស្ត្រទាំងនេះផ្តល់នូវយន្តការដោះស្រាយរយៈពេលខ្លី ប៉ុន្តែបណ្តាលឲ្យស្ត្រីបាត់បង់ឯករាជ្យភាព
បង្កើនការបែងចែករណ្តៈ និងរឹតបន្តឹងភាពមិនស្មើគ្នានៃរចនាសម្ព័ន្ធ និងវិសមភាពយេនឌ័រ។

ទោះបីជាត្រីចិញ្ចឹមមានតួនាទីសំខាន់ក្នុងការរក្សាការផ្គត់ផ្គង់ត្រីនៅកម្ពុជា
នៅពេលដែលបរិមាណត្រីធម្មជាតិពីទន្លេសាបកំពុងថយចុះក៍ដោយ ក្រុមអ្នកធ្វើការនៅជាយសហគមន៍
ដូចជាអ្នកកែច្នៃត្រីដៀត តែងតែត្រូវបានមិនអើពើនៅក្នុងនយោបាយ
និងការគ្រប់គ្រង។កម្មវិធីអភិវឌ្ឍន៍ភាគច្រើនផ្តោតលើវិស័យត្រីសំងួត និងវិស័យចិញ្ចឹមត្រី
តាមរបៀបដែលជំរុញកំណើន និងបង្កើនប្រាក់ចំណេញ ដោយផ្តោតលើសហគ្រាសធុនមធ្យម និងធំ។
ការអភិវឌ្ឍមិនស្មើគ្នានៅក្នុងប្រព័ន្ធពីរបែបដែលកំពុងលេចឡើងនេះ បង្ហាញថា
អ្នកកែច្នៃត្រីមាត្រដ្ឋានតូចនៅជនបទ
នឹងមិនទទួលផលប្រយោជន៍ពីយុទ្ធសាស្ត្រអភិវឌ្ឍន៍ជលផលបច្ចុប្បន្នទេ។រចនាសម្ព័ន្ធពីរបែបដែលមិនស្មើ
គ្នានេះ បង្កើតការព្រួយបារម្ភអំពីការបម្លែងធនធានឲ្យក្លាយជាទំនិញ

ដែលបណ្តាលមកពីការដួលរលំនៃប្រព័ន្ធអេកូឡូស៊ី
ហើយបង្ហាញពីអត្ថន័យនៃជីវភាពរស់នៅរបស់អ្នកកែច្នៃត្រី
និងអ្នកចិញ្ចឹមត្រីមាត្រដ្ឋានតូចនាពេលអនាគត។

និក្ខេបបទនេះអះអាងថា យុទ្ធសាស្ត្រអភិវឌ្ឍន៍ត្រូវតែឆ្ពោះទៅឆ្ងាយជាងគោលដៅសេដ្ឋកិច្ចទូទៅ
ដើម្បីទទួលស្គាល់ពីអភិបាលកិច្ច ការផ្លាស់ប្តូរអេកូឡូស៊ី និងការបែងចែកការងារតាមយេនឌ័រ
ដើម្បីធ្វើការផ្លាស់ប្តូរតួនាទី និងសុវត្ថិភាពនៃការរស់នៅក្នុងខ្សែសង្វាក់នៃតម្លៃត្រី(FFVC)។ ។ ការធ្វើដូច្នេះ
នឹងរួមចំណែកដល់ការសិក្សាលើការផ្លាស់ប្តូរវិស័យកសិកម្ម ពលកម្មយេនឌ័រ
និងជីវភាពរស់នៅប្រកបដោយចីរភាព ដោយបង្ហាញពីកត្តាបំលែងនៅកម្រិតសាកល ជាតិ
និងមូលដ្ឋានតាមរយៈការងារប្រចាំថ្ងៃរបស់ស្ត្រី។ អ្វីដែលកំពុងកើតឡើងនៅតំបន់បឹងទន្លេសាបបង្ហាញ
យើងថា សេដ្ឋកិច្ចត្រីសួតមិនមែនគ្រាន់តែអំពីទីផ្សារ និងប្រាក់ចំណេញប៉ុណ្ណោះទេ ប៉ុន្តែគឺអំពីយេនឌ័រ
អំណាច និងចីរភាពបរិស្ថានផងដែរ។កម្លាំងពលកម្មរបស់ស្ត្រីគឺជាចំណុចស្នូល
ប៉ុន្តែត្រូវបានមិនឲ្យតម្លៃគ្រប់គ្រាន់នៅឡើយ
ហើយយុទ្ធសាស្ត្រអភិវឌ្ឍន៍ត្រូវតែប្រឈមមុខដោះស្រាយទៅនឹងចំនុចវិសមភាពទាំងនេះ
និងគាំទ្រដល់អ្នកកែច្នៃត្រីតាមរបៀបដែលស្របតាមគោលដៅ
និងអាទិភាពនៃការចិញ្ចឹមជីវិតរបស់ពួកគេ។

Dedication

For my mother, Valerie Lipinski. Ever by my side, I could not have done this without her.

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Summary of Acronyms

BBC	British Broadcasting Company
CPP	Cambodian People's Party
CQS	Cambodia Quality Seal
DFM	Dried Fish Matters
DFVC	Dried Fish Value Chain
ELC	Economic Land Concession
FAO	Food and Agriculture Organization
FFVC	Forage Fish Value Chain
FMFO	Fish Meal Fish Oil
FPE	Feminist Political Ecology
GDP	Gross Domestic Product
IFC	International Finance Corporation
IIFET	International Institute of Fisheries Economics and Trade
MAFF	Ministry of Agriculture, Forestry and Fisheries
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
REB	Research Ethics Board
SLF	Sustainable Livelihoods Framework
SMEs	Small-medium Enterprises
UN	United Nations
UNDP	United Nations Development Program
UNIDO	United National Industrial Development Organization
USD	United States Dollar
VOD	Voice of Democracy

Glossary of Key Terms

Term	Definition
Aquaculture	The cultivation of aquatic organisms in a controlled environment.
Chbap Srey	A code of conduct or set of rules governing how women are expected to behave.
Conchets	A set of fish that are skewered and smoked, typically sold as a set.
Dried fish	A broad term referring to processed fish products, including products such as 'prahok' that are not typically dried.
Fish farming	A subset of aquaculture focused specifically on raising fish.
Fish feed	A broad term that can include trash fish, 'trey noi', fish meal, or pellet feed.
Fish meal	Ground fish made from small pelagic species or processing by-products, used as an input for animal and aquaculture feeds and often mixed with other ingredients (vegetables, soy, wheat).
FishStatJ	A desktop software application for fishery statistical datasets developed by NOAA, with data supplied by FAO through country reporting.
Forage Fish	Small-bodied fish species, used for processed fish products and also as animal and fish feed.
Khmer	Refers to the ethnic majority group of Cambodia and their language.
Khmer Rouge	The communist regime that ruled Cambodia from 1975–1979.
Maam	A fermented fish product made by chopping fish into chunks and fermenting them with sugar, salt, roasted sticky rice, and other seasonings; typically sold in jars.
Pellet feed	A factory-made, formulated feed pressed into pellets; a complete food source for fish, often made from fish meal and plant proteins.
Post-harvest	All activities that occur after fish reach land, including handling, sorting, cleaning, processing, packaging, and marketing.
Pre-process	A preparatory method used by fish processors in which fish are cleaned, cut, and sometimes salted before being transported for further processing, such as being mashed into 'prahok' at another location.
Prahok	A fermented fish paste traditionally made from small, wild-caught forage fish species.
Pelagic fish	Small-bodied fish species, also known as forage fish.
Pra-ot	A fermented fish product made by chopping fish into chunks and fermenting them with sugar, salt, and other seasonings; typically sold in jars.

Trash fish	Residual trimmings and waste products from fish processing, derived from small or large species and used as feed for aquaculture.
Trey-cha'eur	Smoked fish made from small, wild-caught forage fish.
Trey neat	Sun-dried, filleted fish made from large-bodied species.
Trey noi	An unsorted mix of small fish used as animal or fish feed because the fish are too small, spoiled, or of poor quality for processing; denotes use of the whole fish body as feed.
Riel	The Cambodian currency: relatively stable, with small day-to-day transactions commonly equating 1 USD to 4,000 riel.

Table of fish species

Khmer name	**English name**	**Scientific name**
Trey ros	Striped snakehead	*Channa striata*
Trey deep	Giant snakehead (juvenile)	*Channa micropeltes*
Trey chadow	Giant snakehead (adult)	*Channa micropeltes*
Trey pra	Catfish	*Pangasianodon hypophthalmus*
Trey ongdae	Hybrid catfish	*Hybrid Clarias*
Trey kampleang	Moonlight gourami	*Trichopodus microlepis*
Trey riel	Siamese mud carp	*Hygrophila siamensis*
Trey kes	Catfish	*Kyrptopterus bleeker*
Trey proma	Small-scale croaker	*Boesemania microlepis*
Trey grahom	Tilapia	*Oreochromis niloticus*
Trey krow	Silver shark minnow	*Osteochilus hasselti*
Trey chickow	Notched mud carp	*Henicorhynchus entmema*
Trey kampot	Puffer fish	*Tetraodontidae*
Trey chong vas	Red-line rasbora	*Rasbora pauciperforata*
Trey kanchos	Striped catfish	*Myslus mulliradialus*
Trey kom pream	Fringed threadfin	*Polynemus melanochir*
Trey komplow	Glass catfish	*Kyptopterus schilbeides*
Trey kanto	Snakeskin gourami	*Trichogaster pectoralis*
Trey krow	Silver shark minnow	*Osteochilus hasselti*
Trey slak russey	Bamboo fish	*Paralaubuca harmandi*
Trey konglang	Jullien's golden carp	*Cirrhinus jullieni*

Chapter 1. Introduction

Globally, fisheries are a significant source of livelihood production and food security. It is estimated that one in 12 people around the world (492 million people) are partly dependent on small-scale fisheries through pre-harvest, harvest or post-harvest work (Basurto et al., 2025), making the industry significant in supporting rural economies. Aquatic foods are an excellent source of nutrients and protein, and compared to other animal foods they have fewer environmental impacts and a lower carbon footprint (FAO, 2024b). However, the sector faces mounting pressure from environmental degradation (N'Guetta et al., 2025), climate change (Brander, 2010), market shifts and governance challenges (Quezada-Escalona et al., 2025).

The fisheries sector is situated at the intersection of natural resource use, economic interests, and gender inequality. Traditionally viewed as a male-dominated sector (Pedroza-Gutiérrez, 2019), the fishing industry is documented primarily through data that focuses on capture fisheries, overlooking post-harvest activities (handling, processing, and marketing), where women play a significant role (FAO, 2016). Moreover, within the fisheries sector, gendered power relations stemming from cultural and social norms result in an environment where women's contributions are undervalued, and they are often restricted from fully participating in decision-making (Galappaththi, 2022). Despite these limitations, fisheries are an important livelihood option for women globally; they make up 35 percent of those employed in the small-scale fisheries value chain, and represent 49.8 percent of the people employed in the post-harvest segment (FAO, 2023).

In 2022, Asian countries produced 70 percent of the world's combined fisheries and aquaculture output and recorded the highest average annual growth in the export value of aquatic animal products (FAO, 2024a). Since the 1970s, aquaculture has expanded substantially, driven by declining wild fish stocks, rising population demand (Little et al., 2016) and innovation in production technologies (Nash et al., 2021). In Southeast Asia, this growth accelerated after the 2000s, with significant increases in shrimp, crab, milkfish, and catfish production (Hishamunda et al., 2009). Thailand and Vietnam have become top aquaculture producers in the region; their intensive production and processing systems increasingly shape markets and regional supply chains (Nash et al., 2021).

The outcomes of transitioning from capture fisheries to aquaculture are not yet fully understood. Too strong an emphasis on wealth creation and the economic gains of aquaculture can displace or exclude fisherfolk and overlook ecological limits (Allison, 2011). A review of literature (Tezzo et al., 2021) on the transition of freshwater capture fisheries to aquaculture in South and Southeast Asia found that the interlinkages of the two sectors are

rarely analyzed together in research and policy despite their closely inter-related production processes. This gap in understanding is particularly evident when considering fisheries products, such as dried fish, that depend on both wild capture and aquaculture fish.

In Southeast Asia, dried fish (also known as processed fish) provides livelihoods and employment for millions of people, from small to large-scale fishers, processors, and traders working in both urban and rural areas (Belton et al., 2022). Rich in calcium and micronutrients, dried fish is a vital protein source in South and Southeast Asia and plays a critical role in nutrition security and reducing malnutrition (Belton et al., 2021; Pradhan et al., 2022). Despite its importance, the literature gives limited attention to the role of dried fish in rural livelihood production and to the socio-economic and environmental factors that shape its production and trade.

The limited research that does exist on dried fish focuses primarily on processing methods, chemicals, and contaminants (Lokuge, 2020). However, recent dried fish research has begun to examine social and non-capital aspects, moving beyond physical properties and financial value to explore the socio-ecological relationships that shape the well-being of all actors in the chain (Pradhan et al., 2022). A socio-ecological systems-oriented approach offers a more dynamic way to analyze value chain interconnections and actions to address inequalities in the value chain (Pradhan et al., 2023). This socialized perspective on dried fish recognizes it as a cultural asset, valued not only as a trade commodity, but also for gifting and unique taste preferences, symbolic of a particular social and cultural upbringing (Belton et al., 2022).

Dried fish is a significant source of nutrition and livelihood security for millions of people (Galappaththi et al., 2023); however, it is increasingly affected by socio-economic and environmental change. Overfishing, aquatic and terrestrial ecosystem degradation, climate change, changing markets and commodification combine, putting pressure on the sustainability and viability of this resource. These pressures impact micro and small-scale value chain actors the most, as their limited access to resources makes it difficult to adapt to shifting market demands and means of production. Understanding these dynamics is especially important in countries like Cambodia, where fish consumption plays a central role in both nutrition security and the economy.

Cambodia has the highest fish and fish product consumption in Southeast Asia, with 65% of the population's animal protein coming from fish (FAO, 2014), and Cambodian fisheries contribute approximately 10% to gross domestic product (Yoshida et al., 2020). Many of these fisheries come from the Tonlé Sap region, one of the world's most productive, fish-abundant freshwater ecosystems (FAO, 2019). Each year, the lake's seasonal flood pulse occurs as the Mekong River reverses its flow during the rainy season, causing the lake to expand up to five times its dry-season size (Eyler et al., 2023). These fisheries directly

support more than 1.7 million people living within the floodplain (Gillespie & Perry, 2019), with dried fish a staple product of the lake's abundant catches. The sustainability of the Tonlé Sap is increasingly compromised by environmental problems stemming from insufficient management, both domestically and from upstream neighbouring countries. Deforestation, intensified agriculture, hydropower development, rapid population growth, overfishing, sand mining near Phnom Penh, and climate change are among the contributing factors to the lake's degradation (Chen et al., 2022; Golden et al., 2019; Kelson et al., 2021; W. X. Ng & Park, 2021; Park, 2022; Rousseau & Marschke, 2023; Uk et al., 2018). These environmental issues contribute to an uncertain future of fish availability for Cambodians and their livelihood production.

Regional transformations in neighbouring countries also influence Cambodia's fish value chains. Vietnam and Thailand are more than 25 years ahead in aquaculture development, with more advanced farming technologies, feed and capacity production (Nash et al., 2021). As a result, fish imports from these countries into Cambodia strain local production. Furthermore, both imported and domestic farmed fish are cheaper than the wild-caught fish typically used by micro-scale fish processors, making it difficult for them to stay competitive (Joffre et al., 2021). Although farmed fish helps fill supply gaps, it leaves rural micro-scale processors in a precarious position where their wild-caught supply is dwindling, and consumers are shifting towards cheaper farmed fish.

The shifts in the dried fish economy are especially evident at the Tonlé Sap where dried fish remains an important part of daily life. This research focuses on Kampong Khleang, a commune of approximately 10,000 people, where the community relies on a steady supply of wild-capture fish to produce dried fish products. Over the past two decades, production has declined, particularly for products made from large-bodied fish such as the sun-dried fillet, 'trey neat'. Women, who are the primary dried fish producers, now almost exclusively use smaller-bodied forage fish species in their products. Disjointed policies and management along with a growing aquaculture industry and degrading environment are reshaping how micro-scale fish processors create their livelihoods. These drivers of change are pushing many processors into increasing marginalization and economic precarity.

In this research I seek to understand how dried fish contributes to rural women's livelihoods, why they continue to be disenfranchised and what this means for their future. The research examines the environmental and socio-economic shifts influencing the dried fish value chain and which actors are benefiting and losing from these changes. The following research questions guide this study:

1. How does the dried fish economy contribute to livelihoods in and around Cambodia's Tonlé Sap region?

2. How are changes in the dried fish economy reshaping micro-scale fish processing livelihoods?
3. How is the dried fish economy changing, who is benefitting and who is losing and what this means for dried fish livelihoods in the future?
4. What are the gendered implications of fish processing work?

Table 1 below summarizes the application of the research questions across the empirical chapters. While RQ4 is addressed across chapters 5-7, each chapter engages gendered implications at different analytical levels, building on one another. Chapter 5 examines women's everyday labour and constraints; Chapter 6 analyzes how value chain pressures shape women's livelihood choices; and Chapter 7 demonstrates how these dynamics contribute to deepening inequalities among women fish processors.

Table 1. Research questions and their application in the empirical chapters

Chapter	Research Question	How it is addressed
Chapter 5	RQ1. How does the dried fish economy contribute to women's livelihoods in and around Cambodia's Tonlé Sap region?	Shows how fish processing is a key income generating activity for women, important to their everyday livelihoods but remains undervalued.
	RQ4. What are the gendered implications of fish processing work?	Fish processing is socially constructed as women's work, socially embedded gendered roles limit women's power and access.
Chapter 6	RQ2. How are changes in the dried fish economy reshaping micro-scale fish processing livelihoods?	Identifies key drivers of change, including environmental decline, forage fish demand, and market expansion. These shifts impact access to fish, alter value chain dynamics, and intensify pressures on micro-scale processors.
	RQ4. What are the gendered implications of fish processing work?	Women have less access to fish resources, pushing them to change their approach to fish processing. Amidst economic shifts, gendered work influences vulnerability.
Chapter 7	RQ3. How is the dried fish economy changing, who is benefitting and who is losing and what does this mean for dried fish livelihoods in the future?	Shows how uneven access to natural, financial, and social capital produces increasing differentiation, benefiting larger actors while marginalizing micro-scale processors.
	RQ4. What are the gendered implications of fish processing work?	Women fish processors with the least access, control, and opportunity experience deepening inequalities.

The research uses a combination of theoretical lenses to explore the complex relations, power asymmetries, and shifting socio-economic and environmental issues involved in dried fish livelihoods. Feminist Political Ecology (FPE) provides a foundation for examining who is most marginalized, emphasizing power imbalances, political dynamics in environmental change, and the relationships between people and nature across scales. It looks beyond market-based values, to explore other meanings of well-being. The Sustainable Livelihoods Framework complements FPE by focusing on people's access to resources, as well as using a relational approach to show how livelihoods are shaped by relationships with people, nature, power, social structures, and institutions. Finally, concepts from agrarian change scholarship help explain the structural forces influencing dried fish livelihoods, such as differentiation among actors, accumulation by dispossession, and the growing inequalities in an emerging bimodal system.

Key findings show that declines in large wild fish species have triggered cascading changes. Wild-caught 'trey neat' is no longer produced at scale in the village. In Kampong Khleang, processors now mainly produce 'prahok' and smoked fish, which rely on small pelagic forage fish. At the same time, overall species declines are pushing many processors into lower-paid wage labour.

Declining wild fish stocks have increased demand for aquaculture, which depends on forage fish, reinforcing a cycle of overfishing. Urban markets in Cambodia now mostly sell farmed 'trey neat', reflecting a broader shift in national fish production. Imported aquaculture adds further pressure and complexity to these value chains. Weak regulation and enforcement of forage fish species worsen sustainability challenges at the Tonlé Sap. The intensification of fish farming also undermines the livelihoods of micro-scale processors. While small-scale aquaculture contributes to pressure on forage fish stocks, the core issue lies in fragmented, market-driven fisheries governance.

This thesis contributes to agrarian change literature through grounded examples of an emerging bimodal system, where smallholders coexist with larger-scale actors in everyday livelihood practices, showing how shifts in species, products, and labour reflect broader structural change. It provides empirical evidence of how resource decline and value chain restructuring drive differentiation and limit smallholder persistence. It further contributes by linking agrarian change to feminist political ecology and the sustainable livelihoods framework, showing how gendered access to resources and uneven value capture shape who benefits and who is marginalized in this transition.

This monograph comprises of the following chapters:

Chapter 1: Introduction
The introduction begins with an overview of the global importance of small-scale fisheries and highlights the often-overlooked role of women in the industry. It then narrows the focus to fisheries in Southeast Asia, reviews key literature on dried fish processing, and introduces the Cambodian context and the purpose of the research.

Chapter 2: Theoretical Framework
This chapter provides a background on the three theoretical bodies of literature used to frame the research. Feminist Political Ecology (FPE), the Sustainable Livelihoods Framework (SLF), and Agrarian Change, from which I develop the theoretical framework for this thesis.

Chapter 3: Methodology
The methodology chapter explains the methodological choices of this research, detailing the research strategies and considerations used to support the rigor and credibility of the analysis. It also addresses the limitations and ethical issues encountered throughout the study.

Chapter 4: The Cambodian Context
This chapter is a literature review that briefly sets the geopolitical, socio-cultural and environmental context of Cambodia's recent history. It highlights how historical and contemporary political, social, and ecological factors shape local livelihoods, gender roles, and opportunities for economic development, providing a foundation for understanding the challenges and changes detailed in the following chapters.

Chapter 5: Fish Processing Livelihoods
This chapter introduces micro-scale fish processors at Kampong Khleang, the main site of this study. Framed by FPE and SLF, it draws on interview data to show how women create livelihoods, the gendered division of labour, and the challenges they face. A comparison with a neighbouring commune highlights the community's reliance on a steady flow of fish and the importance of processing as a livelihood. The chapter reveals deeply entrenched gender norms and socio-cultural expectations severely limit women's economic opportunities, keeping them into low-paid, precarious fish processing work that reinforces poverty and structural inequalities.

Chapter 6: The Interplay of Fish Processing and Fish Farming Livelihoods
This chapter examines the interconnectedness of the dried fish and aquaculture value chains, focusing on the socio-economic and environmental shifts shaping them. It demonstrates how ecosystem changes in the Tonlé Sap have led to a decline in fish species,

which in turn has resulted in the disappearance of specific fish products and, consequently, the erosion of livelihoods. The chapter then turns to forage fish, which sit at the intersection of processed fish and farmed fish production, raising pressing questions of sustainability. Finally, it considers the influence of imported farmed fish, which adds further complexity to these value chains.

Chapter 7: Dispossession and Differentiation in the Forage Fish Value Chain
This chapter goes deeper into the forage fish value chain, analyzing how actors have varying degrees of access to natural, financial and social capitals, who benefits and who loses, and revealing growing inequalities among actors. The analysis highlights the gendered division of labour between aquaculture and fish processing and the inequalities in pay. The chapter theorizes that the forage fish value chain is an example of accumulation by dispossession, in which powerful actors' control and influence resource access through policy, regulation, or a lack thereof. Next, the chapter examines peasant differentiation to further illustrate the growing inequalities in the value chain and offers a discussion on the potential for smallholder persistence.

Chapter 8: Discussion, Recommendations, and Conclusion
The monograph concludes with a discussion of cross-cutting themes that emerged during the analysis: the intersecting dynamics of gendered livelihood production in a shifting value chain marked by classic agrarian change processes. A bimodal fish economy has emerged, raising questions about the future of rural fish processing livelihoods. The chapter discusses the implications of Cambodia's gendered socio-cultural norms for fish processors and the devaluation of their labour. Taken together, the chapter considers what this means for the future of micro-scale dried fish processing. Keeping in mind the thesis' focus on the most marginalized, I close with policy recommendations for key changes and areas of support to improve fish processing livelihoods. Finally, I identify areas of future research that were beyond the scope of this study but warrant further exploration.

Chapter 2. Theory

2.0 Introduction

The chapter begins with an overview of the theoretical literature that frames the analytical approach of the research. It draws on three key bodies of work: Feminist Political Ecology (FPE), the Sustainable Livelihoods Framework (SLF), and the literature on Agrarian Change. These three theoretical lenses are applied across different chapters to address the diverse issues covered. Feminist political ecology was initially the primary focus across the whole research scope and helped to determine the focal point of the research, micro-scale women fish processors. While the research began to broaden into other sectors and scales, FPE brings it back to focus on the 'who' within the research. Given the use of natural resources in a rural setting, the sustainable livelihoods framework was important to tie into FPE because it gives a more comprehensive understanding between the relations of power, gender, and access in resource use and management. Lastly, agrarian change became an important explanatory piece for understanding the major shifts occurring in Cambodia's inland fisheries sector today. The chapter concludes by introducing the theoretical framework for the thesis. The framework draws from FPE, SLF and agrarian change to analyze the situation and actors of the dried fish value chain.

2.1 Feminist Political Ecology

Political ecology puts politics at the heart of understanding how human–environment interactions are linked to environmental degradation, emphasizing that politics and the environment are deeply interconnected (Bryant, 1998). Developing countries, and more specifically, marginalized people living in developing countries, are the ones who face the brunt of resource degradation as they depend on a sustainable supply of natural resources for their livelihoods (Althor et al., 2018; Robbins, 2011). It is the political elites who profit from resource extraction (Strangio, 2014). Unequal power relations are a key component of political ecology, where developing, postcolonial countries have seen an intensification of resource extraction tied to elite capture and personal enrichment (Bryant, 1998). Therefore, the main objective of political ecology research is to explore the relationships between natural resource exploitation, poverty, wealth, and the influencing politics (Bryant & Bailey, 1997).

Although political ecology provides strong theoretical backing for this research, further refinement of its use is needed to capture the complexity of women's work. Political ecology has been critiqued as being produced by and bound to colonial knowledge, whereas feminist political ecology allows for other ways of knowing and aims to lift up the voices of those on the margins (Sultana, 2021). FPE examines politics and power with an enriched analytical approach to gendered power relations experienced in natural resource use and the associated processes of accumulation, enclosure, and dispossession that affect environmental degradation and conservation (Elmhirst, 2015). FPE emerged as a subfield of

political ecology and gender and development studies in the 1990s, drawing on work from the major schools of feminist scholarship (ecofeminism, feminist poststructuralism, socialist feminism, and environmentalism) (Rocheleau et al., 1996). Within the FPE literature, gender is understood as a critical variable that can impact how resources are accessed or controlled (Elmhirst & Resurreccion, 2008).

Gender is used to distinguish differences in social expectations, roles, and behaviours associated with what is considered masculine or feminine (Jule, 2014). Early work by psychologist John Money (1955) created a clear distinction between 'gender role' and gender identity. Gender identity is the experience one has, male, female or ambivalent; it is a private experience, whereas a gender role is the public manifestation of gender identity (Money, 1985). Gender is understood as something that one does, a social construction that is performative, discursive, and cultural (Butler, 1990; Sunderland, 2004). Gender often evokes a Westernized view of two discrete categories, women and men; however, many cultures worldwide do not define gender as a binary, instead seeing multiple gender identities (Cameron & Stinson, 2019). Amongst the increasing fluidity of gender concepts (Mazzuca et al., 2020), FPE continues to evolve, engaging with other world views, other ways of knowing, and promoting other marginalized groups and feminisms (Elmhirst, 2018; Sultana, 2021). Although a primary focus within FPE, gender is only one 'axis of identity', acknowledging that complex intersecting identities of race, culture, class, caste and ethnicity affect how people create their livelihoods (Rocheleau et al., 1996).

Early feminist scholarship often held the notion that women are closer to nature, thereby placing the burden of environmental protection within the feminine realm of care (Nightingale, 2006). This has reinforced critiques that FPE holds a binary, narrow view of sexual difference and gender roles (Mollett & Faria, 2013). Critiques of FPE argue that it has lost its critical and political strength. Development projects designed with an FPE lens to benefit women are often undermined by the need to tie outcomes to environmental protection (Nightingale, 2006). Moreover, as gender in development has become more mainstream, actors seize feminist ideas and rework them to fit their agendas, becoming a 'technical fix', divorced from political and historical contexts (Cornwall et al., 2007). Notwithstanding these valid critiques, FPE is not a fixed approach but a process that adapts to the various theory practices and policies of gender and the multitude of intersectionalities one can experience, moving towards decolonization and rethinking neoliberal designs (Rocheleau, 2015).

FPE emphasizes that there are alternative ways of thinking beyond a market-based capitalist logic of value, trading discussions of efficiency and productivity for experiences of women's livelihoods, basic needs and what constitutes well-being (Harris, 2015). The normative discourse on economic growth as a means to support development has focused on "...an ecologization of the economy and economization of nature" (Wichterich, 2015, p. 72). This approach has privileged market-oriented natural resource use above the everyday needs of

livelihoods (Harris, 2015; Rocheleau, 2015). Instead of building on livelihood approaches that narrowly focus on income generation, FPE reorients what matters within the broader dimensions of well-being (Harris, 2015). Importantly, FPE moves away from technical fixes and aims to understand the broader social and political issues impacting livelihoods (Gonda, 2019). A serious challenge in FPE research is to avoid colonizing the voices of rural women by framing them only as a victim of patriarchy and capitalism, and instead highlighting their perspectives, contexts and knowledge (Sachs, 1996).

2.2 Livelihoods

Livelihood diversification extends beyond income diversification to encompass a broader set of social processes and outcomes, offering important opportunities to improve livelihood security and well-being (Ellis, 1998). This perspective moves beyond material assets as simply means of survival, instead emphasizing how material resources shape people's ability to act, make decisions, and assign meaning to their lives (Bebbington, 1999). It also highlights the complex and dynamic nature of livelihoods, where goals, preferences, and resource use shift in response to changing environmental, economic, and political conditions (de Haan & Zoomers, 2003).

The Sustainable Livelihoods Framework (SLF) (Scoones, 1998) is people-centred and attempts to identify areas of sustainability and resilience in people's livelihoods to understand gaps or room for policy improvement. However, critiques of the livelihoods approach note problems of access to opportunities related to power (de Haan & Zoomers, 2005), a built-in polarization between developed and developing nations (Morse & McNamara, 2013), and the endless livelihood variations (de Haan, 2012). Despite these critiques the SLF was overall met with little resistance. This is likely because it was presented as practical, it aligned with the trend in development to move away from large-scale strategies, and it did not directly challenge international finance institution's economic policies (Natarajan et al., 2022). Scoones (2009) later offered a revised version of the approach to address the deficiencies of the original framework, providing a discussion on scale, knowledge, power and politics, and dynamics. These dimensions help frame whose livelihoods count and allow for a deeper insight into the actors involved and the influences they hold among various spatial and temporal considerations. Still, elements remain unresolved as problems of the 21st-century warrant further modification of the framework.

In an increasingly interconnected world, reconciling global processes with the local is a key challenge in livelihoods research. Rural livelihoods must be situated within a global context of structural historical, and political factors, paying close attention to the relational (Natarajan et al., 2022). Focusing on the relational within the framework moves toward a nuanced understanding of how people, processes and things impact and alter one another (Natarajan et al., 2022). To this end, a revitalized sustainable livelihoods framework for the 21st century emerges to contend with the dynamic aspects that previous framings have not

yet captured. The re-envisioning offers a robust approach to understanding how local livelihoods are embedded in structures and processes affected by varying scales and the role influence and access can have (Natarajan et al., 2022).

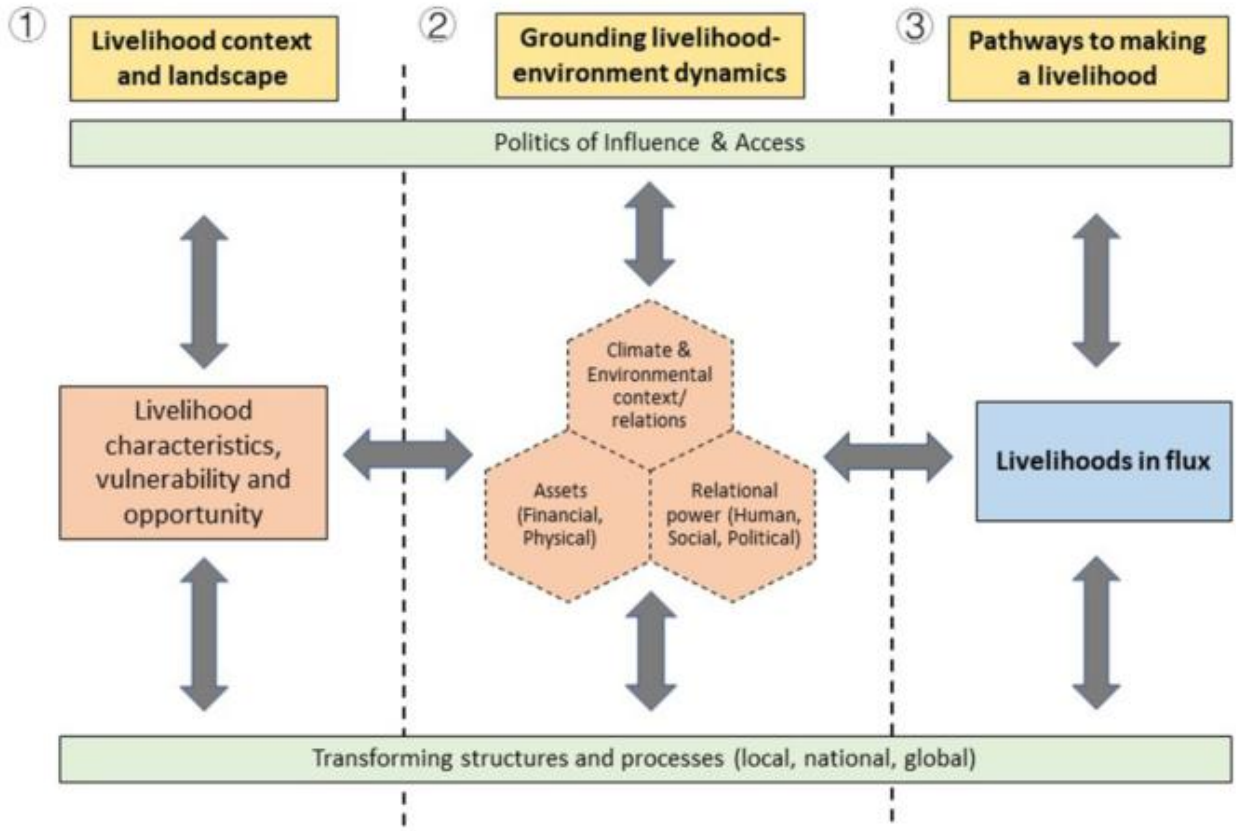


Figure 1. A sustainable livelihoods framework for the 21st century. (Natarajan et al. 2022)

Relational ontology argues that people, nature, social systems and the structures that emerge are deeply interconnected (Curry & Koczberski, 2012). In exploring the relational within livelihoods, it cannot be assumed that human power and agency are the only forces; non-human actors contribute to hybrid agencies, a mix of human action and the situations or arrangements that make action possible (Mitchell, 2002). There are multiple relational approaches, addressing different aspects of human-nature connections (West et al., 2024). In this thesis, a relational perspective takes a structural-metabolic approach to highlight how unequal power relations within a capitalist system exploit people and nature (West et al., 2024). For example, natural resource overuse leads to unstable systems and reduces resiliency, exposing livelihoods to shocks and stressors (Natarajan et al., 2022).. Relationality is used in a limited sense to show how livelihoods are mutually shaped through interactions among socio-economic and ecological systems.

2.3 Agrarian Change

Current agrarian change studies evolved from peasant[1] studies, a field of study that emerged in response to the industrialization, modernization, and capitalism of the 20th century (Wright, 2015). Broadly, agrarian change is the systems of relations in agrarian societies and economies, including socio-cultural, technological and environmental processes that create change (Harriss, 2023). Rooted in Marxist political economy, this body of work investigates how capitalism restructures land, labour, and class relations, often producing new forms of inequality (Bernstein, 2021; Harriss, 2023). While early theorists emphasized the displacement of peasants and the rise of wage labour (Kautsky, 1988; Lenin, 2023), later scholarship demonstrated the persistence of smallholders within capitalist systems (Chayanov, 1966; Kautsky, 1988).

The idea of smallholder persistence challenges traditional Marxist thinking such as 'global depeasantization' or dispossession by accumulation, where small-scale farmers are displaced from their land or incorporated into the market to the benefit of larger companies (Bernstein, 2021). While depeasantization is occurring, many smallholder farms persist, particularly in rural areas of Southeast Asia. This persistence is partly supported by mechanization, which is increasingly accessible to smallholders and can improve production efficiency, and by outward migration, which can increase household incomes and channel remittances back to farms (Boestel et al., 2013; Rigg et al., 2016). However, the benefits of these processes are uneven: access to mechanization varies with farm size and capital, remittances may favor certain households or members, and migration can create labor shortages or shift local agricultural knowledge. These dynamics highlight that smallholder persistence is shaped by both enabling and constraining social, economic, and ecological factors.

Notable gaps have emerged in agrarian studies, including a lack of attention to the gendered division of labour in earlier theorizing (Wright, 2015). Smallholder persistence is partly due to the labour of women and their resistance to appropriation, particularly in Africa (Federici, 2004). Agrawal (2011) highlights how the agrarian transition of the 21st century is gendered; more men are moving to non-farm jobs, meanwhile a feminization of agriculture is occurring where the number of women agriculture workers is rising. The scholarship also underscores gendered inequalities, calling into question issues of land access and labour within

[1] The term 'peasant' is widely used in agrarian change literature, often referring to smallholders. Berstein (2021) defines peasants as a diverse group of rural producers, "…there is no single "class" of "peasants" or "family farmers" but rather differentiated classes of small-scale capitalist farmers, relatively successful petty commodity producers and wage labour (p. 4)". While the term can carry negative connotations in other literatures, I use it in line with the literature I am engaging with. Elsewhere in the thesis, I primarily use more specific terms to refer to people through their occupations such as processors, fisherfolk, etc., reserving 'peasant' for Chapter 7, where I provide a more detailed discussion of peasant differentiation that looks broadly at the rural livelihoods of people considered to be in the 'peasant' class.

neoliberal agendas (Razavi, 2003). Beyond simplistic binaries of men and women, researchers emphasize the role of intersecting factors such as wealth inequality in shaping agrarian livelihoods (Carr & Thompson, 2014). Another overlooked aspect of agrarian change is livelihood diversification, which was not accounted for in the Marxist model of agrarian transition (Razavi, 2003). Under 21st century conditions, the inability to diversify livelihoods beyond agriculture, combined with intersecting social and economic vulnerabilities, leaves marginalized populations at greater risk from climate change (Rao et al., 2025).

Scoones (2021) argues that agrarian studies should incorporate contemporary issues like environmental change, global market pressures, and social and political uncertainties to better reflect the complex and dynamic realities of rural livelihoods, which can also be applied to other societal contexts, such as pastoralism. Environmental issues have indeed been a major point of discussion within 21st century agrarian change. More attention is being given to how natural resources are exploited and degraded for wealthy capitalists at the expense of low-paid labourers and marginalized groups that depend on the resources for subsistence (Brickell & Springer, 2017; Çelik, 2024; Clapp et al., 2018). The literature now acknowledges how the capitalist system mystifies human-nature connections, hiding or distorting the environmental and social impacts of capitalism. The process of turning labor and nature into products disconnects society from the effort and natural resources involved in creating goods, and modern global supply chains further obscure the origins of these products (Araghi, 2009).

While the agrarian change literature fits well into the space of fisheries production, there has been little exploration of how its concepts apply to the commodification and uneven development of fisheries within local and global food systems (Scheidel et al., 2021). This gap is particularly evident for inland fisheries, which receives less attention than marine capture fisheries. This research contributes to addressing this gap by analysing the forage fish value change through the lens of agrarian change to show how uneven development compounds the marginalization of women's work dependent on dwindling fisheries resources. The thesis examines three interrelated aspects of agrarian change, accumulation by dispossession, peasant differentiation, and an emerging bimodal system to situate these gendered and ecological dynamics within broader structural transformations.

Processes of accumulation by dispossession are visible in Cambodia's fish processing and aquaculture sectors, where resources are taken from smallholders to the benefit of corporations and states (Harvey, 2003). As fisheries resources become increasingly commercialized, the value of small-scale producers' labour and products is captured by more powerful actors, including private companies and development agencies (Bernstein, 2021). International markets, donor-driven development programs, and domestic policies

all shape these processes around the Tonlé Sap, deepening existing inequalities and marginalizing those whose livelihoods are most dependent on natural resource access.

These dynamics of dispossession also drive peasant differentiation. First conceptualized by (Lenin, 2023), he saw a growing division of classes amongst peasants in rural areas. Over time, peasants divided into three groups: poor peasants or the rural proletariat, who lost their land or resources and must work for others; middle peasants, who are self-sufficient but vulnerable to hardships like crop failure; and rich peasants or the peasant bourgeoisie, capitalist farmers who own and rent land and employ workers (Harriss, 2023). A more romanticized view of peasant farmers sees the middle peasant as a norm in rural communities (Chayanov, 1966). This view suggests that capitalism disrupted the traditional harmony of peasant life by drawing them into the larger market economy, leading to the emergence of rich and poor peasants (Harrison, 2023). However, contemporary agrarian scholars (Bernstein, 2021) argue peasant differentiation existed before capitalism, seen in inequalities in access to land, as well as labour and power hierarchies; capitalism merely amplifies the differentiation. This thesis will use Bernstein's (2021) understanding of peasant differentiation towards understanding the current situation at the Tonlé Sap.

An emerging bimodal production system further compounds these inequalities. When micro and small-scale businesses lack the resources to compete, a divide forms between modern, capital-intensive production and traditional, labour-intensive systems (Harriss, 2023). In contrast, a unimodal approach that supports small, scalable technological advancements could help prevent the polarization that bimodal systems create (Harriss, 2023). While broad theories and patterns of change provide general insights (Borras, 2009), specific examples of the emerging bimodal system within Cambodia's fish processing and aquaculture sectors will be discussed to offer grounded contributions to agrarian change theory.

2.4 Theoretical framework

The framework developed for this research integrates key concepts from FPE, SLF and agrarian change literature to address the complexity of dried fish livelihoods and the interaction of micro and macro scale influences. Each perspective foregrounds marginalized groups. The SLF mirrors FPE in seeking to put 'the last first' (Chambers, 1983) and agrarian change brings attention to the struggles of smallholders. Within the dried fish value chain, micro-scale fish processors remain among the most marginalized, and small-scale fish farmers face increasing exclusion.

Scale is an important factor in understanding livelihoods. As the analysis zooms out from the localized, lived experiences of micro-scale processes, the SLF serves as a bridge between FPE and Agrarian Change by linking micro-level processes with macro-level forces (Natarajan et al., 2022). Agrarian change concepts focus on large-scale historical and structural transformations that broadly look at production, extraction and accumulation

rather than everyday livelihoods. Similarly, FPE and the SLF, highlight that neoliberal interests often prioritize large-scale production at the expense of the individual, the household, or the community (Harris, 2015).

Concepts from agrarian change provide a strong analytical approach to understanding how livelihoods have come to be marginalized. Using this lens to understand the country's historical and socio-economic context reveals why poor resource management persists, and fisheries continue to decline, leaving fish processors with diminishing opportunities. I will draw from key agrarian change concepts - bimodal production systems, accumulation by dispossession and peasant differentiation - to reveal a space where poor management and natural resource exploitation is leading to declining livelihood options, particularly for those with limited access and power.

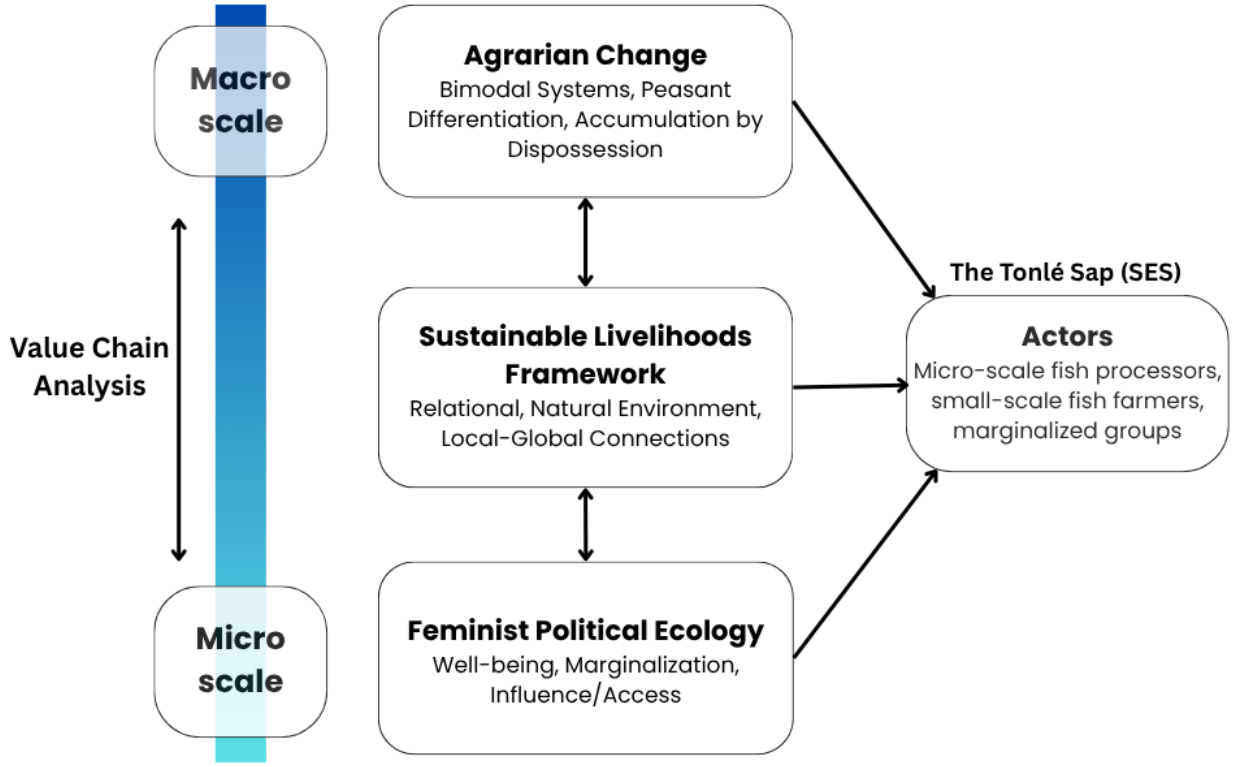


Figure 2. Theoretical framework

Dried fish processing is understudied, and often, value chain analyses lack a recognition of the noncapital relations that occur, negating the important place-based factors (social, cultural, ecological) that influence actors at all scales (Pradhan et al., 2022). While agrarian change focuses on market and capital, FPE expands the analysis to include non-market relations; well-being, marginalization, and influence and access. The SLF builds on FPE by drawing attention to the relational, and how access to capitals is shaped by power and

inequality within structures and relations (Dijk, 2011). Recognizing nature as a non-human actor highlights how ecological transformations and capitalist economic processes are mutually shaping, reinforcing the importance of understanding nature–society influences beyond market forces alone (Sneddon, 2007).

SLF and FPE both acknowledge that there is a multitude of less measurable factors of well-being beyond financial capital that are constantly in a state of flux. Together they address the multiple scales of analysis required to sift through the relationships in natural resource use. FPE attends to tensions across scales, from the individual to the nation and between human and non-human actors (Sultana, 2021). While the SLF broadly encompasses why and how people create their livelihoods, FPE brings a focus to complexities experienced by women and marginalized groups in their livelihood production. It further refines the livelihood approach to observe the emotional influence among nature-society relations that affect people's decisions regarding how and why they use, access, control, or conflict with natural resource use (Sultana, 2011).

This research integrates value chain analysis, most directly in Chapter 7, to understand how value is created, distributed, and captured across the forage fish system, and how these processes shape access, participation, and outcomes for different actors, particularly micro-scale processors. Value chains are when a product moves through a series of activities or nodes, in which each activity adds value to the product (Porter, 1985). For the forage fish value chain, this can include capture, production, processing, selling, trading, and retailing (Pradhan et al., 2022). Value chain analysis concentrates on interlinkages between economic, organizational, and social activities between actors and across sectors and scales (Kaplinsky & Morris, 2000). However, financial value is often prioritized in seafood supply chains in which dried fish are included, overlooking the social values generated (Fabinyi et al., 2018). A value chain analysis should look broadly at the horizontal and vertical interactions throughout the whole chain to understand barriers to participation that impact the poorer actors in the chain (Pradhan et al., 2022).

The research will investigate the contribution dried fish makes to Tonlé Sap livelihoods and understand what processes, relations, and structures shape the livelihoods of micro-scale dried fish processors. By applying concepts from FPE, SLF, and agrarian change, the analysis will uncover how power, gender, and access dynamics influence who benefits and who is excluded within the value chain. This approach aims to illuminate the overlooked role of micro-scale processors, challenge narratives that prioritize large-scale production, and provide a nuanced understanding of the socio-ecological and economic changes reshaping the dried fish value chain. Ultimately, the framework sets the stage for a grounded, multi-scalar analysis that centers marginalized livelihoods in the discussion of resource management and access.

Chapter 3. Methodology

3.0 Introduction

This chapter details the methodological approach taken to answer the research questions and objectives. This research contributes to a broader project, Dried Fish Matters (DFM). DFM is a global network of researchers working in six countries (Bangladesh, Cambodia, India, Myanmar, Sri Lanka, and Thailand). The project aims to understand how dried fish contributes to the food and nutrition security and livelihoods of marginalized groups and poor communities and explores how the production, trade and consumption of dried fish may be improved (Dried Fish Matters, 2020).

I developed the research questions to address the gap in the literature of dried fish and its contributions to rural Cambodian livelihoods. As a PhD student within the Dried Fish Matters project, my research is closely connected to the broader work being conducted. However, I independently formulated my research questions and aims based on my understanding of DFM research and the key issues affecting dried fish in Cambodia (Lokuge, 2020). As such, this study seeks to better understand the gap in the knowledge about how dried fish contributes to the livelihoods of rural households at the Tonlé Sap, and how these livelihoods are changing.

The guiding research questions include:

1. How does the dried fish economy contribute to household livelihoods in and around Cambodia's Tonlé Sap region?
2. How are changes in the dried fish economy reshaping micro-scale fish processing livelihoods?
3. Who is benefitting and who is losing in the changing dried fish value chain, and what does this mean for dried fish livelihoods in the future?
4. What are the gendered implications of fish processing work?

This chapter includes sections that detail the underpinnings and processes taken to answer the research questions. The sections include: positionality, research philosophy, research approach, design, sampling strategy, data collection, analysis techniques, limitations and ethical concerns.

3.1 Positionality

Positionality is how one views the world, their beliefs, assumptions, values and how this influences their research (Holmes, 2020). During my research I was aware that my position as a foreigner would influence the results of the research. At times it was apparent that interviewees were hesitant to open up about certain topics, owing to a culture of distrust in figures perceived to have power (Chhim, 2012). The language barrier and limited time I had to spend getting to know people likely also contributed to their reluctance to share openly. However, being a woman, and interviewing primarily women, I believed my gender was a

strength as Cambodia is a fairly gender-segregated society (Doneys et al., 2020), and women were likely to be more comfortable in the presence of a woman researcher with a woman research assistant. In an attempt to bridge the gap of understanding and as a sign of respect, I learned as much of the Khmer language as I could in the year preceding my fieldwork, taking online classes with a local Cambodian. Once in Cambodia I continued in person classes and practiced my language skills in my daily life and at the village. My language skills were basic conversational. This allowed me to engage in some introductory small-talk prior to an interview and helped to break the ice. I also learned about Cambodia customs, practices, culture and history through reading books, conversations with locals and my research assistants, and from my language teacher.

I was often the only foreigner in the village during the low-tourist season, and people in the area were curious and usually happy to speak with us. Between myself and my research assistant, we explained that I was a student researcher from Canada and the purpose of my research. Some people initially thought I was a journalist, but there was never any hostility, only suspicion and perhaps worry. Usually when we gave more details on the research and reassurance, they did not have to answer any questions they did not want to, they seemed more comfortable with my presence. Despite explaining I was an independent researcher, several NGO and government projects had occurred in this area, and there were likely times where people may have believed I was associated with a program or project that could potentially support them, and this perhaps shaped some of the answers I received. Some interviewees appeared to feel comfortable enough to vent their frustrations about policy or their living situation, something I did not prompt for directly in my questions to avoid anyone feeling uneasy due to potential backlash from authorities. At times, they whispered their answers to prevent others from hearing, indicating that, as outsiders, we were perhaps seen as more trustworthy confidants than their neighbors.

Informant interviews with international organizations, local NGOs, and government officials were mostly held online over Zoom. This was due to the convenience it offered for people's busy schedules, as well as my own since I was based in Siem Reap and most informants were in the capital, Phnom Penh. Online meetings seemed to be preferred, in general, especially in Phnom Penh where traffic congestion is high. I did visit Phnom Penh for fieldwork twice, and offered to visit their offices as an option, but scheduling conflicts, non-responses and perhaps, interview fatigue, led to no meetings taking place in Phnom Penh.

Most interviews were engaging and insightful, despite sensing early on—either at the start of the interviews or during email exchanges to arrange meetings—that some people were reluctant to speak with me. I thought they approached my request with part suspicion and part confusion as to why I wanted to speak to them, believing they did not have anything to contribute to the topic of dried fish. Which reflecting on, speaks to the lack of integration this livelihood has within projects and policy. I approached the meetings from a place of curiosity about their work and project, keeping the conversations light, and only probing for opinions

on government policy when it felt appropriate. The interviewees were also curious about my work, and this opened the door for discussions on connections of their work to the dried fish economy.

3.1.1 Post-fieldwork positionality

I struggled with my position as a researcher throughout the Ph.D., often wondering if I had a place in conducting research within a culture and community I was not a part of. Discussions with other researchers helped me to better understand the value and role I could have as an outsider, but there was one event that brought more clarity. In July 2024, I attended the IIFET conference in Malaysia, presenting some of my initial research on women fish processors, highlighting the decline of the fisheries at the Tonlé Sap, and the livelihood issues this causes. Representatives from Cambodia were in attendance, and after the presentation they contested some of the content (mainly numbers of fish loss from a peer reviewed journal article), saying "the Cambodian government wouldn't agree with those numbers". After reflecting on this, I realized that as an outsider I could use, reference, and express information that Cambodian researchers cannot use for fear of repercussion. My findings, and other's research that I use to support my research, reveals negative aspects of the Cambodian government, particularly their poor social and natural resource governance. In July 2024, two weeks before the IIFET conference, 10 activists from Mother Nature Cambodia, an environmental activist group were sentenced to six years in prison without explanation of how they have broken the law (Ng, 2024). Reporters without Borders (2024) World Press Freedom Index ranked Cambodia 151 out of 180 countries, owing to the high censorship of journalistic content, forced closure of independent media, and murder of two reporters in 2014 who had been investigating deforestation and illegal fishing.

These reflections came after I had completed fieldwork and have changed to a certain degree my epistemological approach. In my analysis I questioned more the validity of literature and reports I used to support my research. Although the suppression of Cambodian's freedom of speech was not new information to me, seeing it happen through a discussion with a Cambodian researcher gave me a clearer perspective as to my place in this research. To be able write freely about the injustices caused to nature and the livelihoods of the Tonlé Sap without fear of repercussion in my home country is a privilege that starkly contrasts with the realities faced by Cambodian researchers. It underscores the importance of amplifying local perspectives that may go unseen and to use my positionality as best I can.

3.2 Research philosophy

The research philosophy and epistemology guides the research process in terms of how one perceives and understands the world (Desai & Potter, 2006). The main epistemological approach my research takes is that of constructivism, where learning and meaning is created through interactions with one another and using multiple subjective experiences

(Schreiber & Valle, 2013). In this approach to the fieldwork and analysis, learning is an active process, building on past experience; it is socially constructed, yet the way it is interpreted is personal (Fox, 2001). This approach emphasizes that I could modify questions and methods as I learn from previous interviews and observations, continuously incorporating new knowledge into the research. A constructivist epistemology is well suited to research in the social sciences due to the use of theory to guide the way in which the issues are approached and addressed. The use of constructivism is coupled with a pragmatic philosophy, with the understanding that the research adapts to what works best in different contexts and is driven by understanding real-world problems towards effective solutions (Legg & Hookway, 2008). The research used inductive reasoning to find general trends, as well as deductive reasoning from established data and concepts such as environmental declines and gender inequalities to make assertions about local experiences.

3.3 Research Approach

While development research has often focused on quantitative methods to produce measurable outcomes, qualitative methods offered a way to understand multiple subjectivities and allowed for questions and hypothesis to emerge throughout the research (Desai & Potter, 2006). The objectives of the fieldwork were to gather perspectives, experiences, and insights of livelihoods within the dried fish economy. The research used mixed methods in a convergent design, collecting quantitative and qualitative data during the same period of fieldwork. However, the study relied mainly on qualitative methods, as they were better suited to exploring the social and relational dynamics of the dried fish value chain and capturing differing meanings and perceptions. A limitation of this approach is that the quantitative data collected lacked consistency and had too few responses to be statistically significant.

Quantitative data were collected where possible, mostly at markets. Secondary, quantitative data of ecological changes were used in the research analysis, as this data was available through various academic articles, reports, and websites. The data helped point to general environmental trends at the Tonlé Sap, such as fish amounts and species, lake flood levels, and climactic changes. Quantitative data on fish catch, imports, and exports are not well documented, but what was available from FAO publications and journal articles was used to support the value chain analysis where possible.

Constructing validity was done in an attempt to draw accurate conclusions about the cause and effect of findings. Internal validity aimed to minimize extraneous variables that may have influenced the results (Yin, 2018). To achieve internal validity, triangulation was used by collecting different perspectives, this included different socio-economic backgrounds, occupations, and family structure for those interviewed at the village and markets. Interviews were held with people working in government, for news organizations, and development organizations to increase the reliability of the data. Peer debriefing was done with the research assistants after most interviews. This enabled an opportunity to confirm

findings and discuss any misunderstandings or questions that came out of the interviews. Since the interviews were being directly translated, the research assistants did not always have the time or energy to provide all the detail during the interviews. These discussions also gave the research assistants time to reflect and offer their insights on the cultural nuances I did not perceive or understand, adding to the 'thick description' (Geertz, 1973) of the research.

3.4 Study Design

The main qualitative methods used were interviews and market questionnaires and personal observations. A restaurant survey was also conducted to provide more data towards understanding the value and commodity chains. The research methods are summarized in Table 2. A total of 42 surveys and 145 interviews were done[2]. Information on gender was recorded[3]. While there was no predetermined percent of women to be interviewed, the goal was to focus on women's voices. Although interviews took place with a main interviewee, there were cases where other people would flow in and out of an interview, joining in for various parts as work allowed. This is the nature of village interviews. Everyone's presence and gender were recorded, but they count as one interview. For consistency in the totals in the chart, only the gender of the primary interviewee is recorded.

Table 2. Methods and interviewee numbers

Method	Number of people	Women	Men
Village Interviews	95	68	27
Market Interviews	26	24	2
Market Surveys	24	21	3
Key Informant Interviews	12	2	10
Restaurant Surveys	18	-	-
Total	175	115	42

The interviews for the village and market were semi-structured; a template of questions (Appendix A) were created to provide a standardized interview approach while allowing space for tangential discussions. Four templates were created for: 1. Fish processors (village); 2. People who have left fish processing (village); 3. Dried fish sellers (market); 4. People who have left fish processing or selling (market). Each template had similar questions but with slight variations to address their work or former work. Later, as interviews branched out to fish farmers and fisherfolk a new template of questions was developed.

[2] Total interview numbers include 20 interviews done by my research assistant in December 2023 and January 2024, and 16 I did during the July 2024 visit

[3] Gender for restaurant surveys not recorded

During the second half of the fieldwork, after analyzing initial data, I realized that specific 'prahok' producer interview questions were needed to understand this part of the value chain more thoroughly. Market questionnaires and restaurant surveys were formatted to be quick, using closed questions that primarily focused on fish species, product type, amounts, and prices.

3.4.1 Schedule

The main fieldwork activities were conducted over an 8-month period, in two phases, January to May and September to December. This time period covered the peak fishing seasons and the peaks of the dry and wet seasons. It also allowed me time to step away from the field and analyze the data collected in the first phase and assess any gaps in my data collection process. An opportunity to present at a fisheries conference in Malaysia in July 2024 gave me the chance to return to Cambodia for 1 week to conduct follow-up interviews.

Table 3. Fieldwork schedule

Month	Activities
November-December 2022	2 week scoping trip, Phnom Penh and site visits around the Tonlé Sap
January 2023	Siem Reap arrival January 24
February	Interviews at Kampong Khleang and markets
March	Interviews at Kampong Khleang, Mechrey, Battambang, market and restaurant surveys
April	Interviews at Kampong Khleang, Chong Kneas, market and informant interviews
May	Interviews at Prek Pnov, Kampong Khleang, market and informant interviews
June	Return to Canada, informant interviews and analysis
July-August	Nvivo analysis and preparation for second round of fieldwork
September	Return to Siem Reap, interviews at Kampong Khleang and markets
October	Interviews at Kampong Khleang, Kampong Phluk, Phnom Kraom, Chong Kneas, and markets
November	Interviews at Kampong Khleang and markets
December	Return to Canada Dec 6
July 2024	1 week of interviews at Kampong Khleang and market surveys

3.4.2 Scoping

A scoping visit occurred from November 22nd to December 6th, 2022. With the help of a research assistant, I visited several floating villages and markets around Tonlé Sap and several markets in Phnom Penh. Informal conversations were held with fisherfolk, sellers, traders and people that partake in various livelihood activities. The scoping visit helped to guide the initial field sites selection. During the trip it became apparent that markets were an important place to interview people, especially in regard to 'trey neat' (filleted dried fish), because this product was not found at the villages. While it was initially thought that most of the research would be done at the village-level, the scoping revealed the importance of interviewing women working at market stalls since they also rely heavily on processed fish as a source of income. The scoping visit was the beginning of understanding the prevalence and influence aquaculture would have on the research. Almost all dried snakehead, 'trey ros', at the market was from aquaculture. Discussions with villagers and sellers at the markets pointed to a significant increase in aquaculture in the last five to ten years. This influenced the decision to add interview questions about aquaculture impacts, as well as interview aquaculture farmers. Lastly, the scoping study revealed how complex, dynamic, and important the 'prahok' value chain is, warranting more focus in the research design.

3.4.3 Site selection

The scoping visit provided an opportunity to confirm study sites and to get a sense of where dried fish was being done and by whom. Wanting to optimize the number of interviews with processors, sites on the eastern side of the Tonlé Sap were not chosen due to their smaller size. The initial research plan had proposed one site on the west and one on the east side of the lake, however it was decided that focusing on one area would allow for a more in-depth understanding of the seasonal variations of dried fish livelihoods. Also of consideration was the cost and logistics of relocating between towns twice.

Two villages were chosen as the main field sites, Kampong Khleang and Mechrey based on purposive sampling (Tongco, 2007). In consultation with my doctoral supervisor, the villages were chosen due to the high amount of fish processing observed during scoping and their proximity to Siem Reap (my homebase) was also a consideration. Kampong Phluk, a village closer to Siem Reap was considered; however, for various reasons, fish processing had declined there over the past two decades. For reasons detailed in limitations (section 3.7), Kampong Khleang became the only main field site. The broader region where the villages are located, the Tonlé Sap, is a well researched area due its size and significance to Cambodia. This was advantageous to my research as there is a substantial amount of literature on the ecology of the area; new studies are published often and there is a continuous stream of updated environmental data available.

The research analysis primarily looked at information collected from Kampong Khleang and the markets. Based on recommendations from research assistants, several other areas around Siem Reap were visited, such as fish farms. As residents of Siem Reap, their local

knowledge was useful in finding places that offered new insights into the dried fish value chain. The research used evidence from these sites, as well as the informant interviews, to support the findings. Markets in Siem Reap were primarily chosen based on size, to get a variety of small and large markets. They were also chosen based on location; the research assistant had a motobike, so we visited markets that were within a reasonable distance of the main city.

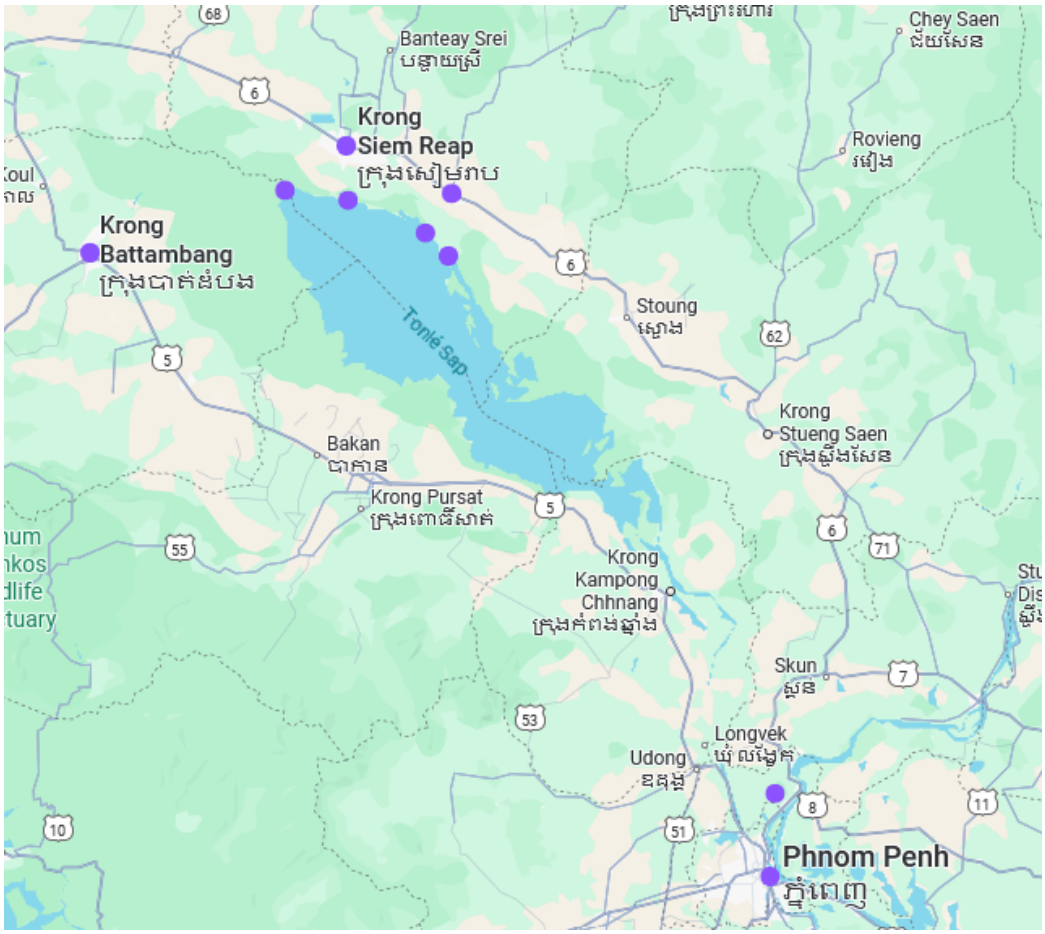


Figure 3. Interview locations (purple dots). Googlemaps 2025

3.4.4 Village Interviews

A total of 95 interviews were conducted with processors, fish farmers, and fisherfolk in and around villages in the province of Siem Reap. 80 interviews were conducted at Kampong Khleang, the focus village for this research. Nine interviews were done at Chong Khneas, nearby towns of Phnom Kroam and Prek Pnov. These places were visited due to suggestions from research assistants to visit fish farm sites. Two interviews were held at Kampong Phluk, during Dr. Marschke's visit. Kampong Phluk is near Kampong Khleang and offered insights into how dried fish work has changed as tourism has developed in the village. Four interviews

were held at Mechrey, which had originally been chosen to be a second main village to interview people. However, due to costs (further explained in limitations), there was only one visit.

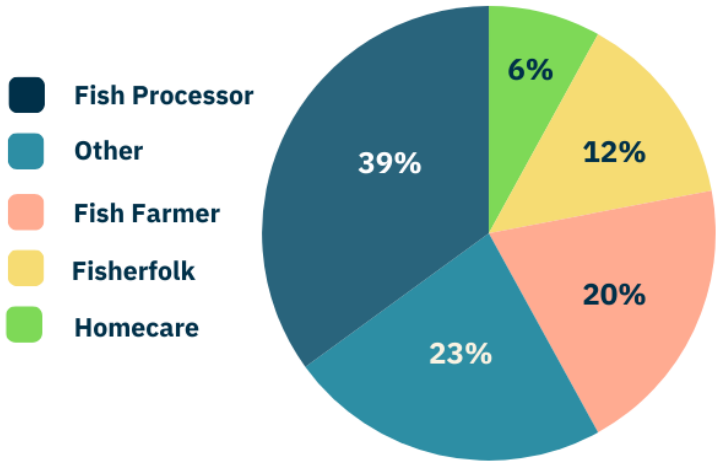
The villages were visited between the hours of 9:30 am and 3:30pm for several reasons. Any earlier in the morning, people were too busy to talk, any later in the afternoon, especially in the dry season, people were often resting due to the heat. Also, the research assistant and I were affected by the heat and were usually tired at this point in the day. Travel to Kampong Khleang also dictated timing. By tuktuk it took approximately 1 hour and 20 minutes each way. I felt it was necessary to be back in Siem Reap before sunset at around 5pm, as the main road was unlit and considered dangerous due to the high speeds of trucks and cars. Most interviews lasted between 30 minutes and 1 hour, however several interviews were less than 15 minutes, either because the interviewee became busy, or showed disinterest or discomfort and we felt it was best to end the interview. Interviews typically took place at the interviewees' homes, often while they were working or doing household chores, which they were encouraged to keep doing. Sometimes other family members, workers, or neighbours were around and would contribute to the conversation.

At the onset of the fieldwork, participants were selected using purposeful sampling, choosing women who we could see processing dried fish. As a better understanding of the dried fish value chain came to light, participant selection was broadened to include fish farmers and fisherfolk. Snowball sampling was used throughout by asking interviewees if they knew someone in the area that was a fish farmer, processor or former processor, the latter being difficult to find. As the research progressed, convenience sampling was employed at Kampong Khleang after realising that most families took part in some form of fish livelihood, and at some point in time dried fish. We used convenience sampling, speaking with people who were available at the time. This approach allowed us to efficiently engage participants in the village as we encountered them. This approach proved to be fruitful, not just in the success of finding participants, but also providing more breadth to understanding the dried fish value chain. The initial purposeful sampling had overlooked people who were not visibly working with dried fish. Once we began interviewing a more random selection of people, we saw other pieces of the value chain and their interactions with dried fish.

Figure 4 shows a breakdown of interviewee occupations. Many people listed several occupations; however, to give a sense of their main livelihood, the chart shows their primary and current occupation. While these were the main individual occupations, most livelihoods were embedded within a household context where activities are often shared, combined, or supported collectively. This means the chart does not capture the full range of household-based livelihood strategies. For example, fish farmers and fisherfolk often engage in some form of fish processing, while many fish processors also catch or raise fish, either themselves or through household members. Some interviewees were former processors,

having left the occupation for reasons that will be discussed in the analysis. Other occupations included shop keeper (4), retiree (3), middleperson (2), shell collector (1), trader (1), labourer(1), homestay owner (1), market seller (2), fish pellet seller (1), city worker (1). Two market sellers were included in this section because they were selling within the village. The city worker was a woman visiting her family, who used to be a shell collector before moving to the city.

Figure 4. Occupations



The village interview template was translated into Khmer and interviews were conducted in Khmer with a research assistant. Some interviews were audio-recorded and transcribed by the research assistant, but a majority of the interviews ended up being handwritten. The research assistant provided the translation throughout the interview while I wrote. I then digitally transcribed my notes within a day or two of the interviews. The main reason for limiting audio-recordings was because of the poor sound quality due to background noises (vehicles, machinery, roosters, music, children) that made it difficult to hear. The poor-quality audio plus the high cost of transcription led to the decision to only audio record if the area was quiet, which did not happen often. Another reason for reducing the use of audio-recording in interviews was the new research assistant during the second half of the fieldwork. This research assistant had excellent in-interview translation capabilities, providing detailed explanations and insights.

3.4.5 Market Interviews and Questionnaires

Market interviewees were selected based on the number of dried fish products at the stall (ranging from none to all possible products) as well as on the availability and willingness of the participant. Market sizes ranged from dozens of dried fish stalls to only one dried fish stall. The size and location of the market seemed to point to a trend in the willingness of a seller to participate in the interview. People at bigger markets in cities (ex. Phnom Penh) often

did not want to talk, whereas people at smaller markets or markets in rural areas (ex. Damdek) were happy to chat. This was likely due to suspicion, time constraints, or disinterest. Because of this, at some markets I was only able to do questionnaires, or not as many interviews as I had intended. I took the opportunity at markets where people were more welcoming to conduct interviews with sellers, forgoing questionnaires. Interviews, which can be rich in detail, often answered a lot of what was asked in the questionnaires but with additional nuances. Table 4 provides an overview of the markets. Market type is based on my assessment of the size and purpose of the market. Local markets were the smallest, with only 1 to 5 stalls selling fish and fish products. City markets have approximately 5 to 20 stalls, and regional markets were hubs, having dozens of fresh and processed fish stalls. One exception is the Battambang Prahok Market, which is a wholesale market of 6 vendors who make prahok on site and ship out to all of Cambodia. Not all market interviews and surveys for the same place were done at the same time. Multiple visits were made to some to see the changes in species availability and price.

Market interviews took place between 10am and 2pm to accommodate the seller's schedules. The busiest time for sales at markets are early mornings and late afternoons. Interviews took place at the interviewee's stall, and we paused the interview and moved out of the way whenever a buyer came.

Table 4. Market interview and questionnaire locations

Market	Type	Province	Interviews	Questionnaires
Svay Thom	Local	Siem Reap	1	0
Phsar Leu	Regional	Siem Reap	3	3
Damdek	Regional	Siem Reap	5	0
Prahok Market	Regional	Battambang	3	0
Boeung Chhouk	City	Siem Reap	4	0
Phsar Kraom	City	Siem Reap	4	5
Phsar Krobei Reil	Local	Siem Reap	1	0
Russian Market	City	Phnom Penh	1	1
Kampong Khleang	Local	Siem Reap	1	1
Phsar Doum Krolinh	City	Siem Reap	3	2
Kilometer 9	Regional	Phnom Penh	0	1
Orussey	Regional	Phnom Penh	0	11
Total			26	24

3.4.6 Key informant interviews

Informant interviews had not been planned for in the initial research design. However, after learning about relevant organizational projects, making connections, and having a lull in my site visits (detailed further in the limitations section), I opted to conduct these interviews. 12

interviews were completed over the course of the fieldwork. Interviews were held with representatives from government, NGOs, development organizations, and journalists. All interviews were conducted in English and transcribed by me. The questions were tailored for each interview and were recorded by note-taking. When possible, the interviews were conducted in-person, at a café or at the person's place of work, but the majority of the interviews were done over video call for convenience. Most interviews were about an hour long.

3.4.7 Restaurant Survey

After two months of site visits and a discussion with my supervisor, it was decided that a restaurant survey would be useful to gain a better understanding of where and how dried fish products are being used outside of households. A survey template was developed, with short and concise questions that took on average 5 minutes to answer. Walking in the main city area, the research assistant and I, visited 18 restaurants between 1:30pm and 3:30pm to avoid the lunch and dinner rush. Some restaurants were initially scoped on google maps, while others were chosen at convenience while walking by and looking at their menu to see if they had fish. The restaurants were diverse in terms of cost per plate, ranging from cheap (<3 USD) to expensive (>10 USD).

3.4.8 Follow-up Interviews: July 2024

Dried Fish Matters was able to support my participation at the International Institute of Fisheries Economics and Trade (IIFET) conference in Penang, Malaysia in July 2024. I took this opportunity to go to Cambodia for one week on my way to the conference and conduct 3 days of fieldwork. Two days were spent at Kampong Khleang and one day conducting market surveys. The interviews and surveys focused on filling in gaps for questions that had come up during my initial analysis or to confirm numbers relating to wage labour and fish prices. I worked with the same research assistant from the second phase of the fieldwork. We conducted 15 interviews at the village, 1 in-depth market interview, and my research assistant did several quick market surveys independently due to time constraints.

3.5 Participant observation

Throughout the fieldwork, observational data was collected through notetaking. Observations in qualitative data are useful in providing immediate information of a certain situation, but are likely not to provide a whole understanding (Yin, 2018). Participants actions may change with the researchers' presence, and we are only observing a snapshot of their life. Observational data offers more context and enriches the reported data with descriptions, it can also strengthen validity by triangulating reported data (Yin, 2018).

Observations included noting any livelihood activities women and men were partaking in, such as who was working, who was relaxing, what children were doing, which family members were present, house materials, and household items. At markets, observations were made on how much fish was available, fish product types, and other items for sale.

Photos were taken, with permission, to provide more detail and greater recall of the observed activities. At times it was difficult to make observations while simultaneously engaging in conversation. If there was a long discussion between the research assistant and interviewee, I would take the opportunity to detail observations in my notes.

Visiting the village several times a month over the course of a year, I was able to observe the change in the flood levels. Having visited the village in late November 2022 for scoping, I was also able to compare the flood levels when conducting fieldwork in November 2023. Throughout the year observations were made on the change in livelihood activities, and it was noticeable how the number of people present at the village changed depending on the season. Monthly observations at the village and market provided insights into the fluctuating availability and amount of fish species.

3.6 Data Analysis

Simultaneous translation from Khmer to English was done during the interviews while I took notes. The notes were then transcribed into Microsoft Word within a day or two of the site visits. Audio-recordings were transcribed by the research assistant and reviewed by me to cross-check with my field notes. Coding and Analysis was done using NVivo 14 for Windows software. Several iterations of coding and analysis were done due to the 3-month break in fieldwork. The first round of coding was done in June 2023, and second round was done in July 2023 after rereading the interview transcripts and assessing which codes could be merged and which information warranted its own code. The next stage of coding was done in December 2023 after finishing the second round of fieldwork (Appendix B). During this round, more fields were merged, renamed or created as I became more familiar with the key themes. The July interviews were added in July 2024. Coding was completely redone on all interviews in Fall 2024 due to an update of the NVivo software that caused a loss of the original coding. I kept the same codes, but it is likely some information was captured under different headings. The decision to recode everything was because having quotes under specific categories and themes allowed for better recall and analysis.

The coding process used a combination of deductive and inductive coding (Lewins & Silver, 2014). To start, deductive codes such as ‘environment’, ‘dried fish’, ‘gender’, and other key headings stemming from the literature review and theoretical framework were created. Most of the primary codes were determined this way. Subcodes were mostly established inductively, as I went through the texts, I used emerging and common themes to create new codes. The codes were mostly used for understanding qualitative data, insights on the dried fish value chain, seeing where trends and commonalities amongst interviewees existed, but also opposing views. The coded data was also used quantitatively to map out the cost of fish and payments for labour, creating a value chain for prahok and smoked fish. Cost averages for popular wild fish species were analyzed against their aquaculture counterpart.

3.7 Limitations

There were several limiting factors to the research during my time in Cambodia. The first issue I encountered was finding a research assistant who was committed and available to work over the course of the first round of fieldwork (February to May). Through contacts I found a research assistant who was able to come from Phnom Penh for a week of work in February, but due to school commitments could only work on weekends. Also providing a per diem and covering travel expenses for four months had not been in my budget. After several unsuccessful attempts of finding an assistant through contacts, I posted an ad on a Siem Reap women's Facebook group and had a few responses. I worked with two research assistants, one for one week and the other for five weeks, but both had to stop work due to health reasons. For the remainder of the first round of fieldwork I used a translation services company, which provided me with different translators depending on their availability. While this interim solution was helpful, it limited the consistency I was hoping for in my interviews. Ultimately, my interview data from the first four months of research is inconsistent in quality and did not allow for a proper build up of a social connection with the research assistants and the people I interviewed multiple times. During my pause in fieldwork (June-August) I found a research assistant who expressed great interest in the work and going out into the field. We worked together for the entirety of the second round of fieldwork (September to December, and July) and made substantial gains in understanding the research questions.

Two field sites, Mechrey and Kampong Khleang, had been chosen, with the goal of visiting both sites equally. During the Mechrey scoping visit, we had paid 60 USD for a boat, which included traveling beyond Mechrey to a village and popular tourist birding area, Prek Toal. When I inquired about costs to go to just Mechrey, they had said at the time it was only 20 USD. Upon returning a month later the boat organizer insisted on 60 USD for four hours. My research assistant tried to negotiate a lower price, but it was non-negotiable. With the cost of the tuktuk to get there, plus the research assistant's fee, and the boat, one visit to the village cost 135 USD for only four hours of access. The two main issues with this were that I had not budgeted this much, and it would significantly limit how many times I could visit Mechrey. Also, the situation fell into an ethical grey area. The people taking the money for the boat rides are not the boat drivers or even local villagers. The drivers do not receive much pay at all; I had confirmed this during scoping. For such a large amount of money to go to someone in a position of power whilst taking advantage of the boat driver's labour, goes against the theoretical backing of my research. I decided the research at Mechrey was not going to work and turned my focus to Kampong Khleang.

Kampong Khleang also held some limitations, but none that could not be overcome with some longer days and lots of planning. Situated about 50 kilometres from Siem Reap, a tuktuk takes approximately an hour and twenty minutes to get there. Therefore, visiting more than a couple times a week was difficult due to the cost of the tuktuk (25 USD) and the long days in the extreme heat. I did plan to stay in the village for a week in April, however, one night

into the visit my research assistant fell ill, and we had to return to Siem Reap in the middle of the night. After that I had hesitations about planning another stay, especially given the difficulty in finding research assistants. It was not actually more cost effective to stay in the village with a research assistant, accommodation was 10 USD/night per person and meals totaled 10-15 USD. However, by not staying in the village, I missed the opportunity to engage in conversations with people later in the evening, meet people informally, be approached by people, observe nighttime activities and gain a richer understanding of their livelihoods.

Another difficulty I experienced was finding people who had left fish processing. I asked almost everyone I interviewed if they knew someone, but often the response was that when a person stopped processing, they leave the area. The people I spoke with that had left fish processing was by chance, and it was only a few people at the village. Finding someone at the market who used to sell dried fish was even more difficult, as it seems they leave the market entirely and do not try to sell something else. Lastly, a lot of dried fish, 'trey neat' (fillets) are often made at people's homes around markets. Compared to the density of prahok and smoked fish processing, it was not possible to find a 'dried fish' village and I did not feel it was appropriate to ask sellers if I could come see their processing activities, or whoever they got their products from. Therefore, most of my information on fillet dried fish comes from market sellers.

Importantly, I was limited in my understanding of my interactions and interviews with people. Although I had taken language lessons a year prior to arriving in Cambodia, my language skills were only basic conversational, and I could not express or understand complex ideas. During interviews, I relied entirely on my research assistants and most certainly missed the nuances between interviewees.

While the Sustainable Livelihoods Framework (SLF) is traditionally applied at the household level, this research took a more individual-centered approach. This focus was intentional, as it allowed for a more detailed understanding of placed-based livelihoods, personal decision-making, and the work of fish processors. However, this approach means that the research does not fully capture the entirety of household roles and livelihood strategies, such as migration. As a result, interactions between fish processors and other household members were less visible. This limited the ability to examine how processing work intersects with or depends on other members in the household, beyond the observations made and the general household questions included in the interviews.

3.8 Ethics

In accordance with the Government of Canada's Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans – TCPS 2 (2018), the research obtained approval (Appendix C) from the University of Ottawa's Research Ethics Board (REB) under Dr. Marschke in time for the initial scoping (November 2022).

Prior to fieldwork, I met with each research assistant to train them on the purpose of obtaining consent and the ethics that the research needed to abide by. I provided a checklist of the key information the participants needed to be told before starting the interview, including an overview of the research. In compliance with the REB, free, informed, verbal consent was obtained from each participant, and they were told they can withdraw their consent from the research anytime during or after the interview. The decision to only obtain verbal consent was to add another layer of anonymity; although the area is relatively peaceful, issues of governance and fishing rights may dissuade people from wanting to be documented. Additionally, participants may have had limited literacy skills, and it would not be ethical to ask them to sign something they cannot read. Verbal consent was sought for all photos and videos taken of people, the work they were doing and their homes. Whenever possible, I tried to take photos that did not include any discernible features of people and avoided taking photos of young children. Verbal consent was obtained to audio record the interviews; if they did not agree, the interviews were only transcribed.

Information relating to the participants was coded. A list of their identifying information was retained, and only l have access to the code to relink the data if necessary (Government of Canada, 2018, pp. 59). If a participant wished to remain anonymous, their identifying information was not recorded, and a random label was assigned to them that followed the same nomenclature as the coded participants. A spreadsheet was kept with the coded information, including a note of their verbal consent to participate. Any publications of the data will remove all names to ensure anonymity; this was clearly explained to the participants.

Chapter 4. The Cambodian Context

4.0 Introduction

This chapter provides a brief overview of the recent political situation stemming from a tumultuous period of colonization, regional conflicts, and a civil war that resulted in the genocide of almost one quarter of the country's population (Springer, 2010). This context is important for understanding the current government's approach to natural resource mismanagement and why socio-economic inequalities are growing. The chapter also provides insight into the socio-cultural context that shapes livelihood production, especially for women in rural areas.

The major political events that took place in Cambodia during the 19th and 20th centuries are complex, and this chapter cannot cover their full scope. Table 5 (BBC, 2018; Hutt, 2024) provides a simplified overview of key events leading up to the present-day political situation, helping to place the research in historical context.

Table 5. Major political events

YEAR(S)	MAJOR EVENT
1863	Cambodia becomes a protectorate of France; colonial rule lasts for 90 years
1953	Cambodia wins independence from France
1965-1970	Cambodia breaks ties with US; support shifts to North Vietnam
1970	Military coup replaces Cambodian Chief of State, Prince Sihanouk with a pro-US government (under Lon Nol); civil war escalates against North Vietnamese and Khmer Rouge forces
1975-1979	Khmer Rouge (under Pol Pot) seizes Phnom Penh, mass killings and forced labour lead to the genocide of 1.7 million Cambodians
1981	Pro-Vietnamese government wins elections but is not internationally recognized. The Khmer Rouge retains its seat at the United Nations
1985	Hun Sen becomes prime minister. Fighting against the Khmer Rouge's exiled government continues
1989	Vietnamese troops withdraw. Hun Sen tries to attract foreign investment by abandoning socialism
1991	Paris Peace Accords; UN-led transition
1993	Democratic elections held; the opposition party wins but Hun Sen refuses to accept the result. The opposition leader and Hun Sen agree to share power
1997	Hun Sen consolidates power through a coup d'etat

2013	The Cambodian People's Party (CPP), Hun Sen's party, is re-elected by a slim margin to an opposition party
2018	Opposition parties are banned, and Hun Sen's party, the Cambodian People's Party (CPP), wins all the seats
2023	Hun Sen steps down and his son Hun Manet takes over; opposition parties continue to be suppressed, and a one-party rule continues

4.1 The Political Economy of Natural Resources

The exploitation of natural resources proliferated after the end of the Khmer Rouge regime in 1979 as the country transitioned to a democratic system and from a socialist economy to market capitalism (Le Billon, 2000). In the 1980s, as foreign aid declined, timber commodification became a politicized source of military funding. Most development agencies and international donors viewed natural resource use for capital accumulation as necessary to give the State the infrastructural power to recover from decades of conflict (Le Billon, 2002). Since the start of the 21st century, considerable forest loss has occurred across the country, most of which has taken place within economic land concessions (ELCs) (Davis et al., 2015). Natural resource exploitation and land grabs that enrich the political elite and well-connected members of Cambodian society continue to this day (Schoenberger & Beban, 2018).

Resistance by the Cambodian population to the elite capture of natural resources and the authoritarian regime has been limited, though not absent. Protests, petitions and public demonstrations occur on occasion (Young, 2019). However, there remains a collective trauma from the decades of violence, which has created a culture of submission, fear, mistrust, and inability to speak out amongst many Cambodians (Chhim, 2012; Strangio, 2014). The government relies on this fear as a tool of suppression when disposing villagers of their land (Schoenberger & Beban, 2018). Furthermore, a stronger turn towards authoritarianism since 2017 has proven detrimental to natural resource protection policies and projects. The controlling party, the Cambodian People's Party (CPP), has ensured it manages the most lucrative government departments, such as agriculture, forestry and fisheries, and water resources, with minimal considerations for equity and sustainability (Blake, 2019). A high-profile case was revealed in 2022; a deputy director within the Ministry of Agriculture, Forestry and Fisheries was arrested in the United States and charged with smuggling wild long-tailed macaques, an endangered primate (Maron, 2022). Land concessions and overtly illegal activities of animal trafficking are indicative of the systematic problem of how natural resources are managed in the country, whereby the primary goals of policies and programs are economic and tied to elite capture (Un & So, 2009). This inequitable natural resource governance system benefits the rich while reducing

accessibility for some of Cambodia's poorest citizens who rely on natural resources for their livelihoods.

Like timber resources, Cambodian fisheries have experienced an increase in commodification and overexploitation. State-sanctioned fishing solidarity groups previously managed the Tonlé Sap; however, in the 1980s, the State instituted a fishing lot system that privatized parts of the lake to earn revenue for the government (Sok, 2014). Local fisherfolk were blocked from using much of the lake as it had become controlled by only a few lot owners (Marschke, 2012). Large commercial fisheries controlled the space and depleted the lake's fish stock, causing tensions between local subsistence fishers and market-oriented actors (Sneddon, 2007). The government's compliance with overfishing during the past four decades highlights a continuing history of conflict and displacement of property rights experienced by Cambodians.

In response to fisheries conflicts, the government cancelled 56 percent of the privatized leaseholds in 2001 and abolished all concessionaire licenses in 2012, making room for conservation areas (Sok, 2014). Despite these reforms, it appears the management of the lake has fallen into further disarray. The violence associated with resource conflict at the Tonlé Sap (Resurreccion, 2006; Sneddon, 2007) that the reforms sought to address remains unabated due to government inaction to mitigate conflicts and allow bribery practices and corruption to continue (Sok et al., 2021). Illegal gear use and habitat destruction continues due to a lack of enforcement resources, and co-management amongst stakeholders has largely failed due to insufficient interaction, limited budgets, and decision-making remains in the hands of the central government (Ratner et al., 2017; Sok & Yu, 2021). A hybrid regime of community fisheries and open access policies were used between 2013 and 2019, but weak enforcement and continuing bribery practices have obstructed any real change (Sok et al., 2021).

These issues at the Tonlé Sap are compounded by the absence of social safety nets and pro-poor policies, which exist largely on paper but fail to be adequately implemented and reach the most vulnerable (Kolesar et al., 2020). Natural resources are a critical part of livelihood production and act as a buffer when governance fails to provide adequate protections. Households often rely on land as collateral to access loans to respond to shocks and stressors (Blau & Arnold, 2024), underscoring their dependence on informal mechanisms for survival. When the Covid-19 pandemic hit, the government implemented a cash transfer program, however, only a narrow subset of the population benefitted, many informal workers, such as those in the fisheries sector did not receive any financial support (Im & Ford, 2024). Many people living at the Tonlé Sap lack land tenure and work in informal jobs, leaving them overlooked in social policies and with limited capacity to adapt, highlighting the persistent vulnerability of communities reliant on natural resources for their livelihoods.

4.2 Cambodia in the 21st Century

Emerging from the civil and regional conflicts of the 20th century, Cambodia has had to rebuild its social and political landscape. Into the 21st century, Cambodia remains under authoritarian rule, although its government considers itself to be democratic. In recent years the government has cracked down on independent media while allowing for the rise of the state-sanctioned online news outlets that supports their hegemonic agenda (Norén-Nilsson, 2021). Most recently, in February 2023, Voice of Democracy (VOD), considered the last remaining news organization reporting on unjust government actions was shut down by the prime minister (Hutt, 2024). Moreover, the government is working to establish a 'digital wall', similar to what China has created in the hopes to monitor all communications (Reporters without Borders, 2024).

National elections held in July 2023 were deemed by the international community as neither free nor fair (Bennett, 2023). The main opposition party was barred from running, and Hun Sen eventually stepped down as Prime Minister, handing power to his son, Hun Manet, in a seamless transition that maintained essentially the same authoritarian power structure (Hutt, 2024). Social freedoms continue to decline; in June 2024, ten young environmental activists were jailed on dubious claims of conspiracy and insulting the king (Ng, 2024). Cambodia is amongst one of the lowest ranked countries on the World Press Freedom Index, dropping four places in 2024 to 151 out of 180, citing the repressed socio-political climate, especially for environmental journalists, two of which were murdered in 2014 (Reporters without Borders, 2024).

Despite declining social freedoms, Cambodia is experiencing rapid development; as one of the fastest growing economies in the world, its human development index (HDI) increased by 56.9 percent between 1990 and 2021 (UNDP, 2024). However UNDP's (2024) report found within country inequalities are growing; consequently Cambodia's 2024 HDI has decreased back to its 2018 level. It is likely that the regression partly stems from a common outcome of neoliberal development, whereby the most marginalized groups are not accounted for in governance, further exacerbating societal inequalities (Harris, 2015). Capitalist systems expand unevenly, often rural smallholders are left out of development opportunities or are exploited to benefit wealthier actors (Bernstein, 2021). Notwithstanding growing inequality and development setbacks, the UN General Assembly recently confirmed that Cambodia will graduate to lower-middle income status at the end of 2029 (United Nations, 2025).

4.3 Socio-cultural Norms and Gender Roles

Socio-cultural transformations have been slow compared to economic development, with changes in gender norms, education, and access to technology emerging gradually. These shifts are part of the broader process of class differentiation[4] in rural areas, where cultural

[4] Over time, peasants divide into different socio-economic groups: rich peasants, middle peasants, and poor peasants and the landless (Harriss, 2023).

and economic changes influence each other. For example, broader use of the internet is increasing literacy, which can lead to greater economic opportunities. A study (Phong et al., 2016) on country wide cell phone usage showed that a third of the population are reading and writing on their phones outside of school and work for self-motivated reasons (entertainment and communication). These gradual transformations occur within the context of deeply entrenched gender norms that continue to shape Cambodian society.

Women held positions of power within Cambodian society until the mid-nineteenth century when Ang Duong[5] created legal reforms dictating women's mannerisms and actions and ultimately their access to power (Jacobsen, 2008). The 'Chbap Srey' (rules for women), is thought to have stemmed from a poem Ang Duong wrote. These rules outline women's behaviour to keep a passive and modest demeanour, and the obedience they must have towards their parents and husbands (Doneys et al., 2020; Pearson, 2011). These ideals persisted into the 21st century, embedded in literature and culture, framing women's dignity around their role as dutiful wives and daughters (Ledgerwood, 1990; Tann, 2024).

The civil war caused a temporary shift in women's roles. More women than men survived the genocide and subsequent years of fighting, resulting in a higher number of adult women in the population who took on labour tasks previously done by men (Ledgerwood, 2008). The gendered division of labour has somewhat returned to pre-war norms, men typically take on heavy labour tasks, but women now have greater flexibility and take on more jobs outside the household (Ledgerwood, 2008). However, within households, women continued to shoulder most or all domestic and caregiving responsibilities (Brickell, 2011). Today, women remain positioned as caregivers, expected to combine paid work with unpaid duties such as cooking, cleaning, and caring for children, the sick, or the elderly. These obligations restrict women's time and mobility, limiting their access to education, jobs, markets, and capital (Kusakabe, 2016; Lamb et al., 2017).

These socio-cultural hierarchies are evident around the Tonlé Sap Lake. Fishing itself is largely male-dominated (Resurreccion, 2008), while women more often engage in post-harvest work. Much research has focused on capture fisheries (Bahadur et al., 2020; Marschke & Berkes, 2006) especially since the rise of community fisheries programs in the 2000s (Ratner et al., 2017). In contrast, post-harvest activities, handling, processing, and marketing fish, remain overlooked despite women's central role (FAO, 2016).

[5]Ang Duong was king from 1848 to 1860, having taken the throne from his niece, Ang Mei. Ang Duong easily gained support to take over the crown owing to him being a man close in line to the throne. Ang Mei was seen as a puppet of Vietnam, which led to an association of women's political power with national humiliation. Yet she was given rule of Cambodia at a time when the Vietnamese were already in charge. During Ang Duong's reign, he created a series of laws that privileged male interests and promoted the control of women (Jacobsen, 2008).

Despite the lack of research, governance and policy in post-harvest fisheries at the Tonlé Sap, fish processing is one of the most common livelihood activities for women due to several factors:

1. Fish is the most abundant natural resource; most women can gain some sort of access.
2. Processing the fish requires patience and precision; attributes associated with women's work.
3. Processing can be done from home, allowing women to do household activities throughout the day.

Despite the social and economic importance of processed fish, this primarily women-held occupation is undervalued. Families typically pool incomes from all their jobs towards paying for food, children's schooling and other expenses. For some households fish processing is seen as supplementary income to the family's main higher earning income such as fishing or manual labour. Often the 'real' income earnings are attributed to catching the fish. This is common in small-scale fisheries; women's contributions are undervalued, and a gendered division of labour allocates lower paid or unpaid tasks to women (Galappaththi et al., 2021). The implications of undervaluing processing work, and by extension the work of women in Kampong Khleang is that there is little movement on policy and governance in the fish processing sector. Socio-cultural norms about which jobs are seen as important and income earning continue to hinder the sector's development and shape perceptions of women's contributions.

4.4 The Tonlé Sap - Environmental Decline

The geographical region where the research takes place is the Tonlé Sap Lake (Figure 5). Located in northwest Cambodia, the lake has an exceptional hydrological system characterized by the world's largest natural freshwater flow reversal (Yoshimura et al., 2022), creating an annual flood pulse. During the rainy monsoon season (May-October), the Mekong River's volume increases and floods into the Tonlé Sap, nearly tripling the lake's area (Frappart et al., 2018). In the dry season (November to April), the water recedes to the Mekong and drains into the South China Sea. The map in Figure 5 (bottom right) shows the floodplain's extent during the rainy season and the area of permanent water in the dry season.

Droughts and floods in the region are strongly influenced by the global weather phenomena of El Niño and La Niña (Tang et al., 2023). These climatic events make the lake's interannual surface water storage highly vulnerable (Frappart et al., 2018). Weather patterns like El Niño and La Niña are less predictable and increasing in severity due to anthropogenic climate change (Rockström et al., 2009). Destructive floods and droughts have become more frequent in Cambodia over the past decade. The worst flood occurred in 2011, affecting 1.6 million people, while the most severe drought struck in 2015, impacting 2.5 million people (Gartrell et al., 2020).

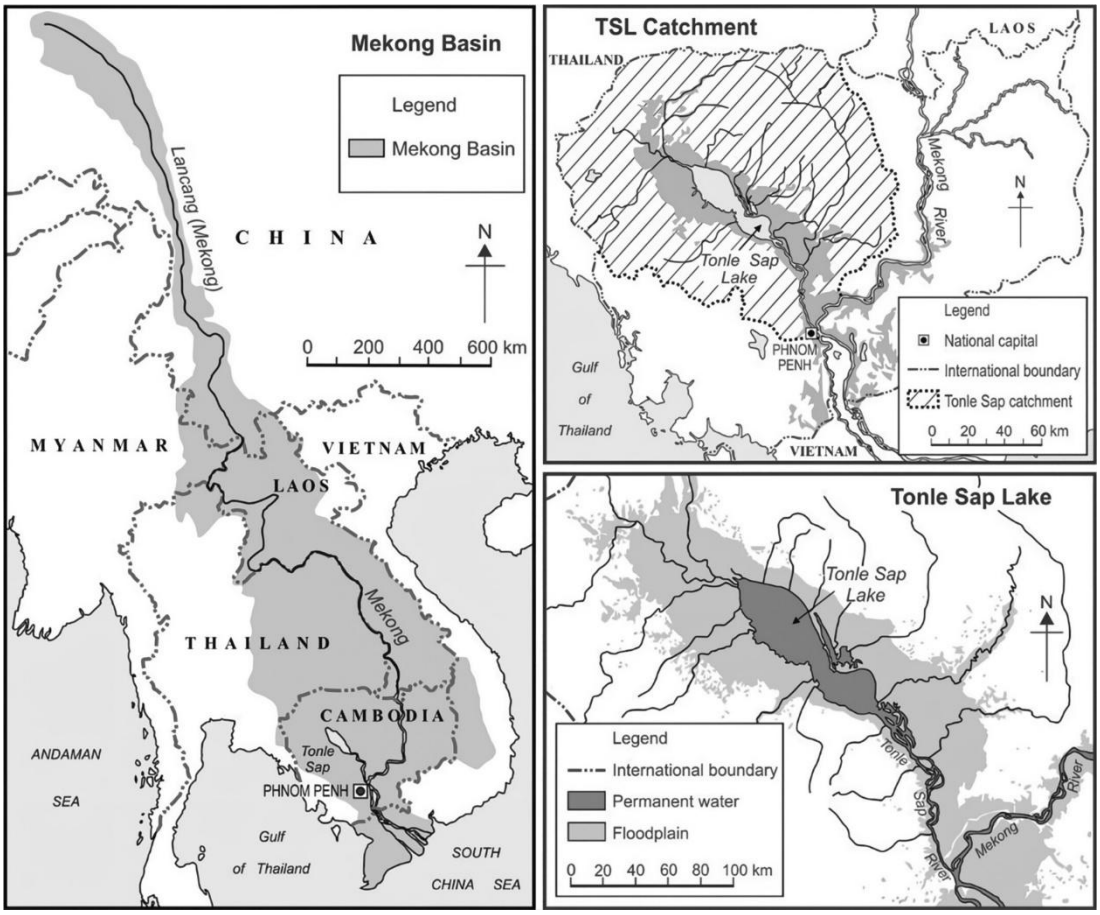


Figure 5. The hydrology of the Mekong Basin, the TSL catchment, and the lake and floodplain (Sithirith & Grundy-Warr, 2025).

With its low barrier for entry, the Tonlé Sap fishery provides employment for many people, and serves as a safety net for low-income households (UNIDO, 2021). The lake directly supports more than 1.7 million people living within the floodplain (Gillespie & Perry, 2019), with dried fish being a staple commodity derived from these fisheries. Figure 6 shows fish dependency by commune, with some of the highest concentrations of fish-dependent livelihoods around the Tonlé Sap. Despite the importance of the lake, environmental degradation, climate change, and overfishing threaten its viability and sustainability. Such environmental changes create unequal and uneven effects, creating injustices and disproportionately impacting already marginalised communities (Sultana, 2019).

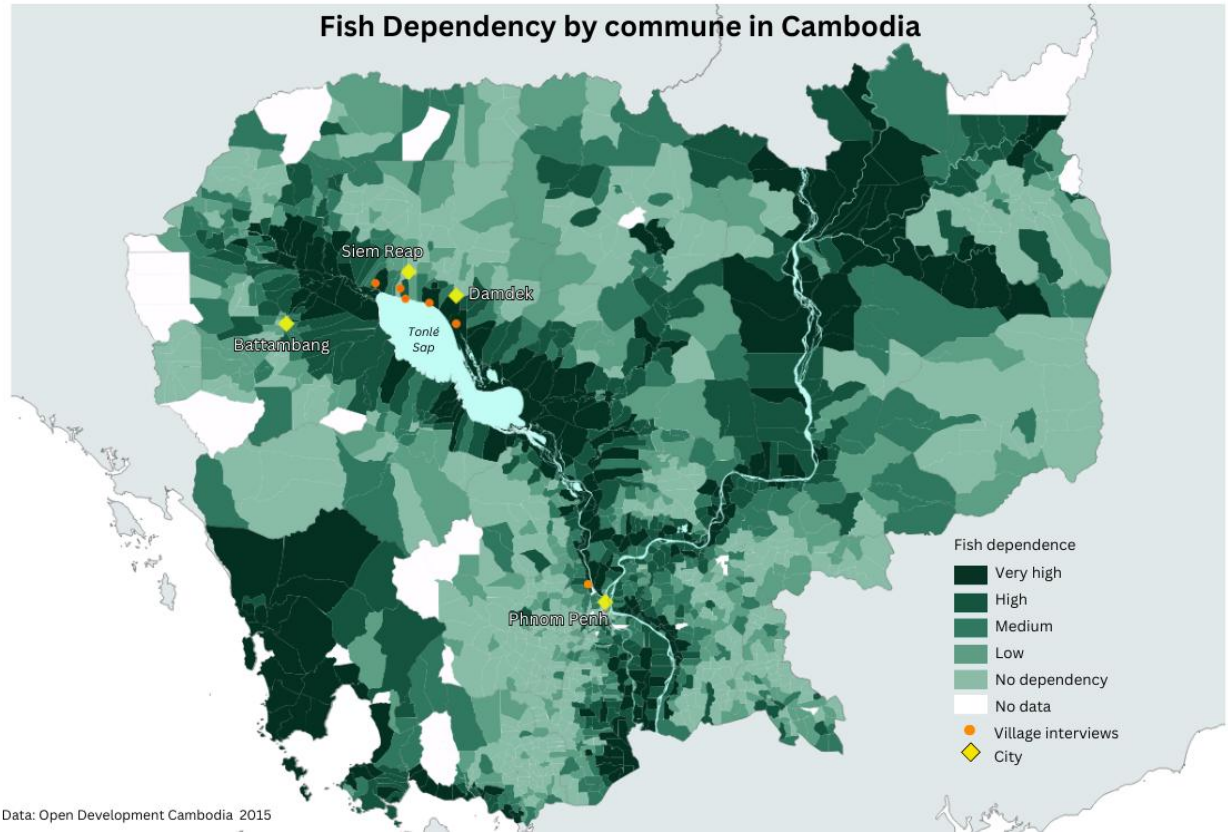


Figure 6. Fish dependency by commune. Data from Open Development Cambodia (2015). Mapped by C. Cranmer

Women and girls are particularly vulnerable to climate change and natural disasters; they often bear the responsibility of domestic burdens that increase after a disaster, missing out on income opportunities (Erman et al., 2021). In Cambodia, women are more at risk to disasters due to patriarchal and cultural norms that hinder access to medical care, deters women from leaving their households, and partaking in physical activity (they are less likely to be able to swim or climb to avoid flood waters) (Gartrell et al., 2020). New research in Cambodia examines the link between climate change impacts and human trafficking, highlighting how disrupted livelihoods drive young rural women toward migration and desperation for work, increasing their risk of being trafficked (Phon & Price, 2024).

The Tonlé Sap Lake illustrates how poor environmental governance harms local livelihoods. Overreliance on the natural resources provided by the lake and surrounding area without adequate management for their sustainability is now showing its impacts. Natural habitats in the Tonlé Sap Lake and Floodplain have declined in the past 25 years (Mahood et al., 2020), and there is a noticeable decline in fish species diversity and volume, particularly among larger species (Chevalier et al., 2023; Gillespie & Penny, 2022; Ngor et al., 2018). While higher trophic-level fish decrease, smaller lower trophic-level fish sustain total catch

size (Bahadur et al., 2017). When one resource is overexploited, people move to another, continuing a cycle of degradation and exacerbating problems for the Tonlé Sap's ecosystem. The interconnected socio-cultural, environmental and economic issues coalescing at the Tonlé Sap create complex challenges for sustaining livelihoods, promoting equity, and ensuring the long-term viability of the fishery.

4.5 The Growth and Constraints of Cambodian Aquaculture

Aquaculture[6], or fish farming has long been part of Cambodian livelihoods; small-scale cage and pen fish culture reportedly dates back to the 10th century (FAO, n.d.). Pond culture, however, is not a traditional activity in Cambodia as the Tonlé Sap has historically provided a significant source of wild-caught fish (Chhim & Mardy, 2024). In the past, wild-caught fish and fish products met food demands, but overextraction and environmental degradation have strained inland capture fisheries, creating a gap in supply (Joffre et al., 2019). Since the 1990s, the government and NGOs have promoted pond culture more actively (Chhim & Mardy, 2024), framing aquaculture as a viable strategy for food security, nutrition, socio-economic development and GDP growth (MAFF, 2015).

As capture fisheries reach their peak productivity, the government believed aquaculture products would reach 740,000 tonnes by 2024 to fill demand (MAFF, 2017). However, a report released by the Fisheries Administration showed that in 2024, only 320,280 tonnes of the country's fish came from aquaculture (Seangly, 2024). A study by Joffre et al. (2021) accurately predicted that Cambodia's aquaculture sector will be unlikely to fill the supply gap due to low yields, dependence on imported seed and feed, and reliance on low-value capture fish feed.

Most fish farming remains small-scale, producers experience constraints from poor water quality, reduced water supply, limited access to seed[7] and feed, and a lack of knowledge of fish culture technology and production methods (Sreyleak & Mardy, 2024). Pellet feed is only affordable for medium and large-scale enterprises, while smaller producers rely primarily on forage fish. No policy regulates the use of wild fish for feed, though the National Strategic Plan for Aquaculture Development acknowledges the issue: "More effective management of the wild [fish] resource is beyond the scope of this strategy, but awareness of the pressure attributable to aquaculture must be raised amongst fish farmers and government officials alike" (MAFF, 2017, p. 35). This lack of regulation illustrates how development goals are prioritized over mitigating aquaculture's ecological impacts.

[6] Aquaculture refers to the cultivation of aquatic organisms in a controlled environment (Amundson & von Brandt, 2025). Fish farming is a subset of aquaculture focused on fish. This research uses the terms aquaculture and fish farming interchangeably.

[7] Aquaculture seed encompasses the young stage of a species and is used to stock ponds. High quality seed is important for successful aquaculture production but remains a challenge to secure or produce in low-income countries (FAO, 2024c). Seed in Cambodia comes from three main sources: local hatcheries (carps, barbs, tilapias), imported from Vietnam (catfish, snakehead) or from the wild (Kruijssen et al., 2018).

The strategy also highlights conflicts created by aquaculture intensification, most notably the dependence on small fish[8] as a feed source. Still readily fit for human consumption, a more accurate descriptor of this resource is small, low-value fish, or forage fish (Belton & Thilsted, 2014). Cambodia's main farmed species, giant snakehead (*Channa micropeltes*), pangas (*Pangasianodon hypophthalmus*), and hybrid catfish (*Clarias*), are typically fed forage fish mixed with rice bran and homemade ingredients (MAFF, 2017). The use of forage fish as feed has been problematic since the early 2000s, leading to a government ban on snakehead farming between 2004 and 2016. Farming resumed after promising research established soy pellet feed as a viable alternative (Hyman et al., 2017; Nam et al., 2016). Despite the research, pellet feed is yet to reach capacity. To date, only one factory in Cambodia makes pellets, while the majority of pellet feed continues to be imported from Vietnam. The Cambodian FMFO (fish meal, fish oil) industry is in its infancy, and information on production remains scarce.

Several policy changes and market events have driven the growth of farmed fish production in Cambodia. The Strategic Planning Framework for Fisheries (2010-2019) outlined plans to expand the aquaculture sector, followed by a specific aquaculture strategy, released in 2016, coinciding with the snakehead ban being lifted (Nam et al., 2016). Market pressures also played a role: in 2021, the government temporarily banned imports of farmed fish from Thailand and Vietnam to promote local production, but retracted the ban after Vietnam protested it violated trade agreements (Sokmean, 2021; Vireak, 2021). Despite rapid growth and state investment, Cambodia's aquaculture sector still lags behind compared to other countries in the region (O. Lang, 2015).

Although farmed fish plays a crucial role in maintaining Cambodia's fish supply as wild-caught fish from the Tonlé Sap declines, small-scale fish farmers and dried fish processors remain on the periphery of policy and governance. Cambodia is in a transitory state where development is outpacing environmental regulations and socio-economic policies, reinforcing existing inequalities in access to resources and markets. This trajectory raises concerns about the commodification of resources drawn from a collapsing ecosystem that millions of rural people depend on for their livelihoods.

This research takes into account the dynamics of the rapidly developing political and economic landscape of Cambodia. The legacies of 20th-century conflicts, continue to shape the current political economy, natural resource use, and socio-cultural norms. Within this context, women's central yet undervalued role in dried fish processing becomes

[8] There are various terms for fish as feed in the literature. Trash fish is a common term for fish as feed, but at the Tonle Sap, trash fish refers to the residual trimmings and waste products from a fish after processing. 'Trey noi', meaning 'small fish' refers to the whole body of the fish that is used as feed. Trey noi are small, low value fish that are often used as feed for animals or fish but can also be used for human consumption. A considerable amount of 'trey noi' is comprised of juvenile fish from commercially important species (Belton & Thilsted, 2014).

especially significant. Their labour sustains household economies and local markets, but it remains largely invisible in policy and governance. Recognizing how political, ecological, and cultural shifts converge is important for understanding both present challenges and the future of micro-scale fish processing livelihoods.

Chapter 5. Dried Fish Livelihoods

5.0 Introduction

This chapter focuses on women's fish processing livelihoods at Kampong Khleang. The analysis examines who practices fish processing and explores daily life in this sector. Taking into account that fish processing is predominantly done by women, a feminist lens on livelihoods is useful to explain the gendered inequalities experienced in access and control of resources (Kwok et al., 2020) and how this affects women's livelihood production. This chapter focuses on livelihoods at the individual scale, and does not deeply explore macro processes, which are addressed in later chapters.

The Tonlé Sap provides livelihood opportunities for millions living within the floodplain, many of whom are part of small-scale fisheries (Jones & Sok, 2015). Being a small-scale fisher has never been easy or lucrative compared to urban jobs, but many people recall a time 20 to 30 years ago when they had no problems filling their nets with fish. Nowadays, fishing households struggle to earn enough money to feed their family, buy petrol for their boats and replace fishing gear. Fisherfolk spend long days on the lake moving to new areas where they might find more fish. After expenses, some fisherfolk can make 120 USD a month (Interviewee MA7-A), a decent salary for a rural area, but still under the 208 USD minimum wage for garment workers[9] (Cambodia Investment Review, 2024). For dried fish processors, the situation is complicated, some are embedded in fishing households, while others, such as widows or women without direct access to fish, rely solely on processing work. Whether a household has alternative income sources, such as migration or wage labour, strongly shapes how vulnerable they are (Razavi, 2003). This highlights that while dried fish processing is often part of household incomes, outcomes vary widely depending on household composition and connections.

Inland fisheries like the Tonlé Sap substantially contribute to the nutrition and livelihood security of poorer groups who operate at small-scale or subsistence level (Lynch et al., 2017). Fisherfolk are among the most marginalized groups in Cambodia, facing poverty due to weak policies and regulations that fail to address threats such as industrial fishing, dam development, and sand mining. Stronger management of these issues, along with social services such as health and education, could better protect their livelihoods. Yet even more marginalized are fish processors. They earn less than fisherfolk (some make only 40 USD a month), lack alternative skills and opportunities, are often expected to take on unpaid homecare, and remain entirely absent in policy considerations. Families that rely on fish processing as their primary income live in poverty, surviving day-to-day on their minimal earnings.

[9] This wage is a 1.96% increase from the 2024 wage of 204 USD, effective January 1st 2025. The garment, footwear and travel goods (GFT) industry salary is used as a comparable benchmark because it is low skill work that fish processors could potentially do if they are able to secure a job.

Despite these challenges, fish processing continues to be an important economic opportunity for low-skilled, rural women and their families due to the accessibility and resiliency it offers for poor and vulnerable households (Belton et al., 2022). At the Tonlé Sap, dried fish resources are particularly important as the lake faces a multitude of stressors. This analysis examines emerging trends in this dynamic yet fragile system, focusing on the role of dried fish and how it supports livelihoods. Two research questions guide this chapter: 1) How does the dried fish economy contribute to household livelihoods in and around Cambodia's Tonlé Sap region? and 2) What are the gendered implications of fish processing work? First, I introduce Kampong Khleang and address the gendered division of labour that takes place in the commune. I then present the two main fish products produced in Kampong Khleang before introducing the dried fish processors, their roles in the value chain, their daily experiences and the importance of dried fish. Finally, I examine how gender norms and structural inequalities constrain women fish processor's livelihood options today and into the future, while also highlighting signs of change.

5.1 Kampong Khleang

Fishing at Tonlé Sap is deeply embedded in Cambodian culture; records dating as far back as 802 CE note that the lake's fisheries were of significance to the Angkorian Empire (Tully, 2006). Throughout Khmer history fish has been an important part of the social and cultural economy. Today, the lake's fisheries directly support more than 1.7 million people living within the floodplain (Gillespie & Perry, 2019).

Figure 7. Map of Cambodia with location (star) of Kampong Khleang from Encyclopedia Britannica (2007) (left). Smaller scaled map of Kampong Khleang from Google maps 2024 (right).

Kampong Khleang is a major producer of fish and fish products. Located in Siem Reap province, 50km from the city of Siem Reap, on the northeast shore of the Tonlé Sap Lake, Kampong Khleang is a rural commune of approximately 10,000 residents. The commune is

made up of several villages that blend into one another, making it difficult for visitors to discern where one ends, and another begins.

Considered a 'floating village', the majority of the houses are built on wood posts to avoid inundation when the lake floods in the wet season. Off the main highway, a paved road leads towards the lake for several kilometers but abruptly ends before it reaches the local market. Houses are typically made from a combination of wood and steel sheet metal, commonly painted red or blue. The central hub of the commune consists of a market area where fruits, vegetables and meats are sold, along with other shops selling clothes and household items. A school, a monastery, a large pagoda and Buddha statue sit on a raised area of land, approximately 8000m^2, giving the community a space to meet when other communal places are flooded. A road winds around the bottom of the Buddha statue towards the only bridge in the commune[10] wide enough for a small car to drive across. During the rainy season the bridge is flooded and the only way to reach the other side is by boat. Getting around by boat is a common form of transportation for 6 months of the year, allowing people to sell their products and for children to go to school.

Figure 8. Kampong Khleang from the main bridge in February 2023 during the dry season.

Kampong Khleang is a place where the rural-urban divide is simultaniously narrowing and growing. Electrification, motorized boats, cell phones and the internet gives the commune

[10] Currently the only bridge, but a concrete bridge was observed being built closer to the main highway in July 2024.

national and global access. Rural livelihoods have long been connected to urban markets, but these links are deepening as modes of production increasingly emphasize financial gains. Yet this connection to capital markets is allowing for poverty to be produced and reproduced in new ways (Natarajan et al., 2022). Extraction of resources to feed growing market demands are unrestricted, allowing capital interests to profit while people living at the margins have to work harder and longer because their access to fish resources is dwindling .

Education for children in rural areas is challenging due to the lack of facilitates and infrastructure, and many children do not continue their education beyond primary school (Ravet & Mtika, 2024). While the Education Law of Cambodia (2007) stipulates the state is to provide 9 years of basic education (Chhinh & Dy, 2009), in reality, as many as 50% of children in rural areas do not have access to education (Ravet & Mtika, 2024). Poor education is a continuing legacy of the Khmer Rouge rule that destroyed the education system and killed the country's most educated people (De Walque, 2006). The current education system in Cambodia faces severe systemic and reinforcing failures. Critically underfunded, teachers are not paid well and often are not well-educated. To supplement their salaries, teachers offer after school tutoring sessions to students whose families can afford the additional classes[11]. To the detriment of lower income students, much of what is taught during the sessions are the more critical pieces of education that the students are tested on. This systematic form of corruption essentially forces students to pay for the extra classes or risk being unprepared for exams (Leng, 2023). Information about rural education is fragmented and much is unknown beyond high drop-out rates, low quality teaching, and poor infrastructure and resources (Hirakawa & Taniguchi, 2021).

In Kampong Khleang there is a primary school and a recently built high school. If students want and can afford to continue post-secondary education, they must go to Siem Reap or Phnom Penh. Interviewees often discussed how they would like to see their children finish secondary education or go to university. It was not long ago that parents would have their children leave school to help with fishing activities, but now it appears there is a shift. Parents see the value in education for learning skills that might give their children the opportunity to work in the city and earn a better income. "We do not want our kids to do the same job as us, they are currently in school, and we do this work to support them" (Interviewee F13-D). However, many families at Kampong Khleang do not have the financial capital to support their children's education. Some families must strategically choose which child will continue in school. Speaking with a 19-year-old woman, she explains how she dropped out of school after grade 7 because the family could not afford to send all the children to school. Her older sister continued her education and is now at Siem Reap

[11] Classes are approximately 20,000 riel (5 USD) a week, depending on the grade the student is in.

University, and the family is working collectively to afford her school fees. Cambodia's education system is one of the most evident ways in which the government stymies its own growth, as it undermines the development of human capital, especially in rural areas. With limited education and employment opportunities, the majority of people at Kampong Khleang work in the fishing industry, and for women, fish processing is a primary source of employment.

5.2 The gendered division of labour

Cambodian society, especially in rural areas, socializes women from a young age to do certain tasks and behave in specific ways. Often young girls are expected to help their mothers process fish after school, and some will leave school at an early age to help earn money for the family, minimizing their education and a chance for higher skill jobs. A gendered transfer of care occurs in households where the eldest daughters take on homecare duties while the parents work, deepening gender disparities in education and in effect access to higher paid jobs (Joshi, 2020). An interviewee discussed how she cannot leave her house for very long because her daughter is only 7 and not old enough to take care of the household. She has 3 older boys and a husband but explained they cannot take responsibility. "I can't rely on my older son to look after the house. The son is not the same as the daughter. They can't handle the housework well. Their father is sometimes busy with drinking (alcohol) too. They may have nothing to eat if I am not at home" (Interviewee DE-2). Boys are not expected to do household chores, and instead are encouraged to play and explore, these differences can have large impacts. The way boys and girls are socialized influences how they forge their livelihoods' economic roles (Hapke & Ayyankeril, 2004). For example, one woman explained that her daughters cannot go to school when the roads are flooded because they do not know how to swim; it would be too risky if they fell out of the boat. Meanwhile her sons, having learned how to swim can continue to go to school year-round. Interviews revealed differences in children's socialized roles, as young girls often helped their mothers process fish while boys played nearby.

Household observations often reveal the gendered division of labour and the burden of care women take on. Women processed fish while also cooking and caring for their children. One woman expressed her fatigue, "I do the processing and all the housework, sometimes I am tired, and it is a lot of work, but it is common. It has always been like that, so I am okay with this" (Interviewee O10-B). She further explains she cannot take on a job outside of the house because her family needs someone to take care of them, if she was not there the chores would not get done. This narrative, common in rural Cambodia highlights the gendered issue women experience in accessing wage labour jobs due to the household duties they are expected to fulfill (Joshi, 2020). Interestingly, how women perceived their domestic roles varied. Some interviewees described fish processing as a 'side job', or something they do in their 'free time', indicating that they view household responsibilities as their primary work.

In contrast, other women saw household chores as activities done between fish processing work, considering household duties as non-work and part of their free time.

The gendered division of paid labour is more pronounced in rural areas where women have fewer job opportunities than men. Table 6 shows paid jobs that were mentioned during interviews, and indicates which gender typically does that job. Some jobs are seasonal depending on resource availability, primarily those that involve fish. Why there are less opportunities for women is a function of resource availability and perceived and embedded notions of capability. Both men and women tend to view women as physically weaker and less capable of performing tasks that require strength, endurance, or involve exposure to challenging environmental conditions, such as working in water or under the sun for long periods of time. The nature of rural living is that work is physically demanding; there are ultimately more arduous jobs to be done that women cannot or do not want to do. Men's work is more overtly physical, engaging in tasks that involve heavy lifting and long exposure to the elements. However, women's work is also physically demanding; they often do work that involves more precision, such as mending nets and preparing fish which requires them to sit and focus for long periods of time. Both men and women believe that women's small hands make them better at this type of work.

Table 6. Common jobs in Kampong Khleang

Job	Seasonality	Typical Gender	Physical Intensity
Sorting/cleaning shells	Year-round	Women	Long periods of sitting, hunched over, potential for cuts from shells and knives
Hauling shell	Year-round	Men	Heavy lifting
Firewood collection	Year-round	Men	Heavy lifting, may have to travel far
Fixing nets	Year-round	Women	Long periods of sitting, hunched over, stretching nets with legs
Fish pond labourer	September – May primarily	Men	High physicality, grinding fish for feed, feeding fish, cleaning ponds
Farming	November – April	Both	Labour intensity varies, weeding, seeding, plowing, harvesting
Hired field labour (harvesting,	November – April	Men	High physicality, harvesting, plowing, spraying, seeding

plowing, spraying, seeding)			
Brick kiln worker	Year-round	Both	Overall high physicality but intensity varies, lifting and carrying bricks.
Fish hauling from lake	Year-round	Men	High physicality, heavy lifting
Fisher	Year-round	Men	High physicality, long hours on the boat, hauling fish, sun exposure.
Fish farmer	September – May primarily	Men	High physicality if no labour to help.
Fish hauling from pond	Twice a year	Men	High physicality, heavy lifting
Fish smoker	Year-round, high season December – March	Men	High physicality, exposure to heat and smoke
Fish processor	Year-round, high season December – March	Women	Long periods of sitting.

5.3 Fish Products

The are two common fish products made in Kampong Khleang, fermented fish paste and smoked fish. Both products require small forage fish species to be cleaned, cut and depending on the species, deboned. 'Prahok', the name given for fermented fish paste in Khmer, is typically made from small, wild-caught species. 'Prahok' holds significant cultural value for Cambodians and plays a crucial role in ensuring food security and nutrition for those living in low-income rural areas (Wang et al., 2022). With a low barrier for entry, prahok processing is the only job many women have had and know how to do. 'Prahok' production coincides around the seasonal flooding of the Tonlé Sap, when the flood recedes, an abundance of 'trey riel' and 'trey kampleang' become available between November and April. 'Prahok' makers will collect the prepared fish, then mash, salt, and ferment in big concrete or plastic barrels. Fermentation time depends on the producer, those who want a higher quality, more pungent 'prahok' will ferment for several months, whereas others might only ferment for a few days and sell the product for less.

Figure 9. Laying fish conchets on bamboo racks (left). Sun-drying the fish before smoking (right)

Smoked fish (‘trey cha-eur’) is a favourite in rural and urban areas in Cambodia. It is easily transported and a diverse meal additive, often eaten with rice and vegetables. It requires more capital and physical input to produce compared to Prahok, but the return on investment is higher. Producers require land to set up an oven for smoking. Inputs include processed fish, bamboo grills, and wood. The prepared fish are put on skewers (conchets) and set out in the sun to dry for several hours (Figure 9), then put over hot coals and rotated for another couple hours (Figure 10). The whole process may take 2 days depending on humidity. Hired labourers tend to help only with processing and sticking the fish on skewers. Smoking the fish is done by a male relative, or a hired male labourer. Typically, the fish processor (a woman) will package up the finished product to be picked up by middlepeople. The conchets are sold in packs of 10 to middlepeople, whereas individuals at the market might only buy one conchet.

Figure 10. Smoking Fish

Table 7. Primary fish products made in Kampong Khleang

Product	Species	Season	Labour regime	Average Price
Prahok	trey kampleang, trey riel[12], trey chadow, trey krow, trey kanto, trey ros [13]	November to April	Cut, clean, salt, mash / pure	4.87 USD/kilo (sold in low volume)
Smoked (trey cha-eur)	trey riel, trey kes, trey kanchos, trey chickow, trey krow, trey konglang, trey slak russey, trey chong vas, trey komplow[14]	Year round – peak season November to April	Cut, clean, stick, smoke	0.25 USD/ stick (varies from species and size)

[12] *Typically at Kampong Khleang* prahok *is only made from* trey riel *or* trey kampleang*, but other fish can be mixed in. Other species listed here for prahok were more commonly mentioned at regional markets.*

[13] *Scientific names: Trichopodus microlepis, H. siamensis. Henicorhynchus lobatus, Channa micropeltes, Osteochilus hasselti, Trichogaster pectoralis, Channa striata.*

[14] *Scientific names: H. siamensis. Henicorhynchus lobatus, Kyrptopterus bleekeri, Myslus mulliradialus, Henicorhynchus entmema, Osteochilus hasselti, Cirrhinus jullieni, Paralaubuca harmandi, Rasbora pauciperforata, Kyptopterus schilbeides*

Figure 11. Finished products: Prahok, fish paste (left) and Trey cha-eur, smoked fish (right)

5.4 Who are Fish Processors

Fish processors are typically women from low socio-economic backgrounds who have had limited skills development due to socio-cultural constraints and inadequate education resulting from systemic governmental failures. At the Tonlé Sap, there are few job opportunities in general, and even less so for women who are influenced by socio-cultural embedded norms of what work they can do. An important part of the fish processor definition is the distinction between the varying levels of production. The Cambodian government's definition of micro-enterprises encompasses those with fewer than ten employees and assets valued at less than 50,000 USD. In contrast, small and medium enterprises (SMEs) have higher asset values and employ up to 50 employees (small) or 100 employees (medium) (MISTI, 2005). Notably, micro-enterprises make up 97.6% of businesses in Cambodia, with a majority (62%) being women-owned (International Finance Corporation, 2019). This trend mirrors the fish processing sector, where most processors are women working alone or within their small family units (Estepa et al., 2016). At Kampong Khleang, it is likely all the fish processors fall under the category of micro-scale.

There are a variety of roles that a fish processor can hold, making the term ubiquitous and difficult to define. Some processors sell their labour, others buy the fish, process a little but outsource most of the labour, and some only collect the processed fish and make the final product. The roles are fluid, some women will sell their labour only during the peak fish season and do subsistence processing during the low season, and vice versa, it all depends on their families' other income generating activities. This segment of the dried fish value chain (DFVC) is increasingly complex as the fish economy is experiencing shifts from a

decline in fish species and an increase in fish farming. Older processors recall a time 15 to 20 years ago when fish were so abundant, everyone had their own to process. Now there is a tiered approach where some women (hired processors) sell their labour to other fish processors (Figure 12).

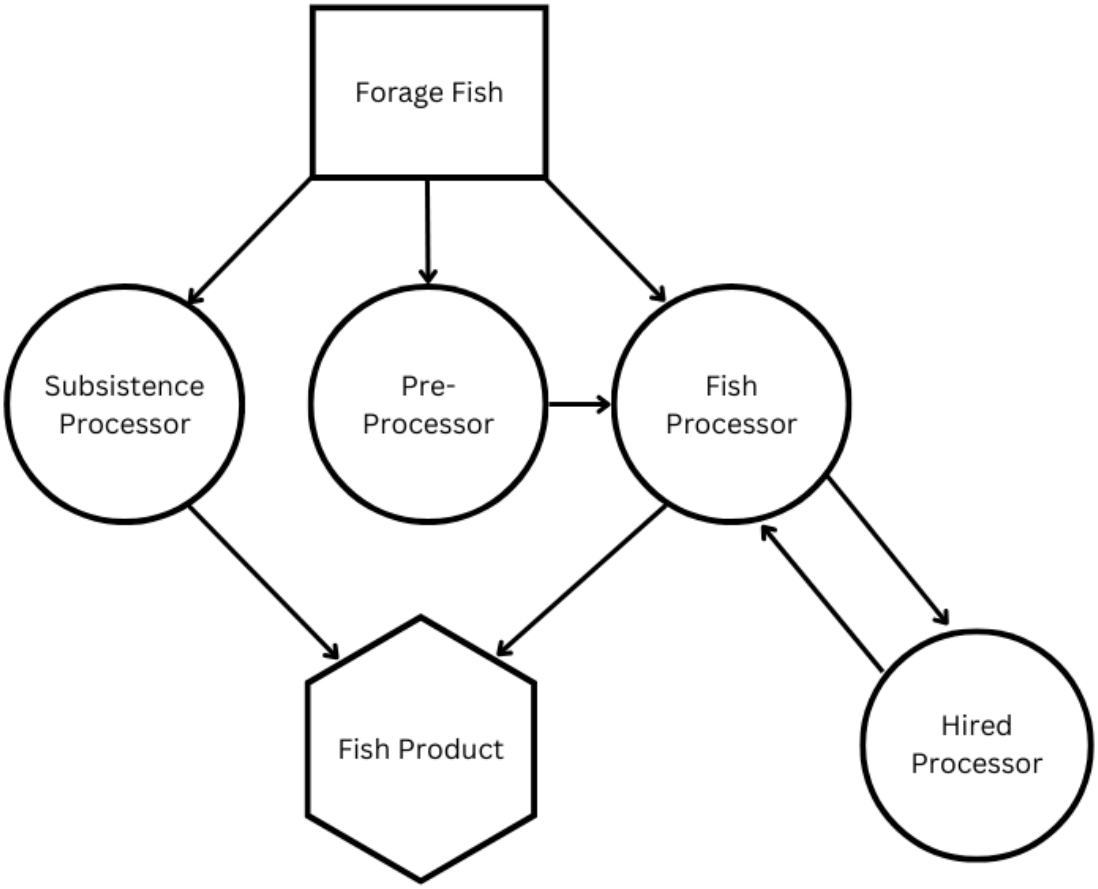


Figure 12. Simplified diagram of the flow of fish between the different processing roles women have in Kampong Khleang

The fish processors are still micro-scale businesses but compared to an individual making fish for themselves and their families, they process significantly more fish. For example, at Kampong Khleang, there is a house that facilitates the largest prahok production in the commune for export to district and provincial markets. The fish processor hires women from around the village to prepare and pre-process (clean, cut, and salt) fish, which is then brought to the house for the final stages of fermentation. This type of fish processor plays an important role in the dried fish economy at Kampong Khleang, as it allows women who cannot afford to buy their own fish to continue earning an income. Examining how these livelihoods have come to be, reveals that the long-term decline of fish species and

increasing market demands puts pressure on finite fish resources. The demand for fish products beyond subsistence has generated deeper poverty for some (Natarajan et al., 2022)

Table 8. Types of fish processors and their roles

Types of fish processors	Role
Fish processor	Buys fish directly from fisher or from middleperson; hires locals to cut and clean the fish (they may also cut and clean). They complete the fish processing (with help), selling the final product (smoked fish or *prahok*).
Hired processor	Hired seasonally by others to cut and/or clean, or smoke.
Pre-processor	Buys and processes fish themselves. May hire people occasionally to help. Sells the cut, cleaned fish to a fish processor.
Subsistence processor	Processes fish for family consumption. May process fish for others when needed

Processing is one of the only economic options available and pays so little, the work keeps micro-processors in poverty. The most impoverished people in the commune do not have access to enough financial or natural capital to make a living and are changing how they approach their work. A growing number of women at Kampong Khleang are selling their labour to other micro-processors. These labourers were once fisherfolk themselves, or ran their own processing business, but as costs increase and fish access decreases, they decide to sell their labour as a more risk adverse livelihood. One woman explains, "I started processing two years ago, before I was fishing but I did not catch much and spent a lot on fuel. I used to use the illegal nets but I stopped, I got caught and my net was destroyed. Now I just buy fish from the person who fishes, clean, gut and sell to my neighbour who makes the prahok" (Interviewee F16-B). Fish processing appears to be a fallback option for those in the village that struggle with the high-cost and restrictions associated with fishing.

Selling labour appears to be the least risky option for poorer families who cannot afford or want to take the risk on fishing or running a business. For those that run a processing business, there are capital investments required. Inputs include large quantities of fish, salt, packaging, fermentation drums, and labour wages. Additionally, the product can take several weeks to produce, so income from the product is not immediate. Selling labour is seen as an easier and faster means of getting money to cover daily expenses. The owner of the largest 'prahok' production in the commune explains: "People half [pre] process because it is easier and faster. Many families need a daily income. They find fish and need to sell them quickly for their daily expenses. For families they earn less money [only pre-processing] but they get money quicker" (Interviewee N23-D). Pay for processing fish is

extremely low and depends on how much fish is available, emphasizing the precarity of the work. “For cutting one kilo of fish, I get 200 to 300 Riel (0.05 -0.07 USD). Depending on the amount of work it could be 40-50 kilos a day. If there are not many fish, I might only work in the morning and get about 5000 to 10,000 Riel (1.25-2.50 USD)” (Interviewee O18-A). The increasing number of women selling their labour is likely an indicator of the deepening poverty in Kampong Khleang. Unable to save money, more processors are selling their labour and only earn enough to cover daily expenses.

5.5 Fish Work – Daily Life

Fish processors’ work schedule varies greatly depending on seasonality. In the rainy season there is less fish, so they might only work a couple hours a day and many people see this time of year as their opportunity to take a break from fish work. In the dry season there is usually an abundance of fish, and some women will process from early in the morning into the evening. The work is flexible in many ways. Some processors have fish delivered to them or will collect it themselves from the boats and process at their house whereas others may work in a group at one house. Time in between processing is spent doing household chores, taking care of their children, or resting.

The amount of fish available to process is inconsistent and it is difficult to capture amongst interviewees the exact hours spent and kilos processed. In December (high fish season), an interviewee said her and two others were working on 100 kilograms of fish. They start at 8am and may finish around 1 or 2pm. How much work women have is dependent on fish availability and the number of workers. In the low season, those who want to work more will move between houses throughout the day to process as the fish comes in. Social relations appear to play a large role in how women find work, often working at their neighbour’s or relative’s house. In one village we observed a group of women quickly chop a few kilos of fish that had just been delivered. A couple hours later, in another area of the same village, a large batch of fish arrived, and the same women were observed working. It was here a larger group discussion on the dynamics of their workdays took place.

> Right now we might earn 10,000 to 15,000 Riel (2.45-3.67 USD) a day because we go to different locations to work as the fish comes in. Right now we do not work in the morning because the fisher does not arrive back until after lunch. They have to go further out into the Tonlé Sap to get the fish and it takes them awhile to get back to shore. We typically start [processing] around noon. We will cut one round of fish and maybe do a few rounds throughout the day. The last batch of fish might come in between 8-9pm. Some employers will soak the fish in water and keep for the next day of cutting. Some of the girls will get up at 2am to go chop fish because then they will get access to the most fish. If they don’t get

> up early to process it might all be done by 7am and they will have to wait until noon for the next haul of fish. (Interviewee JU8-F)

Fish processors' work shifts with the seasonal flows of the Tonlé Sap. Fish abundance and the locations fisherfolk fish varies throughout the year, altering the time of day processing occurs. Because of the Tonlé Sap's unique hydrological pulse pattern, fish catch in terms of amounts and species type fluctuate throughout the year. The flood extent of the lake is typically lowest in May or June and reaches its peak between September and October. This corresponds to fish availability; when the floodwaters are lower, fewer fish are available compared to when the lake floods, bringing an influx of migratory species. However, the edges of flooded forests are known to have high species richness even during periods of low water (Pool et al., 2019), prompting fisherfolk to travel farther to these places during times of low fish availability. In November when the lake reversal begins, fish migrate out of the lake, to the deeper pools of the Mekong (Chan et al., 2020), providing an opportune time to catch species popular for processing, such as 'trey riel' and 'trey kampleang'. These seasonal dynamics largely dictate the availability of fish processing work for women, shaping their labour patterns.

Many of the women interviewed rely on fish processing as their primary source of income, and other family members supplement the household income through other jobs. Processing fish allows women to work from home or within their village. A common sentiment among women is that they prefer to stay home or at least work in their village so that they can take care of their household. However, some women feel more restricted by this norm, "I would want to work extra, but it's not possible because of household duties. I could not work far away. Prahok is the only income I have access to. My husband expects food to be ready when he gets home from work" (Interviewee O18-A). The social expectation of women to do the household chores and take care of the family puts them at a disadvantage of having the freedom to explore alternative job opportunities, thus making fish processing an important income generator as the work can be done at their homes.

5.6 Access and inequality within the commune

Natarajan et al.'s (2022) sustainable livelihoods framework analyzes how structures and processes shape relational power (human, social, and political), and access to financial and physical assets, all while considering the environmental context. In this view, inequalities arise from relational power, which is embedded in the relationships between people, processes, and institutions (Natarajan et al., 2022). At Kampong Khleang, inequalities are produced by national level policies and experienced at the individual and household level effecting people's ability to create their livelihoods. For example, processors' access to education and their lack of alternative skills is shaped by broader socio-cultural and economic forces such as normalized gender discrimination and a lack of government support in rural development. While there is no separating macro forces from micro, this

section focuses on inequalities at the individual level, acknowledging the macro forces that create them, but leaving the discussion of these issues to later chapters.

There is an interesting observation of how socio-economic inequality and equality is produced within the dried fish value chain. Amongst processors there is an unspoken quasi agreement that if a woman wants to process, she will not be denied work if fish is available. Fish processors often said anyone who wants to work can join. “There are 14 people working here, preparing and cleaning the fish. Even if there is only a small amount of fish, I will try to hire people to ensure that they have a bit of money” (Interviewee NO23-C). At the micro level, there is some equality amongst the processors selling their labour in the sense that if they want to work, they will be hired. However, inequalities are more broadly produced. There is a large supply of processors, and this keeps wages in this node of the dried fish value chain suppressed. Processors have no bargaining power and remain poorly paid. The rate of pay for processors (approximately 500 Riel (0.12 USD)/kilo) has remained consistent over the years. The only variation in pay is some species require more precision cutting and therefore processors are paid 100-300 riel (0.02-0.07 USD) more per kilo, however, the cutting takes longer so the pay per hour could end up being the same. Fish processors maximize their profits from a large supply of low-wage work, allowing economic inequality to grow between the processors and the hired processors.

Despite some aspects of equality amongst processors, there are intersecting factors that lead some processors to be more marginalized than others. Cambodia is a homogenous country[15] so intersecting attributes that contribute to inequality amongst processors are not commonly viewed through identities such as religion and race[16], but can be seen more through aspects of power and socio-economic status (class). Expressions of these intersections are best observed at the household scale because despite processors working at an individual scale, they are typically supported and given support within a household unit. Households have varying access to capital and power which creates the difference among fish processors. In addition to what people explicitly said about their socio-economic situations, observations and comparisons of households during interviews added to an understanding of the access and inequality experienced.

Inequalities between households was observed through their physical and financial capital, such as people’s houses and access to land. Houses and land are often passed down through the family. Having access to these assets can support livelihood production. Some homes are better built, with newer, sturdier wood and sheet metal, while in other homes the wood is rotting and the sheet metal rusting. Those that are well-off can afford to replace

[15] 96.2% Khmer, 97.1% Buddhist (National Institute of Statistics, 2022).

[16] Some people did mention Vietnamese fishers and attributed overfishing to them, but no mention of Vietnamese processors came up. This study took place in an especially homogenous community, whereas there are other areas of Cambodia where minority communities exist and face discrimination and marginalization based on race and religion.

rotting wood or rebuild their homes with better materials. Physical capital such as owning a motorbike, refrigerator, fishing gear and boat, can also be an indicator of wealth, albeit, people also may face large levels of debt to procure such items (Lieng et al., 2018). Access to these physical capitals (with or without a loan), can increase people's ability to create livelihoods. For example, in the wet season, having a physical space to work from is important for processors to keep their business running. "I process fish at my house but need a larger space to dry the fish so I come here. When this area floods I will have to move to another space. It's best to be in an area that does not flood, it is easier for the buyer because they do not need a boat" (Interviewee SE25-B). While this processor does have access to space to dry and continue making her products, she is constantly having to adapt to flood conditions because she does not have her own land.

For others, their homes are not safe when the lake floods. Sitting with a woman and her daughter on the partially broken wood platform outside her house she explains,

> "I process here but sometimes we must leave. The flood was higher last year, it came up to the bottom of the house floor. When the water is too high we will leave because it is not safe for the kids. I will go to my parents, their house is taller. The house is dangerous in the rainy season if it floods too much" (Interviewee SE18-E).

Her ability to make an income is disrupted when she has to leave, further adding to the precarity her family experiences when their house floods. Comparatively, further inland in the commune, it floods less and the homes tend to be in better condition. Interviewees I spoke with there were often more well-off and have more access to physical capital that supported their livelihoods. At one home in the paved area of the commune, a woman told us she processes from her home, she does not need to move when it floods. Being in the dryer area of the commune, they also have access to a rice field nearby where they grow dry season rice. Her livelihood is not as greatly impacted by larger floods because her house is sturdy and also unlikely to flood. While a comparative analysis of processors' geographical location in the commune and its relation to income has not been done, it appears that many processors who live in the perennially flooded areas are poorer and are negatively affected during a larger than average flood year.

Amongst households at Kampong Khleang, physical and financial capitals interact with the politics of influence and access and can mutually influence one another. This can be seen through how households are able to (or not) diversify their livelihood activities. Chanthvany an older, widowed fish processor explained that her family is very poor because they cannot fish and do not have land. The family is in debt because they borrowed money to buy a net to catch fish, but because the size of the net is considered illegal, they have had to stop fishing. Some people are able to pay a bribe to allow them to continue to fish, but those who cannot may have their nets taken away. The lack of influence and access Chanthvany's family has affects their ability to access fish and create financial capital and creates a cycle whereby

they do not have the financial capital to bribe officials to allow them to fish or start any other livelihood activities. “People who live on land depend on growing rice and other crops, people like us depend on fish and the Tonlé Sap” (Interviewee FE14-B). Chanthvany sees the difference between her family and others owing to a lack of access to physical and financial capitals.

The ability of families in Kampong Khleang to sustain their livelihoods varies widely, shaped by access to diverse income sources and external economic and environmental factors. Chanthvany’s point of not having land is evident when exploring how and why other families are able to make their livelihoods. Speaking with Sophanna, a woman who lives in the area of the commune where farming is possible, she lists off all the ways her family makes money. They grow rice, they have an aquaculture pond, she is a fish processor and collects from pre-processors, and when fish amounts are low, she works at the brick kiln factory that is about 1km from her house. They make enough money to enjoy a comfortable life, and having a varied portfolio of livelihood activities gives them stability throughout fluctuations in flood levels and fish amounts. Interestingly, among all her jobs Sophanna prefers fish processing because it earns the most money and is the least tiring. She finds processing to provide a more consistent income, whereas fish farming takes awhile to bring in money and it is a higher risk. The brick kiln work offers a way to supplement her income in the low fish season, but the work is physically demanding.

In comparing the livelihoods of Chanthvany and Sophanna, a common thread emerges. Fishing and fish processing are important options. Sophanna has been more successful in diversifying her livelihood activities due to her family’s financial situation and geographic location, she prefers to process fish as her main income source. In contrast, Chanthavy’s family has been low-income for generations and have not been able to do much work outside of fish processing. While poorer households around the Tonlé Sap have historically had limited fishing rights, the combination of intensified overfishing, elite capture of resources, and the absence of social safety nets (Chheang, 2014) has deepened the constraints on families like Chanthavy’s. Policy measures, framed as conservation (Jones & Sok, 2015), further limit her household’s fishing opportunities and contribute to a form of rural dispossession, pushing them into precarious wage labor (Natarajan et al., 2022). They continue to process fish out of necessity, whereas Sophanna has more resources to make fish processing a more lucrative business.

Despite the apparent inequalities amongst fish processors, life at Kampong Khleang is difficult for all. The commune is highly dependent on fisheries, however seasonal decreases and the long-term trend in the decline of fish stocks are pushing women and men alike to find alternative jobs. Collecting and cleaning shells[17] (gleaning) is a popular option for women as it is similar in accessibility and effort to fish processing. Two women in their mid-

[17] Translated directly during the interviews as ‘shell’, the species is a river clam, leas cha. Typically dried in the sun and seasoned with salt and chili, it is a popular street food stall item in rural and urban areas.

30s explain that 15 years ago they and their family would exclusively catch and make dried fish but began to supplement with catching shrimp and shells because there was not enough fish. They now change between whichever resource is most available, and when they cannot find anything, they will work as labourers for others (Interviewee M20-A). Even fisherfolk, who make more than fish processors, still do not make that much money. A fisher family explains that over the last 3 years they have only been able to earn 60 USD/month from their fish catch during the peak season, and must do other jobs like fixing nets and odd labour jobs the rest of the year (Interviewee AP3-B). Fishing livelihoods in general are not desirable, however, most people are not able to move out of fishing: it costs money to move, they do not have the educational skills required, and they would pay a huge emotional cost in moving away. Fisherfolk are having a difficult time creating sustainable livelihoods; fish processing livelihoods are even more precarious.

5.6.1 A commune comparison

A contrast of Kampong Khleang to its neighbouring shoreline commune, Kampong Phluk, reveals a difference in access to capitals that impacts livelihoods and incomes. Kampong Phluk, located 30 minutes closer to Siem Reap than Kampong Khleang, has attracted more tourism and organizational development interest over the years. In the mid-1990's the Food and Agricultural Organization (FAO) began working on resource management issues in the commune, achieving success due to the interest and active participation of the community (Marschke, 2005). Ecotourism activities began at Kampong Phluk in 2002 and since then government and NGO programs have developed community-based ecotourism to reduce livelihood dependency on fisheries (Kry et al., 2020). The influx of money from tourism and NGOs shows in the infrastructure, most homes have access to electricity and there are more paved roads compared to Kampong Khleang. Commune poverty rate data is not available, however there is district level data (Table 9) that likely reflects a similar rate if extrapolated at the commune level.

Table 9. District poverty rates (Open Development Mekong, 2015)

District	Number of families	Total Population	Poverty rate
Prasat Bakong (Kampong Phluk)	13,984	68,596	17.3%
Soutr Nikom (Kampong Khleang)	23,006	111,224	25.39%

The number of people processing fish at Kampong Phluk has visibly declined in the past 20 years. Household surveys done in 2003 at Kampong Phluk found that 89% of households engage in prahok production, 33% in smoking fish and 29 % in drying fish (Marschke, 2005). During a visit in October 2023, we walked around the commune looking for signs of any type of processing and found very little. Discussions with local people revealed that there is not much fish processed within the commune anymore.

> I only know two main families who make prahok or trey neat[18] to sell; no one else does anymore. There used to be more people, but now fewer make it because demand has dropped. The middlemen don't pay enough, and sometimes they don't pay at all unless it's a big order. They'll come for fresh fish, which sells better, but not for dried fish, as it's too much effort to collect from each processor. Improved roads and refrigeration make transporting fresh fish easier (Interviewee OC19-B).

Several factors seem to have contributed to the decline of fish processing in Kampong Phluk. First, active ecotourism programs have shifted people's livelihoods away from fishing. Fisherfolk now use their boats to take tourists out to the lake to birdwatch, fish, and bring them to local restaurants and vendors (Rashid, 2020). Second, improvements in infrastructure and technology have increased access to fresh fish, leading to a shift in consumer preferences. This change has resulted in a decrease in demand for processed products, making it difficult for processors to profit from small batches, while they lack the capacity to produce larger quantities. Lastly, one woman we spoke with noted that the decline in processed fish in the commune is also linked to less fish overall being available. "More people used to make it about 10 to 20 years ago, but now there is less fish available. There's a big difference compared to the past of the amount of fish" (Interviewee OC19-A). Residents of both Kampong Khleang and Kampong Phluk report a similar timeline of declining fish availability. However, Kampong Phluk is less impoverished, likely due to its stronger tourism economy, access to electricity, and proximity to Siem Reap, including a paved road in the dry season. In contrast, households in Kampong Khleang do not have electricity, are further from Siem Reap, rely on a gravel road in the dry season, and do not have the same income opportunities from tourism as those in Kampong Phluk. Hence the reliance on ever-diminishing fish stocks.

5.7 The importance of processing

Processing is tedious, tiring, and inconsistent work. The importance of dried fish as a livelihood activity for women in Kampong Khleang is due to several factors, which have been highlighted in previous sections through quotes from the women. The reasons can be categorized as: location, access to natural resources, skills and education, time, and risk aversion. These reasons (Table 10), while beneficial for providing women with access to an income, are intertwined with constraints that reinforce why women choose to process fish. As one woman who has spent her whole life smoking fish explained: "If I could do other things instead of drying and smoking fish, I wish I could do it, but I don't know what else to do... this is where we live, and it is all we can do. Working in dried fish is very important for my livelihood" (Interviewee AP3-C). Having spent several months speaking with women at

[18] 'Trey neat', directly translated as dried fish, is a whole fish fillet, salted and sun dried. Still easily found in markets, it is not often seen being made in large quantities at the village level.

Kampong Khleang, it is clear that without fish processing, many families would lose a substantial source of income.

Table 10. Key reasons why dried fish is an important livelihood for women

	Importance of processing	Constraints
Location	Bound by where they live, one of the only jobs available	Unable to travel far for work due to homecare duties Too impoverished to move
Access to natural resources	Common-use resource, most people can access fish	Finite resource Cost of fish and supplies to process
Skills/education	Processing knowledge is passed on generationally	Low education in rural areas Gendered roles limiting other jobs Low pay, continues a cycle of poverty
Time	Flexible work that can be done from home and at varied times	Rigid gender roles impose un-paid care on women
Risk adverse	Low or no capital input required	Low wages, unable to save and improve economic position

Gender roles play a large part in why dried fish processing is important. Looking back to Table 5 in section 5.2 (*Common jobs in Kampong Khleang*) shows how few job opportunities there are for women in the commune. Women may migrate for work out of necessity, but they typically prefer to stay home with their families. Dried fish work offers local employment. They can do the work out of their homes or close by within the village, giving them the ability to earn an income while still having the time to look after their families. This sentiment is common throughout the commune, "I cannot go out for other work, so I stay here because I am able to take care of the children and my older father (Interviewee OC18-A)". Fish processing work is an interesting paradox; it is a flexible job but is situated within restrictive gendered norms. Socio-cultural embedded gender norms deepen the marginalization of micro-processors, making it near impossible for them to improve their social and economic position.

For many women at Kampong Khleang the reality is that they lack access to education and have limited job opportunities so their employment in fish processing becomes indispensable. Several processors spoke of how they work hard to pay for their children's education in the hope that they will not have to do the same job. "I do not want my kid to do [processing] work like I currently do. If they can succeed in their education they will find a good job, if they don't succeed, they will do this job" (Interviewee F14-A). The limited government social support and a poor education system allows a reinforcement of poverty.

Low-income families cannot afford to send their children to school, and ultimately the cycle will continue for women, who may turn to fish processing out of necessity.

Processing work is also an important livelihood option for people who have been unsuccessful at other livelihood activities, or those unable to take high capital risks. Like Chanthvany's story, people have left fishing because of the high cost of equipment and gasoline, coupled with fishing regulations and a decline in the number of fish overall. Fish processing offers a less risky livelihood opportunity; it appears to be a fall-back option. "I started processing 2 years ago, before I was fishing but I did not catch much and spent a lot on fuel. I used to use the illegal nets, but I stopped, I got caught and my net was destroyed. Now I just buy fish from the fisherman, clean, gut and sell to my neighbour who makes the prahok (Interviewee, F16-A)". Unwilling to risk more financial loss, this woman prefers to process. Despite decreasing fish amounts fish processing is seen as a relatively consistent form of daily income that allows households to earn just enough money to pay for their daily food and school fees. Fishing is not seen as stable, there are many risks involved; therefore, dried fish is one of the only stable income options for many low-income households.

When asked what other jobs they do and which they prefer, many women prefer processing work over other jobs for several reasons. Primarily, it gives them the ability to do the work close to or at their home, allowing for flexibility to do household chores, and take care of their children or elderly relatives. Secondly, while it is physically intense with long hours of sitting, it does not require the same level of physical strength that other jobs in the village do. Lastly, it is a consistent form of income compared to other work. A woman who has several income sources prefers her processing work over aquaculture, despite the higher earning potential aquaculture has. "I prefer to do prahok work because it can earn more money. I may have some money leftover to feed the fish and there is more consistency in the income, whereas aquaculture takes awhile to bring in more money and it's higher risk" (Interviewee, JU10-G).

5.8 Gendered implications of Dried Fish Livelihoods

Analyzing Cambodia's sociocultural engendered power system (Wichterich, 2015), women appear to be resigned to their roles as fish processors and caretakers, roles that stem from patriarchal norms engrained from a young age. Socialized roles fundamentally shape how women participate in the workforce (Hapke & Ayyankeril, 2004). Discussions with women at Kampong Khleang show their perceptions of work outside of fish processing remain limited because gendered restrictions are accepted as the norm. For real change to occur, the underlying structural issues that limit women need to be addressed at a societal scale. Despite documents that tout gender inclusivity, so far, development programs are kept apolitical (Sok & Yu, 2021). Integrating gender equality into development agendas within institutions that perpetuate gender inequality may benefit some individuals, but will unlikely

bring about any deep structural transformations of inequality and discrimination (Cornwall & Rivas, 2015).

Culturally embedded gender roles create conditions at the Tonlé Sap where there are fewer work opportunities for women. Women are limited in time, place, and space. Expectations to do most of the homecare restricts how much time they have for other work (and time for themselves) and seasonality is a large factor in their work. Living at a place like the Tonlé Sap limits job opportunities, and even more so for people who live in the perennially flooded areas. Furthermore, the broader, socio-culturally constructed space of what is considered 'women's work', shapes hierarchies, reinforces differences and internalizes limitations and perceptions of ability. For example, a husband and wife explained that they mostly hire men to help with their agriculture work and that women cannot do the tasks because they either do not know how to use the equipment, or they do not have enough energy to work the whole day (Interviewee JU10-G). These tasks can earn someone up to 40,000 Riel (9.79 USD) a day, double than what a processor makes. Equal access between men and women to higher paying jobs (non-farm work, self-employment, and salaried government jobs) is an issue in other parts of Cambodia, citing education as a determinant (Joshi, 2020). However, these jobs should be considered in another tier of employment compared to what is available to people in Kampong Khleang. Most jobs at the Tonlé Sap involve physicality, and it appears the main determinant of women's access is in socio-cultural perceptions of gendered ability. Although Cambodia's shift to a market-capitalist society promotes women's equal involvement towards driving economic development, persistent gendered stereotypes and traditional lifestyles continue to restrict women's livelihood development and outcomes (Brickell, 2011).

Persistent gender roles and the lack of economic opportunities push fish processors into precarious lives. Low-paid fish work ensures poverty persists, gender roles are maintained, and structural inequalities remain intact. By keeping wages low and reinforcing women's dependence on this work, it limits their ability to gain economic independence ensuring that gendered divisions remain entrenched (Mezzadri et al., 2024). It further reinforces class divisions, keeping a group of poor workers who cannot afford education, ensuring their labor is continually exploited in low-paid, precarious jobs that sustain the broader population's fish supply (Bernstein, 2021).

While many rural areas in Cambodia are impoverished, women at the Tonlé Sap are among the most marginalized. Several women I spoke with mentioned collecting shells (river clam, 'leas cha'), as an alternative income source. These conversations reveal that collecting shells is fairly common when fish are scarce. However, in Banteay Meanchey province near Thailand, Hapke et al. (2025) found that only women who were desperate would collect shells and believe the work is seen as degrading. In areas less dependent on a single natural resource (fish), collecting shells is a last resort, but in Kampong Khleang, it is a common job

for women. Although it could be said that women at Kampong Khleang are also desperate, the fact that this work is considered normal highlights the severe challenges women at the lake face.

Despite the rigid institutions and gendered structure of Cambodian culture that marginalize women, signs of change are emerging. In Kampong Khleang we saw many young girls in school and spoke with women who want to send all their children to school. Furthermore, some small statements spoke loudly against the 'obedient servant' imagery that has been taught to woman. For example, a woman from a fishing family said, "People who have more children, they do not have as much free time because they need to take care of their children. I do not want more children because I don't have the time, I work too much" (Interviewee SE25-E). While to some this a normal statement, comments on family planning are rare and counter to the ideology of the 'Chbap Srey'. The 'rules for women' states that it is a Khmer women's destiny to be subdued, obedient, raise children, and manage the household (Ovesen et al., 1996). What is interesting is that the ideology of a passive Khmer woman is a more recent creation. Women held positions of power within Cambodian society until the mid-nineteenth century until legal reforms were created to dictate women's mannerisms and actions and ultimately their access to power (Jacobsen, 2008). Questions about retaining traditional values are then not so relevant. Perhaps today's shifts can be seen as a move towards women's earlier forms of autonomy rather than a break in tradition.

The growing number of women migrating for work is also further challenging traditional gender norms, as their increased income allows them to gain more influence and power within their households (Vigil, 2024). However, such movements can reinforce inequalities whereby women face a double burden of taking on paid work on top of their homecare duties. In the case of Kampong Khleang, many women feel they cannot leave home because of their household duties, reiterating the importance of dried fish work in this place. Migration is not viewed as a good option for many women at the Tonlé Sap. Despite rapid economic development in Cambodia, deeply ingrained gender expectations around homecare continue to limit their mobility and reinforce traditional roles. Women and girls who migrate for work also face added stigma. They are seen as "modern women" who do not follow the rules of the 'Chbap Srey', leading to a lack of respect and the perception that they are sexually accessible (Lilja, 2016). There is still significant work to be done towards shifting gender perceptions, as deeply rooted socio-cultural norms continue to shape women's opportunities and choices.

When considering the best way forward for development and socio-culture shifts that would lift up the most marginalized, a feminist political ecology approach advocates for alternative ways of thinking beyond a market-based capitalist logic of value, to focus on basic needs and what constitutes well-being (Harris, 2015). Meanwhile, evidence from historical patterns of development points to economic development and growth to be the catalyst to

institutional development, not necessarily the other way around (Grindle, 2004). Reconciling local needs and their interconnectedness with global networks is necessary in livelihoods research (Natarajan et al., 2022). Fish processing is a way of life that needs to be carefully considered as Cambodia's fisheries sector industrializes and the country continues its rapid economic development. The duality of dried fish is that is an important economic opportunity, while simultaneously reinforcing poverty and restrictive gender norms. This raises an important question: How should it be valued moving forward? As poverty becomes increasingly concentrated in rural areas (Rigg & Salamanca, 2017), the lack of alternative livelihoods for fish processors will continue to be a problem. Should fish processing be supported through targeted policies and programs, or is it time to look towards livelihoods that are sustainable and can break the cycle of poverty and limiting gender roles?

5.9 Conclusion

This chapter has examined how the dried fish economy contributes to women's livelihoods in and around the Tonlé Sap region. Dried fish is a valuable resource for processors and fish processing remains a key income-generating activity embedded in women's everyday livelihood strategies. Already socially and economically disadvantaged, an increasing number of processors cannot access large quantities of fish to sustain their business. Those who can access fish make a (marginal) profit, while those who cannot have to rely on selling their labor. The income from their work only covers basic family needs, leaving them with little ability to save money.

In addressing the gendered implications of fish processing work, this chapter has shown how processing is socially constructed as women's work and remains undervalued despite its importance to household survival. Gender norms and low socio-economic status compound and constrain women's power and access, contributing to the most impoverished becoming poorer. Similar to Belton et al.'s (2018) findings of fish dryers in Bangladesh, fish processing is a last resort for those most socially and economically disempowered. This is even more evident for hired labourers. Working as a hired labourer represents a low-risk, and perhaps the only, livelihood option for the most socio-economically disadvantaged women at Kampong Khleang. As fish species at the Tonlé Sap continue to decline, processors are having to navigate how to best earn an income amidst these changes.

Chapter 6. The Interplay of Fish Processing and Fish Farming Livelihoods

6.0 Introduction

Cambodia is in a transitory period of development; the country's economy is growing at a rapid rate, driven by industrialization, urbanization, and integration into global markets (Kenh & Wei, 2025). This transformation affects rural livelihoods, particularly those working in the dried fish economy. Understanding how socio-economic, and ecological drivers shape this sector is essential for evaluating its current state and future trajectory. The dried fish economy, overlooked in national policy and governance, is intrinsically linked with the growing aquaculture sector, where a complex interplay of socio-economic and environmental factors influences both sectors.

The chapter is guided by the research question: How are changes in the dried fish economy reshaping micro-scale fish processing livelihoods? It unpacks three key findings: the disappearance of 'trey neat' at the village level, a shift toward farmed fish products, and the growing complexity of the dried fish value chain. As Cambodia pushes to industrialize the sector, these shifts are contributing to the further marginalization of rural, micro-scale fish processors, as a bimodal system begins to take shape. The analysis focuses on inland wild-capture fisheries at the Tonlé Sap and examines how the emergence of fish farming influences what micro-scale fish processors decide to do with their fish. Attention is paid to small-scale fish farmers[19] who rely on fishponds as a source of income. They compete with fish processors for the same small fish species, used as both feed in aquaculture and for dried fish products.

This chapter draws on the relational approach from the Sustainable Livelihoods Framework (Natarajan et al., 2022) to examine how people's lives, perceptions, access, opportunities and struggles are shaped by their relationships with others, nature, and the structural aspects of society. A relational structural-metabolic approach challenges the status quo of capitalist logic, towards transformative visions and alternatives (West et al., 2024). As global markets and national governance intersect with local livelihoods, understanding the macro-level influences on everyday livelihoods is important to identifying pathways that support resilient and sustainable development.

This chapter begins by investigating how the changing biophysical environment at the Tonlé Sap affects people's socio-economic livelihoods. In response to species decline, shifts have occurred in dried fish production. Some wild-capture species are increasingly rare to find and 'trey neat' products are no longer being made in rural areas. While domestic and international farmed fish expands to fill the wild-capture supply gap this growth brings new

[19] Small-scale fish farmers emerge as important actors in the dried fish value chain due to the competing fish resources required. They are also affected by industrial fish farming through increased competition for markets and fish feed resources.

challenges, including increased forage fish use and pressure on domestic markets. The chapter explores these interconnected issues, focusing on their impact on the most marginalized groups: micro-scale fish processors and small-scale fish farmers.

6.1 The Changing Biophysical Environment

Fish processors' perceptions of environmental change reflect their deep dependence on the Tonlé Sap's seasonal flows and ecological health. This section explores how they interpret and respond to shifts in fish abundance, flooding patterns, and ecosystem degradation, and how these issues shape their processing livelihoods.

The changing environment was evident in every conversation. At times I would prompt the topic, but often it came up organically. Interviewees consistently identified declining fish availability as the most serious threat to their livelihoods. "We face challenges in the dry season of not having an income because we cannot get enough fish, it is getting harder and harder every year". (Interviewee M1-B). Many recalled a time when fish were so abundant that they could be caught by hand, expressing dismay over the lake's deterioration. A local photographer who has documented communities around the Tonlé Sap reflected:

> "The lake feeds so many people in Cambodia. The future of it is so uncertain. Because the dam has been built on the Mekong, it affects the flood pulse. I'm not sure if, in the next 20 or 30 years, the reversal will still exist—or if the fish will be gone. I can already feel it starting to disappear. The people who live there rely on this, and they're struggling" (Interviewee MA11-A).

These comments reflect the perceptions of reduced catch and stress felt amongst fish-dependent households. While families diversify their income by catching shrimp, farming, collecting shells and flood forest wood, for many, fish remains their main livelihood resource. Recent ecological assessments confirm fish stocks continue to decline at the Tonlé Sap (Baird & Hogan, 2023; Chevalier et al., 2023; Thapa et al., 2024).

Another major concern was the unpredictability of the flood pulse, which affects both fish migration and the timing of fish drying activities. People remarked how droughts and floods are more extreme, and the flood's timing and recession are no longer predictable.

> "There are environmental changes, when it is supposed to rain, there is no rain. Sometimes there is supposed to be flooding and high water, but it doesn't come. Twenty years ago the water would always come in July and August, but now the rain doesn't come anymore. I prepare and wait for the water because I have to move when the water comes." (Interviewee AP3-C)

Observations align with hydrological studies that show the timing of the Tonlé Sap's peak expansion has shifted from September to October (Eyler et al., 2023). Such a relatively quick shift raises serious concerns. The timing of the flood pulse is a critical cue for species migration and directly impacts when and how much fish gets captured and processed. Interviewees also linked ecosystem change to broader stressors, including upstream dams, overfishing, extreme heat, storms, and deforestation. As one processor explained: "They block the water in another country. When the wet season comes the fish cannot return. The fish flow according to the water" (Interviewee M20-B). Pollution and agricultural run-off causing deteriorating water quality was also frequently mentioned: "The water is now unclear and unhealthy. We can't cook with it and have to buy land water. The many tourist boats passing through make it dirty" (Interviewee M1-D).

These local accounts correspond to the quantitative and scientific data that has been produced in recent years. Satellite imagery analysis determined sand mining is altering the lake's hydrology (Hackney, 2021), and water quality is declining due to agricultural run-off, a decrease in groundwater storage and land-use changes in the surrounding area (Lindsay et al., 2021). Interviewee observations not only echo scientific findings but also provide grounded insight into how ecological disruption is experienced through everyday livelihood practices. The following two sections delve deeper into specific dynamics of species decline, and the case of 'trey neat', to further illustrate the urgency and socio-economic impacts of these changes at the Tonlé Sap.

6.2 Species Decline

This section presents firsthand evidence of changes seen in Tonlé Sap fisheries, how people respond, and how species decline shapes access to fish and dried fish production. Their experiences highlight how shifts in species availability influence what kind of products are made, and who can access fish. Not only do species amounts matter, but the type of fish available plays a role in processing livelihoods. As species composition in the lake changes, processors must constantly adapt, facing growing uncertainty about the future of micro-scale fish processing.

Interviewees frequently remarked on declining fish stocks, particularly the loss of larger species. Scientific studies support these observations, showing that the number and volume of species have declined over the past 25 years (Chevalier et al., 2023). The Tonlé Sap experiences a common fisheries dilemma, whereby larger species are targeted and overfished leaving smaller fish species without predation (Ngor et al., 2018). This initially creates a situation with higher biomass, suggesting a thriving fishery with abundant smaller species. Despite fish declines, processors continue to have some access to smaller fish species. "There has been no problem finding fish, it is decreasing but still okay for now" (Interviewee F15-B). Although smaller species reproduce quickly and face few predators, studies suggest that if fish reproduction does not match fishing rates, all species will

eventually decline (Bahadur et al., 2017; McCann et al., 2016). This pattern is already visible in the Tonlé Sap, where overfishing first depleted larger species, and now smaller species are also overfished (McCann et al., 2016).

A recent study by Chevalier et al (2023) found a significant increase in one small-bodied species, *Polynemus melanochir* ('trey kom pream'). When asked about the viability of this species for fish products, interviewees explained it is not suitable for processing. "It's normally just in the market, it may be sold fresh. It is not popular for smoking, it is used more for cooking and frying" (Interviewee NO23-C). Furthermore, this species is not (yet) very common in Kampong Khleang's area of the lake and can be expensive. Considering the resiliency of this species at a time when most other species in the lake are declining, perhaps this species will become more popular for processors and rural cuisine in general.

As wild-caught fish decline, their market values rise, allowing those with more capital to benefit, while creating uneven impacts on livelihoods. Some market sellers who can afford to buy fish wholesale are able to grow their profits, while others do not have the resources. "A challenge we face is not having enough fish to sell, sometimes we do not have enough money to buy. Other people with more money will buy it" (Interviewee F13-C).

Like market sellers, access to fish at the village is also uneven, where social connections and money play a key role.

Processor A: Sometimes, I can't find any fish. Most fisherfolk have regular buyers, so they don't sell to us. For instance, I can only buy fish from Mr. A and Mr. B. The rest of the fishermen have their own buyers, and we can't purchase from them. If fisherperson A and B don't catch any fish, we don't get any either.

Interviewer: If others have extra fish, will they sell to you?

Processor B: They might sell to us, but the price is often higher than what their regular buyers pay. Sometimes, those buyers resell their fish to us for a bit more money. If we buy at those higher prices, it's hard for us to make a profit (Interviewees MA13-C).

Processors regularly face unpredictably in both the quantity and price of fish. Social connections to middlepeople or fisherfolk are important; the wider social network one has, the more access to fish they will have. With fewer fish coming from the Tonlé Sap, the available supply is spread thin amongst buyers. Since products like smoked fish and 'prahok' are most profitable when produced at large volumes (as discussed in Chapter 5), this reduced availability leads to lower profits for processors.

Arguably, the decline of species is felt more acutely at the village level. "This month we cannot sell any fish, we couldn't find anything. We are unable to find fish from the middle of the lake, even if we go out farther" (Interviewee M1-B). Many notice the decrease in the

amount of fish available and foresee the issue only getting worse. People often had an idea of possible causes of the fish declines, pointing to overfishing, “More fisherfolk are here and this is reducing the fish” (Interviewee AP3-A). These experiences show the relational interconnections between nature, people, and their livelihood systems are continuously shaped by one another.

Market sellers notice the decline in fish, but most I interviewed were not concerned about future access. “I noticed that there is no ‘trey kampot’ (puffer fish) anymore and less species now. It’s not that important to me, it doesn’t impact the amount of fish that I am able to sell, I just sell other types of fish species” (Interviewee F13-B). Another seller said, “I do not think too much about the environment, as long as people are buying, my business is okay” (Interviewee MA4-B). Their lack of concern is likely because their supply comes from middlepeople who buy from a variety of sources, including farmed fish. As a result, market sellers see consistent amounts of fish, whereas people living and working at the lake experience firsthand the lack of fish availability.

Despite data pointing towards a significant decline in the number of species at the Tonlé Sap, there are some accounts that run contrary. Several interviewees attributed policy changes as a reason why they are seeing more fish. “They shut down the larger fishing, so there seem to be more fish this year. Before, many people use large nets and electric fishing equipment to catch fish. However, since last year, there have been fewer Vietnamese with large boats and nets” (Interviewee AP24-B). In 2018, in response to concerns of overfishing and environmental degradation the Cambodian government evicted three floating villages, primarily targeting ethnic Vietnamese communities (Chann et al., 2024). Blaming ‘the Vietnamese’[20] for overfishing was common amongst interviewees, however, there is little data to suggest that Viet-Khmer fishers were taking such large quantities of fish relative to Cambodian fishers. There is a strong sentiment amongst interviewees that there is a relation between fish amounts and the Vietnamese evictions. “They used large-scale equipment, going around and scooping up all the fish. Now that they are gone, the fish are returning in large numbers” (Interviewee F15-A). The more likely reality is that the new gear policies, which Cambodians see as targeting ethnic Vietnamese, are working but also preventing local Cambodians from using illegal gear.

One study of the commercial bagnet (dai) fishery and gillnet captures between 2007 and 2013 observed no declines in fish size average, suggesting a minor stabilization in population relative to the significant declines experienced in the years prior (Kelson et al., 2021). The authors suggest this could be attributed to the abolishment of the fishing lot system in 2012

[20] Vietnamese have migrated to Cambodia since the mid 1800s, during French colonial rule. The second largest minority in Cambodia (after the Cham) identify as Vietnamese. Despite being born and raised in Cambodia, they are not given citizenship, and face significant racism (Mauk, 2018). Khmer fishers argue that Vietnamese fishers use more efficient fishing gear, which puts local fisherfolk at a disadvantage (Mekong Eye, 2017).

and several other factors (large flood pulse in 2011, fish size averages shifting prior to the time series). This study took place over a decade ago and much has changed on the Mekong River including numerous dams that have impacted water flow (Hackney et al. 2020). Beyond the Kelson et al. study, searches for white or grey literature relating to species increases at the Tonlé Sap do not currently return any results, except for the 'trey kom pream' found in Chevalier et al. (2023). Some villagers described seeing more fish in 2023 but linking that to specific causes is difficult to confirm yet. 2023 was a La Nina year, bringing higher floods compared to neutral and El Nino years, therefore bringing more fish.

For now, it appears 'prahok' and smoked fish processors are sustained by smaller bodied species, which suit the primary types of products they make. The only dried fish products produced in large quantities for markets in Kampong Khleang are made from small species. As explored next in section 6.3, this is not necessarily by choice, it reflects the limited access due to the decline of larger species. Does this mean that processors are resilient to the lake's change in species composition? Or has the 'fishing down the food web' (Bahadur et al., 2017) problem reached a point where few micro-scale fish processors are able to sustain their business?

6.3 The Disappearance of 'trey neat' at the Village

While most of the research at the Tonlé Sap centres on specific species declines, this research found a strong connection between species decline and dried fish product availability. Particularly, the availability of 'trey neat' has changed, not in quantity, but in where it is produced and with which species. 'Trey neat', directly translates to 'dried fish'; it is a salted, sun-dried fish that is made from medium to large fish species. The product is made by cleaning and gutting the fish, filleting it, then salting and drying it on racks. It is emblematic of dried fish in Cambodia and is commonly seen in markets. Twenty years ago, 'trey neat' was made for sale and consumption in Tonlé Sap villages (Marschke, 2005). During my scoping trip in November 2022, I looked for this product at the villages, under the assumption it is produced at the lake. But amongst the several villages I visited I could not find it, and people I spoke with said it is no longer made there. This finding pushed me to reframe the focus of dried fish products for this research, but 'trey neat' remained a product of interest when interviewing people at markets. I also continued to ask interviewees at the Tonlé Sap about 'trey neat' to try and understand its disappearance. Observations over the year showed the occasional household that had a small basket of thin, boney, 'trey ros' (snakehead) 'trey neat' drying in front of the house. No racks set up for 'trey neat' drying were observed. It appears that 'trey neat' is only made in small, subsistence quantities at Kampong Khleang.

Based on conversations with processors, market sellers, and local people in Siem Reap, 'trey neat' is no longer made at the lake primarily because there are few, larger species left that can be used to make this dried fish product. This lack of wild-caught fish led to price

increases, reducing processor access and profit margins, making wild-caught ‘trey neat’ unprofitable for those who could not afford to buy in large quantities. A processor at Kampong Khleang explained:

> “For the past 10–20 years, no one has been selling ‘trey neat’; it is made only for personal use. It is more common to produce and sell ‘trey cha-at’ (smoked fish), ‘pra-ot’, or ‘mamm’[21]. If someone orders ‘trey neat’, it can be made, but it has been a long time since people prepared it specifically for sale. People are reluctant to make ‘trey neat’ because it is less profitable compared to other fish products—they simply cannot compete. Packaging ‘trey neat’ is also more challenging than other products” (Interviewee SE18-F).

In addition to the low profit margins and complexity of packaging, processors found that middlepeople would no longer come to the village to collect ‘trey neat’. One interviewee suggested this was because middlepeople could not get enough of the product at the village to make it profitable or worth their time. This is likely compounded with an increase in cold chain storage, which allows fresh fish to be more readily transported. Fresh fish typically makes a higher profit than dried fish, so middlepeople may choose to focus on selling fresh fish. An added benefit is that if the fish is close to spoiling, it can then be sold to fish processors who will make it into ‘trey neat’. As one interviewee explained:

> “We don’t make ‘trey neat’ here, it is made at the markets. We never knew of people who made it here in the village. People from Damdek[22] will collect the fish from here and make ‘trey neat’ there” (Interviewee SE18-D).

These factors have combined to push ‘trey neat’ processing further inland, where it is now an activity done by wealthier processors, often those who have market stalls and access to land to set up drying racks. This shift reflects a relational dynamic in which power imbalances and unequal access to natural resources, financial capital, and social networks shape who benefits from ‘trey neat’ production

[21] ‘Pra-ot’ and ‘mamm’ are both a type of fermented fish product. They are made by chopping fish into chunks and fermenting them in a mix of sugar, salt and other seasonings. Roasted sticky rice is added to mam. Neither were typically seen in large quantities in Kampong Khleang.
[22] The closest city to Kampong Khleang, approximately 7 kilometers away.

Figure 13. A selection of 'trey neat' (dried fish) at a market in Siem Reap

The decline of wild-caught species has led to the decline of wild-caught 'trey neat' products, but the product is sustained at the markets by aquaculture fish. This research found that the majority of 'trey neat' products sold at Cambodian markets are from aquaculture. The most common large wild-caught species seen at the market are 'trey proma'[23] (which can only grow in the wild) and 'trey ros' (snakehead). But even seeing wild-caught 'trey ros' (snakehead) 'trey neat' in the market was infrequent compared to its aquaculture counterpart. All the 'trey pra' (catfish) observed at the markets in Siem Reap, Damdek, Phnom Penh, and Kampong Khleang were aquaculture. Many fish farmers prefer to raise 'trey pra' (catfish) because it is more profitable than other species; it grows easily, eating any combination of pellet and forage fish, and it also less susceptible to disease (Interviewee MA13-A).

Ecosystem changes are often slow, with a lag between cause and effect. Fish populations have been declining since the 1990s, and the shift towards using farmed fish for both dried and fresh consumption appears to have happened gradually over 20 to 25 years. Speaking with a market seller in Battambang, the shift to aquaculture appears to have started here around the time wild-caught fish began to decline. "Before 1995 the fish was from Cambodia

[23] Trey proma (Small-scale croaker*)* is an oily fish usually dried whole or eaten fresh. It is not filleted like *trey neat*. It is not a very popular fish due to it's oiliness.

but we could not get as much so around 2000 we started importing more from Thailand. I'm unsure where exactly, maybe Ubon [Thailand], near the boarder. It has always been aquaculture that we import. Between 1995 and 2000 we used this type of fish, but we used other types as well, it has slowly just become 'trey pra' (catfish) that we use" (Interviewee M7-A). Given Battambang's proximity to Thailand, it makes sense that aquaculture became more dominant in the markets there first and is now spreading to the rest of Cambodia as road infrastructure and transport technologies improve.

Most market sellers reported that they began selling farmed fish around 10 years ago; that seems to be when a key shift in the market occurred. Discussions with market sellers suggest that by the early 2010s, farmed 'trey neat' had became more common than wild-caught 'trey neat'. One seller described this shift saying, "about 10 years ago there was always wild caught fish, no farmed fish. People did not want farmed fish but now it has switched, and I cannot find wild fish" (Interviewee M8-C). Another seller recalled that 10 to 15 years ago, 90% of her fish were wild caught. However, about five years ago, that number dropped to 50%, with her remaining wild fish products consisting of small species that cannot be farmed. (Interviewee F15-A). It is likely that in the past 10 to 15 years there was a juncture point where the productivity of the Tonlé Sap had declined so much that farmed fish became the means to fill the supply gap, including dried fish products. Many interviewees pointed to this as a key reason for the shift, "There is not enough fish from the Tonlé Sap. It is because of overfishing and people eat more so there is less wild caught fish" (Interviewee AP5-C).

The lack of 'trey neat' produced at the lake points to a rapidly shifting environment and loss of associated livelihoods. Is the disappearance of 'trey neat' from the Tonlé Sap villages indicative of what is to come for other fish products if the lake's fish stock continues to decline? While 'prahok' and smoked fish are still produced at the village level, processors are increasingly concerned about the availability of fish. These products rely on small, wild species that cannot be farmed. At the same time, the dried fish sector is now competing with the aquaculture sector for access to these forage fish which are then used as direct feed for farmed fish. Although the current supply of forage fish from the Tonlé Sap appears sufficient, this abundance is misleading, as harvesting large amounts of fish before they can mature undermines ecosystem stability. The overall decline of fish stock underscores the need to understand the interconnected dried fish processing and farmed fish value chains and the implications of their shared use of wild-caught forage fish.

6.4 The Use of Forage Fish

Trash fish and 'trey noi' are the most common source of feed used by small-scale fish farmers (Joffre et al., 2021). Trash fish are the trimmings and waste products of a fish after processing, whereas 'trey noi' (forage fish), refers to whole small fish, unsorted, and unprocessed[24]. Pellet feed as an alternative is prohibitively expensive for most fish farmers as there is a limited supply and high cost of importing from Vietnam (Joffre et al., 2016). Most farmed fish species in Cambodia are fed trash fish or 'trey noi' mixed with rice bran and other home-made feed ingredients (MAFF, 2017). Very little feed is produced domestically; the majority of pellet feed is imported from Vietnam. Barriers due to the supply and cost of pellet feed have led to continued dependence on forage fish for most small-scale fish farmers.

Government and donor initiatives encourage the adoption of pellet feed; however, most aquaculture feed continues to come from inland capture fisheries (Joffre et al., 2016). With the limited introduction of manufactured pellets to the market, it will take time for pellet feed to be widely used, especially for small-scale producers where forage fish is currently the most cost-effective feed method (Joffre et al., 2021). Those who can use pellet feed do so because they have the financial capital to. The sector's continued dependence on low-value fish puts pressure on strained wild capture fisheries and diverts cheap and nutritious fish away from low-income people who could consume or process it. While the government has been slow in implementation, its aquaculture policy outlines a strategy for improving domestic pellet feed. However, the capture fisheries sector lacks a corresponding policy to manage its fish resources for feed.

The interconnectedness of wild-capture fisheries and aquaculture can be clearly seen when the use of forage fish species is analysed. What was once primarily a source of fish for micro-scale processors, is also now being used as fish feed for ponds at the Tonlé Sap, and inland. Some processors are deciding to sell their fish as feed ('trey noi') because it is easier and more profitable. '"Trey noi' makes us more money more quickly and is a lot less work. It is risky with *'prahok'*, we need 3 to 4 kilos to make and sometimes it is expensive, and we cannot make a profit. Whereas selling 'trey noi' makes a profit right away" (Interviewee S25-A). Processors explain that when there is less fish available from the Tonlé Sap, there is not enough to fill the demand for feed and make fish products, so what fish is available is used for the most profitable means. Processing is labour-intensive and does not guarantee a profit, the fish processed into *'prahok'* may not sell for a good price, or sell at all, therefore, forage fish is increasingly sold as fish feed. During times when there is an excess of fish, it will be made into products for consumption; however, such excess is becoming less common.

[24] The term 'trey noi' was often used interchangeably by interviewees to mean the whole fish or the by-product, but it is important to delineate because there are differences in the price they are sold for, and the selling of fish by-products for feed is a more sustainable practice.

As small-scale fish farming has grown in popularity, there is a greater demand for ‘trey noi’. The cost of ‘trey noi’ fluctuates seasonally; over the year that fieldwork was conducted the price ranged between 1000 to 2000 Riel/kilo (0.25-0.50 USD), with some interviewees noting they got a better price when buying in greater quantities. Some fish farmers find ‘trey noi’ themselves, which makes the cost of raising fish a bit cheaper. For ponds with 5,000 to 10,000 fish near the end of their growth cycle, it could cost 1000 USD a day to feed. For those that cannot afford enough feed, they will feed the fish less, but then the fish may get weak and die or not grow to their full size, ultimately selling for less.

Figure 14. ‘Trey noi’ - fish too small to be processed, it is instead used as fish feed for aquaculture

The rising price of ‘trey noi’ poses challenges not only for fish farmers but also for fish processors. While some processors may benefit from selling ‘trey noi’ directly, those who rely on it for production face higher costs. This price increase is especially pronounced during the late dry season. For example, a smoked fish processor can purchase fish for 1000-1500 R/kilo during the rainy season, but in the dry season, the price rises to 2000-2500 R/kilo. However, the sale price of the final product does not increase, resulting in reduced earnings. As demand for ‘trey noi’ grows, its price continues to rise, making it more difficult for processors to secure the quantities they need to maintain production and profitability.

Observations at the village revealed the sheer quantity of ‘trey noi’ being transferred from boats (Figure 15) onto trucks that are delivered directly to farms. Dozens of buckets like the one seen in Figure 14 can come from just one boat. At a farm on the outskirts of Siem Reap, a labourer hired to take care of the ponds tells us about the staggering amounts of ‘trey noi’

they use for their ponds. “We do not use pellet feed, it is too expensive. Sometimes I cannot feed them a lot of ‘trey noi’ and will go a day without feed them. For the ‘trey noi’ we need to feed the fish about 500 to 600 kilos a day” (Interviewee OC05-C). This amount was across several ponds and for larger fish that require more daily feed. At another nearby farm we spoke with a worker who was feeding fingerlings, which require less feed. “The size of the fish depends on how much they eat each day. Right now, I'll feed these fish about 10 kilos a day in small increments, giving them about three or four feedings over the day” (Interviewee OC05-D). Although it is unclear how much forage fish is being used for aquaculture, it appears ‘trey noi’ from the Tonlé Sap is not enough to fill demand.

Figure 15. A boat arrives at Kampong Khleang, bringing kilos of ‘trey noi’ to fish farms.

A key informant who extensively researched aquaculture in Cambodia said that trash fish is imported from marine fish processing factories in Vietnam to fill the Cambodian fish feed supply gap (Interviewee AP6-A). This method is apparently the cheapest, even cheaper than local forage fish because of the mass quantities available, however, there is little data reported on this. Data from FishStatJ for imports to Cambodia shows 2832 tonnes[25] of fishmeal is imported from Vietnam, 1806 tonnes from Thailand, and a total of 22161 tonnes from all countries (FAO, 2024a). It can be speculated that these numbers are well below what is actually imported given the limited capacity at border points to record, and likely bribes

[25] All numbers in tonnes from FishStatJ (FAO, 2024a) are a 4 year average from the 2019 – 2022, including years of no reporting, from the FAO Global Aquatic Trade dataset, reported to the FAO by countries.

that are exchanged to prevent sellers from paying duties. Surprisingly, FishStatJ data shows that Thailand imported 5727 tonnes of fish waste from Cambodia, more than Cambodia's total fish waste imports from Thailand and Vietnam combined (FAO, 2024a). The source of this Cambodian fish waste and the reason for its high export volume remain unclear.

Imports of marine fish by-product is a good re-use of waste, however, the required amounts of feed in Cambodia are not fulfilled by imported trash fish. It is estimated that marine low-value fish only account for 3% of aquaculture feed, and pellets account for less than 1%; the rest of the feed used for Cambodian fish farming comes from inland capture fisheries (Joffre et al., 2016). While this report is now nine years old, it is likely that the percentage of pellet fed systems has not changed much considering Cambodia has yet to manufacture its own pellet feed. As aquaculture expands and wild fish stocks face increasing pressure, micro-scale processors may struggle to access affordable raw materials, reinforcing the shift toward selling fish as feed rather than processing for human consumption. Without locally produced pellet and government support to help small-scale fish farmers upgrade their feed methods and knowledge, the tension between these competing uses of forage fish is likely to grow.

6.5 The Impacts of Imports

In Cambodia, there is no clear definition of what constitutes a small, medium, or large-scale fishpond operation. However, based on a combination of documents, a small-scale fish pond is considered a homestead pond run as part of a family business, typically producing less than 200 kg per household per year (Joffre et al., 2010; Kruijssen et al., 2018; MAFF, 2017). While small-scale domestic fish farming creates resource use conflicts for local fish processors, imported farmed fish from neighbouring countries adds pressure on both Cambodian processors and fish farmers. Information on the amount of farmed fish being imported into the country is scarce and unclear. In 2023 Cambodia reported importing 25 tonnes of catfish (panagus, 'trey pra') (fresh or chilled) from Thailand and 74 tonnes of catfish (fresh or chilled) from Vietnam (FAO, 2024a). The same products for export reported by Thailand and Vietnam did not match, with Thailand reporting 2601 tonnes and Vietnam reporting 214 tonnes. Underreporting is occurring within the value chain, distorting market information and highlights the uncertain competition local producers are experiencing.

The amount of imports is evident in Battambang, a trade gateway near the Thai border; here it can be seen just how much farmed fish is imported into Cambodia. At a *'prahok'* and 'pra-ot' factory outside of town, dozens of trucks and vans arrive daily (Figure 16), full of 'trey pra' (panagus, catfish). We spoke with the men unloading the fish from the truck and they explained that the fish came from Poipet, a Cambodian town on the Thai border. It will be processed here and sold wholesale throughout the country. The fish are far bigger than any Cambodian fish, weighing several kilos compared to the 500 grams to 1 kilogram fish farmed at the Tonlé Sap.

Figure 16. 'Trey pra' (catfish) imported from Thailand

There are 6 stalls within the factory (Figure 17), owned by different businesses that make the same products ('prahok' and 'pra-ot'). We spoke with several of the business owners to understand the process better.

> 'Trey pra' for 'prahok' comes from Thailand. While Cambodia does have 'trey pra', the fish here are not as large. In Thailand, 'trey pra' can weigh 2-3 kilos and have better-quality meat. This is because the fish feed used in Thailand is superior to that in Cambodia, allowing the fish to grow bigger. The larger Thai fish are also more profitable and cheaper. Additionally, the Thai fish are iced, which extends their shelf life and preserves more meat. Cambodian fish are not iced, leading to significant meat loss. When we receive the iced 'trey pra' from Thailand, we ferment it to make 'prahok' (Interviewee M7-A).

This discussion reveals how the more established Thai aquaculture industry creates better quality, larger fish that are more profitable for wholesalers than local farmed or wild-caught fish. Kruijssen et al. (2018) found that the price of imported farmed fish is consistently less than that of domestic fish sold at markets which was confirmed in my interviews with market sellers. While this benefits wholesalers, market sellers, and consumers, it creates

challenges for micro-scale processors. Local fish are more expensive; demand for locally processed products may decline and reduce micro-processors' competitiveness in the market.

Figure 17. 'Prahok' and 'pra-ot' processing in Battambang using imported 'trey pra' (catfish) from Thailand

The growth of domestic and imported farmed fish is noticeably changing the availability of dried fish products in markets and villages. Interviews with fish processors indicate that wild-caught 'trey ros'[26], (snakehead) have decreased over the past decade. This is visibly supported by the lack of wild 'trey ros' at the markets, and it appears most farmed 'trey ros' is imported from Vietnam. An experienced fish farmer explained that 'trey ros' does not do well in ponds and must be bred with another species: "Cambodia lacks an established stock of the hybrid species and so it imports 80-90% of the 'trey ros' that comes to market" (SE20-A). Nearly all dried 'trey neat' snakehead sold in markets now comes from aquaculture. This trend appears to apply to other large fish species traditionally made into 'trey neat'. Of the 38 'trey neat' products surveyed for price and source, 32 (84%) were from aquaculture, while only 4 were wild-caught and 2 had unknown origins.

Wild-caught 'trey neat' sells for more than 'trey neat' made from farmed fish due to its preferred taste and increasing rarity. For example, wild-caught dried 'trey ros' (snakehead) sold at a market for 14.69 USD/kilo, whereas the same species farmed sold for between

[26] This species was once a popular choice for 'trey neat'.

6.12-9.06 USD/kilo. Dried wild 'trey chadow'[27] sells for 9.79 USD/kilo compared to the farmed version that sells for around 7 USD/kilo. At market stalls that had wild 'trey neat', it was available in relatively small quantities compared to the quantities of farmed fish seen at other stalls (Figure 18). Due to the small sample size of wild-caught 'trey neat' prices, it cannot be confirmed that all wild-caught 'trey neat' sell for more than the same species from aquaculture, but it is very likely considering the price of fresh farmed fish is consistently lower than wild-caught.

Figure 18. 'Trey ros' (snakehead) at the market. Wild-caught (left), Aquaculture (right)

Based on market surveys, the price of fresh aquaculture fish is lower than wild-caught when comparing the same species, season, and location (market). Table 11 below shows the comparative price of farmed fish and wild-caught fish. Many of the market sellers did not know where their aquaculture fish came from, although some did state it was from Thailand. For wild-caught species, sellers usually only knew that it came from the Tonlé Sap but did not specify where.

[27] There are three common types of snakehead species in Cambodia, market sellers differentiate because they do vary in price. 1. 'Trey ros' , *Channa striata*, Stripped Snakehead, 2. 'Trey deep', '*Channa micropeltes (juvenile)',* Giant Snakehead, 3. 'Trey Chadow', *Channa micropeltes (adult)*, Giant Snakehead.

Table 11. The price of fresh fish in 2023. Farmed versus wild-caught prices in both Siem Reap and Kampong Khleang

Species	Location	Season	Price (USD/kilo) Farmed	Price (USD/kilo) Wild
'Trey ros'	Siem Reap	Rainy	2.94	3.80
'Trey ros'	Kampong Khleang	Rainy	2.69	3.31
'Trey pra'	Siem Reap	Rainy	3.67	7.34
'Trey pra'	Kampong Khleang	Rainy	1.96	3.18

The influx of cheaper farmed fish alternatives is impacting the dried fish economy. The shift towards farmed fish signals an acceptance by consumers that affordability and accessibility is driving the transition over the traditionally preferred taste of wild-caught products. There is also a shift in market dynamics for dried fish micro-processors. Processors with access to farmed fish do not appear to be worried about their supply. They continue to create dried fish products, and consumers have access to cheaper options. However, many processors at the Tonlé Sap rely solely on wild-caught fish but are facing less availability, higher prices (especially if they are buying from a middleperson instead of sourcing it themselves), and a more competitive market.

This shift revels a less acknowledged trade-off: cheaper fish benefits low-income, food-insecure people but can create hardships for rural micro-scale processors. Rural micro-scale processors making wild-caught 'trey neat' cannot compete with urban processors using farmed fish. Similarly, 'prahok' made from farmed fish, though not traditionally popular, is becoming increasingly common. If forage fish populations continue to decline, 'prahok' products could follow a similar trajectory to 'trey neat'. Additionally, smoked fish, which is exclusively made from forage fish, may become rare and transform into a delicacy if current trends at the Tonlé Sap persist.

Small-scale fish farmers in Cambodia also find it hard to compete with the cheap imports from Thailand. A business owner at the Battambang factory tells us she buys 'trey pra' (catfish) wholesale for 3000 to 4000 Riel (0.75 – 1.00 USD) a kilo depending on the season (Interviewee MA7-C). Small domestic farmers cannot compete with the economies of scale that Thai imports offer. The cost of electricity and pellet feed is a big barrier for fish farmers, and some rural areas do not have access to electricity making it difficult to run productive ponds. This excerpt from an interview reveals the choices local fish farmers have to make to try and sustain their business against Thai imports:

A: By raising ‘trey chadow’ *(snakehead), are you able to sell more?*

B: It depends. If there are a lot of imported fish from other countries, it will be challenging to sell, as traders can purchase the [same] imported fish at lower prices than ours. For example, imported ‘trey pra’ *(catfish) was sold for just over 3,000R per kg, while our fish is sold for around 4,000R, despite the higher costs of raising them.*

A: Why did you decide to raise ‘trey chadow’*? As far as I know, only a few people raise this kind of fish.*

B: ‘Trey chadow’ *costs more to raise than* ‘trey pra’*, but I can catch some of the fish feed from the Tonlé Sap on my own, which helps to save on costs (Interviewee MA13-C).*

To maintain their sales and compete with Thai imports, pond farmers are forced to sell at prices that barely cover their costs. This farmer chooses to raise ‘trey chadow’ because it does not directly compete with ‘trey pra’, the species most imported from Thailand. Additionally, ‘trey chadow’ eats ‘trey noi’, making it cheaper to raise. Since pellet feed is often too expensive for local fish farmers, most rely on ‘trey noi’ for feed, but the decline of fish at the Tonlé Sap reduces their access to feed. “We are considering stopping fish farming because it is not profitable. We spend a lot on fish feed. Others have already stopped due to losses, but we continue because we have other income sources. Previously, we used ‘trey noi’ for feed, which was cheaper than the pellets, but now that option is not available (Interviewee AP24-A)”. A chain reaction occurs whereby imported aquaculture fish drives down the price of local aquaculture. For their businesses to survive, fish farmers heavily rely on the cheapest source of feed possible, ‘trey noi’. This puts further strain on forage fish resources that are also used by fish processors. In addition to ‘trey noi’ used by processors for dried fish products, some small fish species are also cooked and eaten. People especially rely on these smaller species when larger fish are unavailable.

Figure 19 illustrates the positive and negative impacts of imported aquaculture on domestic producers and fish processors, as well as the shared resource demand between local fish farmers and micro-processors. Various Cambodian associations have urged the government to better regulate aquaculture trade with Vietnam and Thailand due to its significant impact on lowering fish prices for farmers (Phanet, 2021). A relational understanding of the political economic factors at play here show the shifting value chain benefits some, and constrains others (Natarajan et al., 2022), usually those already marginalized. What may be the most pressing issue is that the international imports are stifling the growth of Cambodia’s aquaculture sector by preventing domestic profits from being made and reinvested back into the industry. Small-scale fish farmers are unable to earn enough to reinvest, innovate, and upgrade their production, especially in terms of fish feed. At the national level, the government and development organizations are trying to establish domestic pellet production, but progress has been slow.

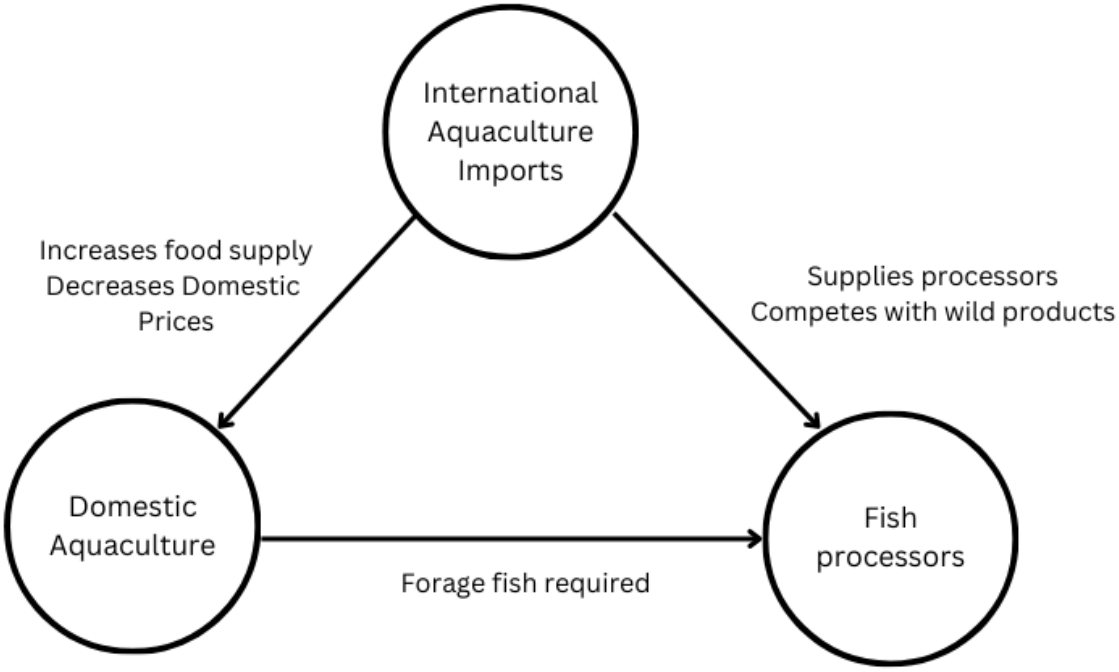


Figure 19. The impacts of imported aquaculture - the direction of the arrow denotes the direction of impact.

6.6 Conclusion

This chapter has examined how transformations in the dried fish economy are reshaping the livelihoods of micro-scale fish processors. In addressing this research question, three key changes emerged: the disappearance of 'trey neat' at the village level, a shift from wild-capture fish to farmed fish, and a more complex, industrializing value chain. These shifts reflect a classic agrarian transition, in which the growing market-oriented fishery systems drive resource-use intensification and enable the rise of large-scale producers with greater capital and power than smallholders (Bernstein, 2015).

Contradictions arise in people's perceptions of fish availability; the overall decline in fish appears to be a more long-term view (10+ years), whereas in high-flood years, people notice an abundance. Rather than treating conflicting accounts as inconsistencies, they reveal the relational nature of resource change. How people view and understand fish availability is constantly changing through their everyday interactions. People's perceptions differed depending on many factors such as age, what species they target, where and how they work in the value chain, and the moment in the seasonal cycle when interviews occur.

In examining the gendered implications of these changes, this chapter has shown that women have less access to fish resources and are therefore pushed to alter their approach to fish processing, adjusting species use and production strategies, or selling their labour. A relational approach also highlights how the broader socio-economic structures of market

development shape the opportunities and struggles of fish processing livelihoods. Pressures from aquaculture, both domestic and imported sources, has implications for fish processors that have not been recognized. Current policies, or a lack of, are likely to be detrimental for micro-scale fish processors, and even small-scale fish farmers, especially if the fish-feed demands of the expanding aquaculture sector remain unaddressed. Without interventions that support micro and small-scale actors, continued declines of the Tonlé Sap fishery will deepen inequality and marginalization.

Chapter 7. Dispossession and Differentiation in the Forage Fish Value Chain

7.0 Introduction

This chapter examines key nodes in the forage fish value chain (FFVC) and how access to capitals shape the livelihoods of micro and small-scale producers. Whereas Chapter 5 focused primarily on fish processors, the scope now widens to include a broader range of rural actors. Building on Chapter 6's discussion of the pressures on forage fish use, this chapter shifts focus from the "dried fish value chain" to the broader "forage fish" framing to enable a more holistic analysis of fish resource use across the intersecting dried fish and fish farming value chains. In doing so, it addresses Research Question 3: how is the dried fish economy changing, who is benefitting and who is losing and what this means for dried fish livelihoods in the future? This chapter uses a value chain perspective to examine rural actors' access to natural, financial, and social capital in the FFVC. These dynamics become clearer when looking at the specific roles and capitals of micro and small-scale actors.

As Cambodia's inland fisheries shift under environmental pressures and aquaculture expansion, this chapter focuses on the access and outcomes that rural value chain actors must contend with. It aims to make visible the everyday practices, inequalities and opportunities that are often not captured when examining value chains at national or global levels. A local, grounded analysis reveals who benefits and who loses in an unregulated and overexploited value chain, and how these dynamics may evolve as production scales to bigger markets. The most vulnerable actors in the value chain are micro-scale women fish processors. Facing socio-cultural restrictions rooted in gender discrimination, they must navigate declining access to natural, financial and social capitals, within a system increasingly oriented towards medium and large-scale production.

In addition to a value chain perspective, this chapter draws on the concepts of accumulation by dispossession and differentiation from the agrarian change literature to understand how value and power are unevenly distributed along the forage fish value chain. Accumulation by dispossession (Harvey, 2003) draws attention to how micro and small-scale producers are being pushed out or marginalized, not through formal land grabs, but through policy action or inaction that strip away their natural resource base and livelihood options. The concept of differentiation (Bernstein, 2021) highlights a growing class divide and deepening of poverty of the most marginalized actors in the forage fish value chain. This helps explain how and why dispossession, along with the socio-economic and environmental shifts within the value chain create greater precarity for some, while growing the wealth of others. The chapter concludes with a discussion on smallholder persistence; while research has shown there is smallholder resilience in Southeast Asia, micro-scale processors at the Tonlé Sap may not follow the same path.

7.1 Value Chain Analysis

A value chain analysis here aims to consider how shifts in the value chain has uneven impacts among actors (Bolwig et al., 2010). Conventional value chain approaches often focus narrowly on financial flows and efficiency, overlooking the social, ecological, and relational dimensions of production (Dunaway, 2020; Fabinyi et al., 2018). In the Tonlé Sap forage fish value chain, linear models fail to capture the interconnections between dried fish and aquaculture production, gendered labour distribution, and the effects of ecological decline on livelihoods. By foregrounding these dynamics, this analysis highlights how value, risks, and inequalities are distributed across actors and scales, providing a more nuanced understanding of livelihood transformations.

Research shows that the supposed benefits of value chain participation towards improving inequality has been overestimated (Ponte, 2022) and can often reinforce existing inequalities (Selwyn, 2015). This section introduces the rural actors in the forage fish value chain and their varying levels of access and power. This shows who is best positioned in the value chain and can be used to help understand how fish processors are amongst the more marginalized actors. Mapping access to resources and power helps reveal structural inequalities that shape who gains and who loses amid the shifts in the dried fish economy. Resource conflict further complicates these dynamics, as multiple actors vie for the same declining resource. Understanding these dynamics can help shape programs, policies, and governance approaches to support marginalized livelihoods.

Table 12. Actors in the rural forage fish value chain, their role and access to capitals

Actor	Role	Access		
		Natural capital	**Financial Capital**	**Social Capital**
Fisher	Catches fish from the Tonlé Sap, sells to various actors	Declining due to overfishing and environmental issues	Low	Moderate – interacts with middlepeople and processors
Middleperson	Moves fish between different nodes of the value chain	High - controls resource flow	Moderate to high	High – interacts with many actors throughout the VC
Fish processor	Buys fish directly from a fisher or from a middleperson; hires locals to cut, clean and process fish. This is sold as a value-added product (smoked fish or 'prahok').	Declining due to overfishing, environmental issues and fish feed competition	Low	Moderate – interacts with fishers or middlepeople, hires workers

Pre-processor	Buys and processes fish themselves. Sells the cut, cleaned fish to the fish processor.	Declining and inconsistent	Very low	Low to moderate - interacts with fishers or middlepeople
Hired processor	Hired by fish processors to cut, clean, or smoke.	Declining and inconsistent, depends on fish processor access	Very low	Low – depends on proximity for work
Market seller (local)	Sells processed fish products, fresh fish (farmed and wild), and can make dried fish	Fairly consistent access, buys from middlepeople and processors	Moderate	Moderate – interacts with middlepeople and consumers
Small-scale fish farmer	Owns or rents land to farm fish in ponds. May feed and harvest fish	Access varies depending on resource availability and financial capital	Low to moderate	Moderate – interacts with fishers or middlepeople, hires workers
Hired pond labourer	Tends to ponds: cleans pond, feeds and harvests fish	Depends on fish farmer access	Very low	Moderate – likely to have an 'in' to get the role

Based on conversations with the various actors in the forage fish value chain, Table 12 provides insights into the levels of access people have. Natural capital in this case is the availability of forage fish. A noticeable trend is that those with more financial and social capital (middlepeople and market sellers) do not experience the same level of inconsistency or decline in their access to forage fish compared to all other actors in the value chain. Middlepeople not only have more financial capital, but they have greater vertical mobility, moving between nodes, giving them access and capacity to build networks for buying and selling, however, middlewomen often experience discrimination and lack of bargaining power relative to middlemen[28] (Kusakabe, 2016).

Market sellers also have a higher positionality as they can set prices, and shift to alternative suppliers and products when availability declines. Meanwhile processors remain dependent on whatever fish is available in their location. It was common to hear from market sellers that they were not worried about access to fish products, whereas processors and fisherfolk living in Kampong Khleang experience the decrease in fish availability more acutely. Ultimately, everyone in the value chain depends on access to natural capital. However, those with power and access to multiple forms of capital, are better able to adapt

[28] Discussed further in section 7.2.1

to fish decline, which reinforces their position. In contrast, actors lower in the chain lack the means to improve their position, leaving them further marginalized.

7.2 Who is Benefitting and Who is Losing

Exploring the forage fish value chain reveals the growing inequalities among rural livelihoods. Middlepeople gain a lot of the product value, positioned between nodes of the value chain where they control market access, pricing and distribution. It is problematic that the value created by fish processors for this increasingly scarce resource is being captured by others, effectively moving money and food away from poor rural areas that need it the most. As a result, the loss of ecological, nutritional and financial resources is externalized to households at Kampong Khleang (Ferolin & Dunaway, 2013). Table 13 summarizes how the key actors benefit or lose out amongst the socio-economic and environmental shifts. The major benefactors at the rural level are middlepeople. Meanwhile micro-scale fish processors are disproportionately impacted.

Table 13. Summary of who is benefiting and who is losing in the shifting dried fish economy

Actor	Status (Benefits/ Loses)	Key Changes Impacting Them	Implications
Fishers	**Loses**	Wild fish stocks declining due to overfishing and environmental changes	Loss of fishing livelihood; forced into low-pay, land-based jobs
Middlepeople	**Benefits**	Greater fish supply from farmed fish. Consolidates dried fish products as resources decline	Profits more from farmed fish; controls fish processor market access
Fish Processors (including pre-processors and hired processors)	**Loses**	Wild-caught fish diverted to fish farming, decline in fish stocks due to overfishing and environmental changes	Women will be the first to experience job loss; forces women to migrate outside the village for low-pay jobs.
Market Sellers	**Mixed**	Access to fish is constant, but a change in products	Sells what is available, may lose access to some products
Small-scale fish farmers	**Loses**	Lack of knowledge and support limits growth; limited fallback options[29]	Large financial loses, poverty and inequality increase
Hired pond labourer	**Mixed**	Increased job opportunities but physically demanding work	Low wages, long hours, environmental exposure
Consumers	**Mixed**	Increased availability of farmed fish, often at lower	Greater affordability, continued access to fish. Possible health risks from

[29] Small-scale fish farmers do not often have the flexibility to switch to producing other species when faced with seasonal or environmental stressors compared to larger-scale, intensive producers (Betcherman & Marschke, 2016)

		prices. Reduced access to wild-caught fish.	farmed fish (unregulated chemicals); possible loss of nutrient-dense small fish.
Large Businesses & Corporations	**Benefits**	Expansion into large scale fish farming & dried fish commodities	Control over production and distribution, increasing profits and market dominance
The Environment	**Loses**	Exploited for aquatic resources	Further degraded, ecosystem decline

7.2.1. Who Benefits

The main benefactors in FFVC at the rural level are middlepeople who have significant control over fish resources at most nodes of the value chain. While they can add value to fish products by sorting and transporting, they capture a larger proportion of the product's final value relative to their input. They are able to capture more value through setting and controlling product costs. They do so by taking advantage of smallholder's limited bargaining power and market access (Kusakabe, 2016). Rural producers are disconnected physically and socially from urban centres where their products are sold. Often middlepeople are their only way to access markets, and processors must use them at the cost of losing a lot of the value they have created.

Social connections play a large role in the buying and selling of products; middlepeople benefit from the numerous connections they have. For example, a fish farmer told us that "The middlepeople will delay buying the fish from me so I have to keep feeding the fish for longer and this causes more expenses. They delay buying because they buy from other sources" (Interviewee MA13-A). In this case, the farmer depends on a single middleperson, whereas the middleperson has multiple sources and can negotiate lower prices. This dependence reflects some of the barriers small-scale fish farmers experience such as limited access to alternative buyers and a reliance on established social networks. This is especially problematic for a resource like farmed fish because it must be kept alive, which costs the farmer more for every day they must feed the fish. These dynamics become visible when examined locally, where informal relationships and power inequalities shape everyday access.

Interviewing middlepeople was difficult due to their transient nature relative to other actors in the value chain. We would see them coming and going, and the rare time we were able to speak with one, they were busy conducting transactions and collecting products. There were only two middlepeople I spoke with that gave details on how they work; they both happen to be at the same smoked fish processing house. Coincidently, the two are opposites in many ways, one a man, the other a woman, and they run different operations and have very different profits. Boxes 1 and 2 below highlight how differently these two middlepeople operate.

Box. 1 The local middleman

The middleman collects fish from fisherfolk around the village and sells to processors and fish farmers. He earns 500 Riel (0.12 USD) per kilogram and can sell up to 1 tonne of unprocessed fish per day, generating approximately 500,000 Riel (125 USD) daily profit. This is a significant daily income, far above what any of the fisherfolk or rural fish processors can make. Arguably, his labour input is far less than the other actors, yet he can capture more value.

Several factors give him an advantage:

- **Local embeddedness**: Long-standing relationships likely give him consistent supply and negotiate favorable prices.
- **High-volume**: Raw fish has multiple buyers (processors and aquaculture operations)
- **Costs**: Working locally reduces transport costs and time delays.
- **Capital**: The ability to purchase in bulk suggests access to working capital unavailable to smaller actors.

Box 2. The regional middlewoman

The middlewoman travels from Siem Reap and buys smoked fish to sell wholesale to market sellers, and she also has her own market stall. She buys 300 sticks of smoked fish at one location and 200 more from another processor in the commune.

She sells:

- 200 sticks wholesale for 1,000 Riel (0.25 USD) per stick, immediate wholesale profit is 40,000 Riel (10 USD)
- 300 sticks at her own market stall, pricing them between 1,200 and 1,500 Riel (0.30 – 0.37 USD) per stick, her retail profit, sold over a few weeks, is between 120,000 – 210,000 Riel (30-52 USD).

Although she has a similar role to the middleman, her profits are significantly less.
Several factors may explain this:

- **Regional work**: Possibly has less connects with the local community because she does not live in Kampong Khleang
- **Low- volume**: less people buying smoked fish compared to raw fish
- **Costs**: More gasoline and transport time required
- **Capital**: Gendered disadvantages may also contribute, women-owned businesses often face constraints such as limited access to credit, market information, networks, and systemic discrimination (Kusakabe, 2016).

The middleman's case illustrates how value capture in the transforming forage fish value chain increasingly favors actors who can mobilize capital and operate at scale, meanwhile, the middlewoman demonstrates that not all intermediaries benefit equally from value chain transformation. The cases of the middlepeople illustrate how uneven value capture is already embedded within the dried fish economy at a local scale. As the fisheries sector develops, corporations and larger businesses are positioned to benefit, as often is the case with lead firms that set up spatially extensive and exploitative systems (Ponte et al., 2019). While it is uncertain how this will play out, the country's history of resource exploitation in the forestry sector (Le Billon, 2002; Milne, 2015) suggests the potential for further dispossession, with political and corporate elites consolidating control over fish resources at the expense of those who depend on them. This is examined further in section 7.3 through the concept of accumulation by dispossession.

7.2.2. Who Loses

It is no surprise that micro-scale fish processors are losing out the most as wild-capture fisheries decline and farmed fish is more readily available in markets, creating a shift away from traditional dried fish production. Dried fish processors are also the most marginalized group in the value chain due to the informal and precarious nature of their work, combined with gender discrimination. Informal work is often divided among gendered lines; women disproportionately work in insecure, poorly paid jobs (Taylor, 2014). Women are also disadvantaged by having lower social capital; because of household care duties, they are expected to stay close to home, limiting how far they can travel to processing households, reducing their work opportunities.

Fish processing in Kampong Khleang is still largely done by hand; fish processors are paid by the kilo, yet it takes hours to produce a few kilos of processed fish[30]. Labour, in the sense of hours worked, is not accounted for in the value of processed fish. Their paid and unpaid labour is undervalued, reinforcing economic dependency and acceptance of little pay relative to the value they generate. Hired processors are the lowest paid actors in the FFVC: the median amount a hired processor earns per kilo of processed fish is 500 Riel (0.12 USD). With an abundance of poor, unskilled labour, processors have little knowledge of the value of their products outside the village and therefore lack bargaining power. As a result, workers are paid less than the value of the commodity they produce, creating surplus value that is collected by downstream actors.

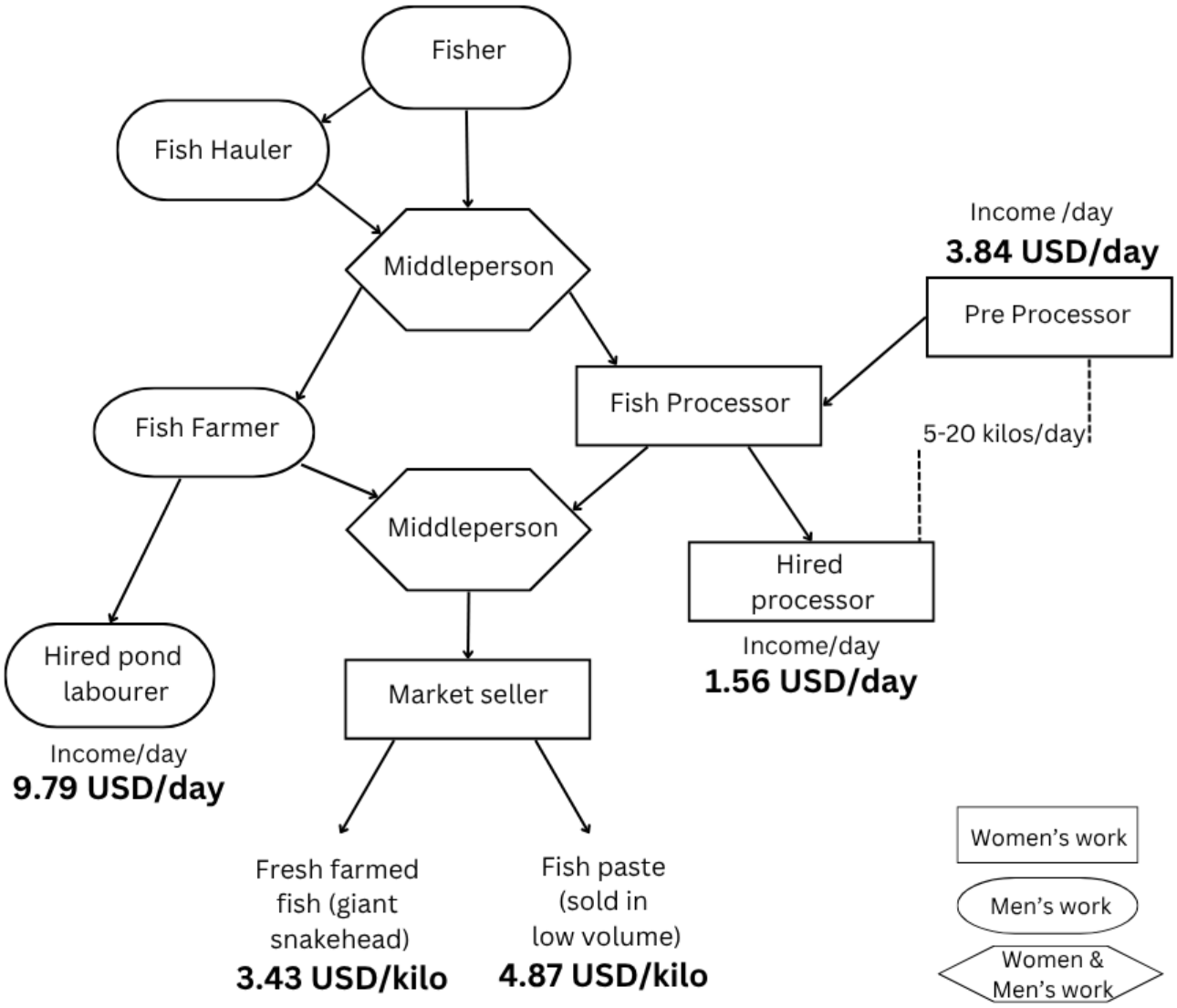
Gender norms limit women's access to higher paying jobs, even those available within their villages, such as male dominated occupations like fishpond labouring[31]. Social norms

[30] Processed fish are cut and cleaned in preparation for smoking or making into paste.

[31] Families that have fishponds and do not hire labourers rely on both men and women family members to do pond labour. Pond owners who can afford to hire labourers only hire men. It seems women are willing to do pond labour if their family owns the pond, but do not want to be hired as a wage labourer for this job, and employers prefer to hire men.

dictate that heavy labour is something that men do, and this is reinforced by the idea that women are not physically capable of such work but also that they must retain their dignity (Tann, 2024). Fish processors earn between 1.56 and 3.84 USD a day. Despite it being strenuous work, fish processing is valued less than other types of physical labour, likely stemming from a history of gendered perceptions that women's work is worth less (Ledgerwood, 1990). Figure 20 shows the value captured downstream at the market and highlights the gendered division of labour and the associated pay that appears in the forage fish value chain. Hired fish processors earn far less than they should given the amount of time spent processing fish. The unequal pay in the value chain reflects not only market dynamics but also gendered social constraints. The cost of production is externalized and women's paid and unpaid labour ends up subsidizing commodity production, reinforcing a system where their contributions are undervalued and invisible (Ferolin & Dunaway, 2013).

Figure 20. The forage fish value chain resulting in 'prahok' and farmed fish products.



It is difficult to determine the value captured by and from fish processors[32]. No consistent amount was recorded for how much they earn. Although fish processors are seen as making a decent living compared to other types of village fish processors (pre-processors and hired processors), they also endure precarity and uncertainty. Despite running a successful fish smoking business, a woman we spoke with explained the hardships she endures, "My biggest challenge is having enough money. I wake up every morning at 4am. I order the fish and work hard to make the fish well. As women we are trying to survive" (Interviewee AP3-C).

7.3 Accumulation by Dispossession

Mapping the forage fish value chain at the rural village level shows that financial and nutritional benefits from fish resources are being diverted away from poorer, upstream actors and concentrated in the hands of downstream actors in more urban areas. Scaling back, this section draws attention to the broader systems the forage fish value chain is embedded in that reproduces inequality amongst actors (Lang et al., 2023). Environmental and economic policies, programs, and entrenched social norms can restrict or exclude some actors from creating livelihoods while enabling more powerful actors to capture wealth and value, producing dynamics of accumulation by dispossession (Harvey, 2003). Non-action by actors in positions of power also drives dispossession; when policy, regulation, or enforcement is absent or weak, those with the least access to capital are the most vulnerable to exclusion and exploitation (Li, 2010; Peluso & Lund, 2011). This section first looks at an example of a program that has the potential to dispossess micro-scale fish processors and then turns to an example of how narrow policy along with weak regulation and enforcement further exacerbates unsustainable fish capture.

Recently, the Cambodia Quality Seal[33] (CQS) certification program began certifying sustainable and hygienic products for international export (UNIDO, 2023). Certifications can be problematic, products marketed under sustainability standards are more commonly becoming essential for market access, excluding less-resourced actors (Campling & Havice, 2018). Furthermore, certification has the potential to mask the hidden costs of sustainability, whereby upstream actors are the ones having to adhere to environmental upgrading and compliance while firms capture the value (Ponte, 2022). The CQS initiative provides an example of accumulation by dispossession, exploiting commons resources, waged labour, and pushing micro-scale processors further to the margins.

UNIDO's partnership with Confirel, a Cambodian food manufacturer, illustrates how these dynamics materialize in practice. Confirel plans to build a factory for prahok powder production for international export, and to source fish only from producers who have already achieved CQS certification (Malai, 2024). These plans for industrializing and commodifying fish products take place within an already overfished and strained ecosystem. Furthermore,

[32] Fish processors here is referring to the specific subset of processor that are able to buy fish, hires others to help them process, and creates a finished product for markets.

[33] CQS is a part of the Capfish Capture program run by the United Nations Industrial Development Organization (UNIDO)

this integration into global markets does not create high-paying employment opportunities for rural households. While the factory jobs created through this model may offer wages that are more stable than village processing, they remain low-paid industrial positions that require significant trade-offs. For rural women, taking these jobs means spending long periods away from home, despite being expected to manage household and caregiving responsibilities (Brickell, 2011). Shifting prahok production into industrial settings directs profits to downstream actors rather than to the processors themselves. Unless systemic barriers (market access, policies, institutions, infrastructure, sustainability) are addressed, the CQS model risks deepening processors' marginalization and reinforcing the dynamics of dispossession.

The design of CQS further illustrates how benefits are structures to flow to downstream actors. For example, the CQS scheme focuses only on the most profitable nodes of the value chain, fishing vessels, landing/collection sites, processing enterprises, and large retailors[34], all of which operate at a medium or large scale. Meanwhile, micro and small retailors[35] and aquaculture farms are noted as "relevant stakeholders but not included in the CQS" (MAFF, 2022, pg. 21). Notably absent is any mention of fish processors and the definition of "processing enterprises" refers only to establishments, not the people processing the fish. This suggests that the CQS is structured to prioritize profits for already established enterprises rather than the workers who contribute to the industry; highlighting how well-intentioned program design can leave behind the most marginalized actors.

A comparable pattern appears in the government's aquaculture strategy, where narrow policy choices exclude small-scale fish farmers, and place additional pressure on forage fish resources. The government plans to develop extensive and semi-extensive aquaculture systems for domestic food production and intensive systems for commercial export (UNIDO, 2023), but support is focused towards already established producers located near Phnom Penh or Siem Reap. A government official confirmed that small-scale farmers will not be included initially: "I don't believe the small-scale farmers will contribute to our target unless we encourage some kind of investment… Small-scale fish farmers are not part of the support. The 20% annual increase will come from medium and large-scale producers" (Interviewee MA10-A).

This approach exemplifies accumulation by dispossession. Development support prioritizes medium and large-scale producers, excluding small-scale fish farmers from investment, technical assistance, and markets, ultimately shifting value and opportunity away from those with the least capital and power (Figure 21). This is a common trend in fisheries, the large-scale, industrial fishing subsector receives four times the subsidies given to small-scale, artisanal and subsistence fisheries combined (Schuhbauer et al., 2017). In Kampong

[34] Large retailers who perform as distributors, supermarkets or smaller marts that sell high quality products specifically (MAFF, 2022).

[35] Micro or small retailors or street/market vendors who have no storage facilities or does not sell the product on a daily basis due to the limited quantity of products (MAFF, 2022).

Khleang, small-scale fish farmers rely on dwindling forage fish resources because pellet feed is unaffordable. This puts strain on micro-scale fish processors, as resources are diverted away from them. Regulatory action is necessary; until pellet feed becomes widely established, the government must regulate and enforce sustainable forage fish use. In both examples, fish is treated as only a resource to be consumed. If only capital is focused on, the consequences of disrupting ecological cycles and dispossessing small fishers are overlooked (Sneddon, 2007).

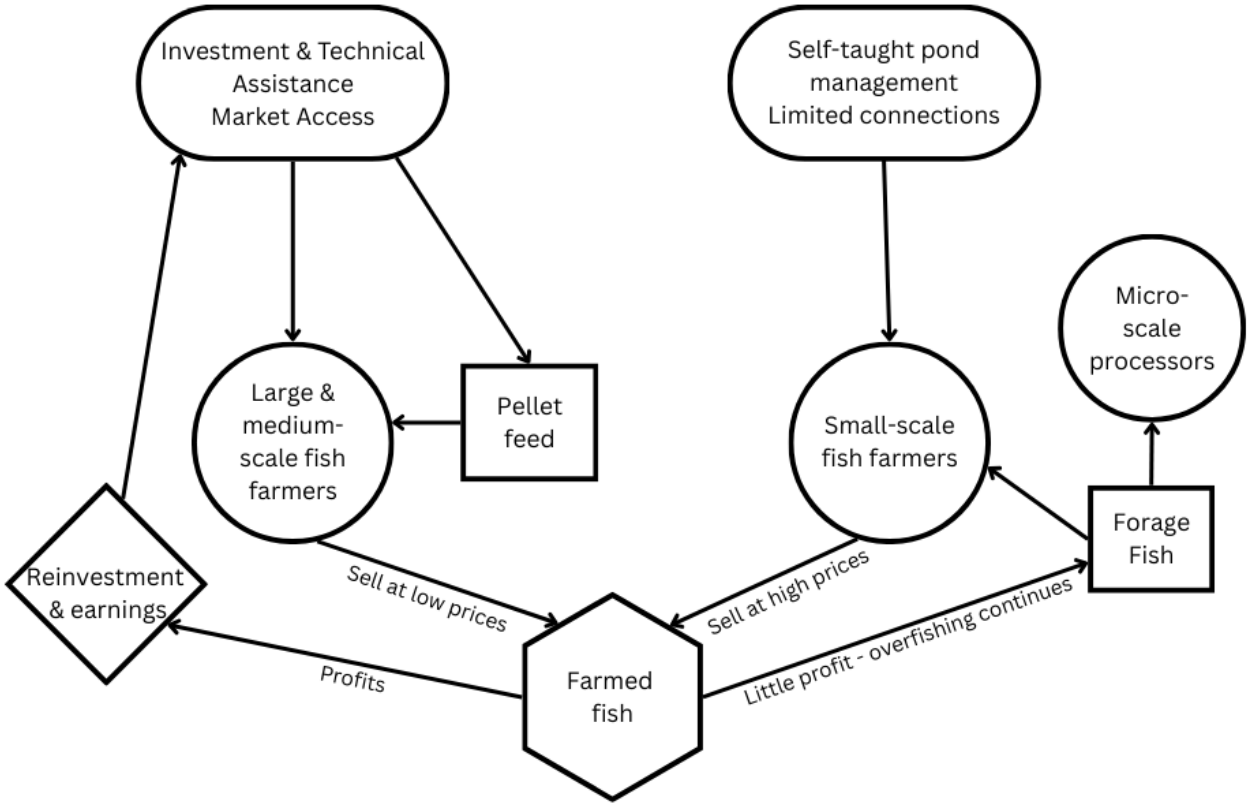


Figure 21. Uneven Policy Support and Market Advantages - A lack of support for small and small and micro-scale producers leads to reinforcing market advantages for medium and large-scale producers

This case of accumulation by dispossession is distinct because, unlike agriculture, the supply of wild fish cannot be easily intensified, making livelihoods highly vulnerable to resource shifts. It is further distinguished by the interconnection between two value chains, dried fish and aquaculture, both competing for the same fish species. As a result, one group of actors, micro-scale processors, are being dispossessed to support the expansion and profitability of another sector.

Accumulation by dispossession does not affect all people equally; it can be a driver of peasant differentiation. Rural smallholders are dividing into different classes as some gain access to capital market opportunities. In Kampong Khleang, a small minority are considered well-off, typically those who have land for agricultural farming, and have a

diversified livelihood portfolio which may include fish collection from hired labourers. Moderately successful small-scale fish farmers and fish processors who run their own business have some financial stability but still live in precarity. Meanwhile, many fish processors are falling deeper into poverty; they have lost access to fish and must work as wage labourers.

7.4 Peasant Differentiation

Peasant differentiation is theorized in several forms, but here I draw on Bernstein's (2021) approach which sees that peasant differentiation has long been around, but capitalism amplifies the inequalities between the peasant classes. As more demand from domestic and global markets is created for processed fish products, more value is available but is not evenly distributed (Bernstein, 2021). Inequality is growing between and within occupations in the FFVC. Fish processing work can include the poorest of women alongside those who operate at larger scales. Some fish processors can buy several tons of fish and hire others to process. Pre-processors can afford to buy some fish and process it themselves, whereas the poorest of the fish processors must sell their labour, earning just enough to support daily expenses.

Table 14 below highlights several factors that show the differences between the livelihoods of the different types of micro-scale processors, shaped largely by market dynamics and state policies that affect access to resources and opportunities. What is important to note is that despite the fish processor being considered a 'rich peasant', they are typically not financially secure. Fish processors often have loans and worry about money and their livelihoods to a similar extent that the hired labourers and pre-processors do. This reflects findings by Green (2022) on Cambodian rural households, where relative wealth does not necessarily protect against socio-economic or ecological vulnerabilities. Instead, loans can exacerbate insecurity, create indebtedness and reinforce cycles of poverty and vulnerability to shocks and stressors.

Table 14. Peasant differentiation among fish processors

	Hired Labourer (ultra-poor peasants)	**Pre-Processor (poor peasants)**	**Fish Processor (rich peasants[36])**
Livelihood(s)	Sells labour	Sells pre processed fish, may have another business	Sells fish products, may have fish farm or other businesses
Fish access	Cannot afford to buy	Can afford to buy in small quantities	Can afford to buy in large quantities

[36] The term rich peasant is used here to show the differentiations amongst fish workers, but they are only 'rich' relative to the hired labourers and pre-processors.

Financial situation	Lives on daily income, may have loans[37]	Can save a small amount, likely has loans	Can save a moderate amount, likely has loans
Control over production	No tools or infrastructure, works when fish is available	Processes at home, creates own schedule	Has processing equipment (racks, containers), creates own schedule, hires employees
Social capital	Relies on neighbours and family for work	Relies on commune connections and middlepeople	Relies on middlepeople; may have direct market access; relies on local women to process
Mobility	Limited opportunities to work outside of fish processing	Limited opportunities to work outside of fish processing	Alternative livelihood opportunities available[38] (agriculture, fish farming)

Growing peasant differentiation exists within other nodes of the forage fish value chain. Fish farmers, though wealthier than processors, also experience wealth disparities (Table 15). Often peasant fish farmers struggle to raise fish, not having the knowledge and financial capacity to properly feed and maintain their ponds. They are often in debt from the loans they have taken to start their ponds and cannot make a profit. These farmers use the cheapest feed available, forage fish, and will forgo regular feedings to save on costs. This is a vicious cycle whereby the fish do not grow large enough to sell for a good price, and the farmer makes less of a profit, thereby limiting their capital to reinvest. As Bernstein (2021) argues, many peasants are trapped in 'simple reproduction', unable to generate surplus to reinvest, leaving them vulnerable to debt and downward mobility. Pond culture can be risky, as seen in Thailand and Vietnam for both low intensity and high intensity aquaculture (Betcherman & Marschke, 2016). In the village of Kampong Khleang, there is evidence of abandoned ponds, perhaps nearly 50 percent, albeit it was unclear which type of fish farmer[39] had tended to the ponds.

[37] Hired labourers may be less likely to have loans because they are too poor to qualify.

[38] Most fish processors are constrained to commune based livelihoods but some can access alternative, more profitable, livelihoods. Their access to financial capital may give them access to nearby land for farming. One example of a relatively well-off fish owner is the 'Prahok house' family who have agricultural land in another province where they grow mango.

[39] See Table 15 for the different types (differentiations) of fish farmers.

Table 15. Peasant differentiation in fish farming

	Hired Labourer	Failing Fish Farmers	Coping Fish Farmers	Thriving Fish farmers	Landowners
Fish pond access	Hired to work and live at pond by landowner	Rents or owns pond space	Rents or owns pond space	Rents or owns pond space	Hires workers to tend to ponds and rents to peasants
Financial situation	Earns a daily or monthly wage	May have loans and debt, cannot profit from ponds	May have loans and debt, struggles to profit	May have loans and debt, profits from ponds	Profits from ponds and rent
Knowledge	Limited to moderate aquaculture knowledge, depends on resources provided by landowner	Limited aquaculture knowledge, gained by trial and error and from within the commune	Limited to moderate aquaculture knowledge, gained by trial and error and from within the commune	Likely has had formal training in aquaculture	May have aquaculture knowledge, hires workers to do tasks
Feed	Pellet feed and trey noi	Trey noi	Trey noi, some pellet	Pellet feed mixed with other food (trey noi, bran, vegetables)	Pellet feed and trey noi[40]
Pond productivity and profits	Varies depending on worker skill	Low-weight fish production, little to no profit	Low to average weight fish, no to small profit margins	Average weight fish, small profit margins	Dependent on hired workers

The most successful ponds are run by those that have knowledge on how to properly feed the fish and maintain the ponds, or at the very least have the money to feed the fish regularly. In Kampong Khleang there were only a few households that could be considered thriving, illustrating differences in capacity, resources, and outcomes among fish farmers. Yet even successful fish farmers are not free from exploitation. They often rent the pond from a landowner, while they tend to the land and create products of value from it, the landowner takes a cut from the value created. This highlights the unequal relationship between fish farmers and landowners, where farmers must surrender a portion of the value generated from their labour to the landowner in order to sustain their livelihoods (Harvey, 2003). This is

[40] From observations pellet feed was mostly used by landowner-run fish ponds. In the ponds near Phnom Penh it appeared to be exclusively pellet feed, but a combination of pellet and trey noi use was observed at landowner ponds near Chong Khneas. Ponds near Phnom Penh appear to be wealthier than those in Siem Reap, likely due to proximity to markets, technology, and knowledge coming from the government and organizations based in the capital. Land near Phnom Penh is likely more expensive, so the landowners may be wealthier to begin with.

what Bernstein (2021) calls a ‘disguised proletariat’; the fish farmers initially appear to be independent, but in reality, remain dependent on landowners and the market. Taken together, this illustrates processes of peasant differentiation, how actors experience varying degrees of precarity and inequality.

While Tables 14 and 15 present categories of fish processors and fish farmers, these should not be read as fixed or permanent. They illustrate general livelihood patterns, but in reality, these roles are dynamic and can shift depending on seasons, household circumstances, and external shocks. For example, women processors described becoming hired labourers temporarily, experiencing income fluctuations depending on which family members were working, or coping with stressors such as health issues, flooding, or other shocks. Fish farmers may experience even greater volatility, as their capital is fully invested in production and subject to risks from weather, disease, or market fluctuations. Given that the divergence of fish processors into different categories is recent, it is likely that these roles will continue to shift over time. Fish farmer categories may be somewhat more stable in the near term due to a focus on expansion, but both sets of categories remain analytical tools rather than strict classifications. Despite their simplification, these categories are useful for capturing patterns of inequality, risk, and livelihood strategies within the system.

The scatterplot (Figure 22 below) is a conceptual representation to show the desirability of the different types of fish processing professions and fish farming jobs, and the relative income each makes. It shows fish farming is a preferred profession but does not always make more money than other occupations in the forage fish value chain. An exponential gap in income can be seen between hired processor, pre-processor, and fish processor, as well between the three types of fish farmers. Conversations with hired and pre-processors reveal they prefer to have their own pond or processing business but cannot afford the start up investment (Interviewee JU8-F).

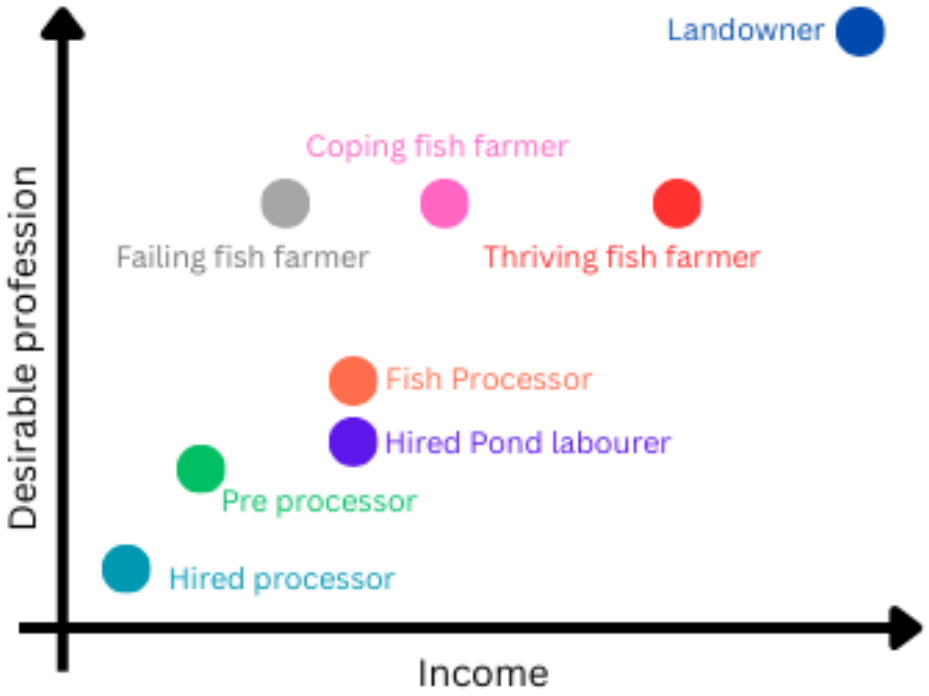


Figure 22. Visualization of the income and desirability of occupations

At the same time, important differences exist across groups. While many fish farmers face uncertainty and livelihood struggles, they generally occupy a higher socio-economic position than fish processors. Access to land, business assets or credit provides them with more opportunities for livelihood production. For example, a processor (Interviewee F14-B) shared that a neighbour lost 60,000 USD trying to start a fish farm. Her family, by contrast, cannot secure a loan to start any business. This shows how even heavily indebted fish farmers often have greater financial resources and diversified opportunities than processors, underscoring how differences in access to capital and assets produce stratifications that shape economic opportunities and daily life (Natarajan et al., 2022).

A cycle emerges in which the disposition of natural resources increases reliance on capital markets, deepening peasant differentiation and, in turn, reinforcing the development of a local market for capitalism (Bernstein, 2021). The overall decline of Cambodia's freshwater fisheries since the 1990s coincides with a greater integration into the global markets (Sneddon, 2007), as well as dam development along the Mekong River, environmental change and sand mining (Ng & Park, 2021). These structural and ecological changes reinforce the patterns observed in Kampong Khleang, where households increasingly struggle to access their means of production. Many interviewees spoke about reduced fish abundance and how difficult life is when fish resources are scarce. As a result, differentiation among peasants has intensified, some households have acquired more land,

equipment, and capital, while others have become poorer and more dependent on cash markets (Bernstein, 2021).

7.5 Smallholder Persistence

One of the many agrarian questions is whether smallholders will persist within a capitalist system that favours large scale production. Marx (1992) believed smallholders would be consolidated, whereas Lenin (2023) refined this to argue that smallholders would differentiate into classes, breaking down the peasantry. While differentiation has occurred, a complete breakdown of the peasantry has not happened in the case of Kampong Khleang or Cambodia more broadly. Smallholders still persist despite Marx's (1976) accurate prediction of capitalism's wide reach over society and capture of production, in part because, as Ferguson (2013) notes, land offers value and security to rural households even when it is not fully productive.

Chayanov (1966) believed that smallholders persist because they work outside of capitalist logic; that they are not fully absorbed into larger enterprises because they meet their needs through subsistence-level activities. Interviews confirm that many people rely on wild fish from the lake for sustenance and livelihood production, perhaps adding evidence to Chayanov's theory. However, among interviewees there was a sense that their reliance on fish was out of necessity, they lacked the financial means to move into other types of work but would if they had the chance. This aligns with Kautsky (1988), who saw smallholders persisting out of necessity, through self-exploitation and their ability to survive on the margins of the capitalist conditions they are tied to. This experience reflects the reality of many micro-scale fish processors and small-scale fish farmers in Kampong Khleang, who rely on family labour to produce fish and fish products. Kautsky (1988) viewed this reliance on unpaid family labour as a temporary advantage over large-scale production, allowing smallholders to compete. However, he argued that over time, the pressures of overwork and the increasing efficiency of industrial systems would lead to the eventual decline of small enterprises.

The situation of rural smallholders in Cambodia often reflects a mix of both Kautsky's and Chaynov's perspectives. One man, for example, explains that he prefers to work at home with his family, even though he remains tied to the market to buy necessities: "I worked on a chicken farm and I only got to sleep two hours a day due to the hard work. So it is better for me to work here. I can be my own boss. It is difficult here, but there's more freedom and we can rest" (Interviewee OC19-A). Although life as a smallholder is difficult, he prefers it to low-wage work under a boss within large-scale capitalist farming. He chooses to be a smallholder, struggling in a different way, maintaining autonomy but still depends on the market system to sustain his family's livelihood.

Li's (2014) research in Sulawesi, Indonesia, shows that the indigenous highland people chose to become capital-intensive smallholders, converting their land from primarily

subsistence crops to cocoa. While this shift opens opportunities for income generation, it also exposes households to new forms of vulnerability. When carried out under unstable environmental and economic conditions, not all smallholders are able to maintain production over time (Bernstein, 2021). Many now face challenges similar to fish processors and fish farmers in Cambodia, such as indebtedness, declining resource access, and limited livelihood alternatives (Li, 2014). This points to how broader structural constraints can make commodity production simultaneously enabling and exploitative.

Rigg et al. (2016) find that in Southeast Asia, many smallholder farms persist despite the limited financial returns, likely because holding land provides a sense of security and offers an option to diversify livelihood activities with non-farm work. However, at Kampong Khleang, very few people use land for agriculture (except for rice) because the lake's flood pulse inundates it for half the year, and in the dry season the soil can be either too muddy or too dry for cultivation. To buffer against shocks and stressors people rely on boats, gear, fish availability, sturdy houses for processing, and strong social networks. People living on the Tonlé Sap do not have the same capacity to persist the way traditional agriculturalists might. In the absence of consistent resource access, smallholder persistence depends on fallback options and diversified livelihoods to buffer against risk and uncertainty.

While smallholder farming persists across Southeast Asia (Rigg et al., 2016), it is questionable if fish processing at the village level will continue. Micro-processors are giving up their businesses and selling their labour power to work for other processors, effectively resulting in a village-level consolidation for fish processing. 'Trey neat' processing has already disappeared from the village, the result of decades of dispossession of fish resources through poor state regulation, commercial (over) fishing, and ecological decline. This loss not only undermines a key livelihood but has also deepens class differentiation, as households without the capital or connections to shift into other forms of production are left increasingly vulnerable. As subsistence livelihoods decline, they are not disappearing but rather shifting towards more productive variations; people in rural areas are using the same natural resources for their livelihoods, but are now partaking in wage labour (Cunningham & Hollweg, 2019).

With integration into global markets, people at the Tonlé Sap experience commodification; fish processing is more market-driven and people start to produce for profit (Bernstein, 2021). The persistence of smallholder livelihoods is therefore closely tied to uneven development as the most marginalized are unable to access alternative livelihood activities. Viewing this through the Sustainable Livelihoods Framework lens (Natarajan et al., 2022), access to assets, such as land, capital, and market networks, allows some households to accumulate wealth, while others, including micro-scale fish processors, are increasingly marginalized. Limited access to these assets constrains opportunities to diversify or scale up, leaving people dependent on low-return livelihoods and vulnerable to broader structural,

relational, and market pressures. Peasant differentiation, and the persistence of smallholders, contributes to the growing bimodal fisheries sector, where larger, wealthier producers have more resource access while smallholders lose out due to reduced fish stocks and market access.

7.6 Conclusion

Chapter 5 focused on the micro-level impacts, specifically, the daily challenges and livelihood strategies of women fish processors, while Chapter 6 examined the macro-level forces shaping the dried fish value chain today. This chapter builds upon both to analyze the transformation of the forage fish value chain. It explores the key actors involved in this shifting landscape and investigates who stands to benefit and who is most disadvantaged by these changes. This thesis answers the research questions by demonstrating how the dried fish economy is undergoing a restructuring, driven by aquaculture expansion, environmental declines, and integration into global markets and what this means for women fish processors.

Answering, how the dried fish economy is changing, who benefits and who loses, the findings show a clear movement towards a bimodal system where actors with greater access to capitals grow their wealth, while in contrast micro-sale producers face increasing exclusion. Considering the gendered implications of these transformations, the research shows that structural changes are experienced unevenly, and women micro-scale processors experience the most marginalization. Constrained mobility, a lack of opportunities and entrenched patriarchal norms restrict their ability to adapt to shifting market conditions. Transformations in the forage fish value chain are not gender-neutral; they reproduce and intensify existing inequalities, further marginalizing women at the lower end of the value chain.

The use of finite forage fish as a capital-driven commodity illustrates how economic shifts and widespread environmental degradation puts pressure on rural livelihoods. Cambodia's transition, from an informal economy to a more capitalist market, and from local to global trade, is changing dried fish livelihoods. Without strong policies and governance that support micro and small-scale actors in the forage fish value chain, or the development of alternative sectors they can move into, wealth inequalities will continue to grow.

The thesis demonstrates how structures of capitalism, alongside processes of globalization reshape value chains, making old forms of production obsolete and creating new ones (Scoones, 2021). Socio-economic forces and power embedded in institutional structures extract resources in ways that commodify them for the benefit of downstream actors, growing inequalities and limiting the rural poor's access to the resources and conditions they need for sustainable livelihood production. These themes will be explored further through a discussion on bimodal systems and gendered labour in the concluding chapter.

Chapter 8. Discussion, Recommendations, and Conclusion

8.0 Introduction

This chapter contributes a theoretical discussion of cross-cutting themes that emerge in the study's analysis: the intersecting dynamics of gendered livelihood production in a shifting value chain marked by agrarian change processes. As fish processing at the Tonlé Sap becomes increasingly integrated into regional and global value chains, the pressures of commodification, competition, and ecological decline reshape who can continue to participate and on what terms. What this thesis finds is that women dependent on micro-scale fish processing are struggling to maintain their livelihoods amidst economic and environmental shifts within socio-cultural gendered constraints.

This chapter will examine the emerging bimodal fish processing sector, and the implications for micro-scale processors. Industrialized processed fish is in its infancy, yet there are clear signs that point towards the continued marginalization of micro-scale fish processors. I discuss gendered labour and agrarian transitions, how women embody the social and environmental burdens and inequalities produced in natural resource commodification and value chain dynamics. Fish processors receive marginal wages for their work, most of the value produced from processing and drying is captured by downstream actors. Meanwhile social and ecological costs are pushed towards upstream actors, particularly women, echoing feminist critiques of how value chains externalize labour and environmental responsibilities (Dunaway, 2020). Ultimately, within this thesis's theoretical framework, the livelihoods of micro-scale fish processors are understood as deeply relational, mutually shaped by gendered inequalities, environmental change, and broader agrarian processes.

Given the numerous socio-economic and environmental pressures, evidence indicates that micro-scale fish processing at the Tonlé Sap is becoming increasingly unviable. Future trajectories of the artisanal dried fish economy are discussed. In closing, policy recommendations are offered based on the research's findings, linking back to the theoretical framework that guides the focus of this work. While the recommendations emphasize support for the most marginalized groups, they must be implemented within a broader socio-political system that would benefit from change itself. Strengthening institutions and promoting transparent governance would enable true livelihood transformation for the country's most marginalized citizens. Lastly, the research brought up many questions outside of the scope of work, I discuss other possible avenues of research that can be taken and offer my conclusions.

8.1 The Emergence of a Bimodal Fish Economy

As Cambodia's economy has rapidly developed over the past 40 years, the Tonlé Sap has experienced an ecosystem decline. Conversations with residents reveal how the changing environment negatively impacts livelihoods, especially the poorest who rely on natural

resources. Signs of such environmental change include the disappearance of 'trey neat' production at the Tonlé Sap. 'Trey neat' is now produced closer to urban centres; what was once primarily sourced from wild-caught species is now almost entirely sourced from farmed fish. Cambodia's growth in the aquaculture sector is helping to fill the fish supply gap; however, this industry also contributes to an emerging set of problems. Fish feed for farmed fish primarily comes from the small, wild-caught forage fish of the Tonlé Sap. Without adequate regulation, this exacerbates fish declines at the Tonlé Sap. Micro-scale fish processors struggle to compete with imported Thai fish made into cheaper versions of the same products they sell. Similarly, local aquaculture producers face challenges competing with Thai and Vietnamese imports of catfish and snakehead. Small domestic fish farmers also struggle with imports from neighboring countries, leaving them unable to earn enough to reinvest, innovate, or upgrade their production. New programs led by UNIDO aim to promote industrial growth in the aquaculture and dried fish sectors, yet micro and small-scale producers are largely excluded from the support and resources needed to compete and thrive. The challenges facing rural livelihoods at the Tonlé Sap highlights broader dynamics of agrarian change, showing how modernization can erode some livelihoods even as it creates opportunities for others.

The development of bimodal systems in the fish processing and fish farming sectors is not surprising. Bimodal food systems are prevalent in the majority of countries because larger-scale production is often more efficient and profitable; governments and businesses strategically focus on larger production (Harrison, 2023). The dried fish processing sector is only recently experiencing a division into a bimodal system. Until recently, the majority of dried fish as a bought and sold domestic commodity seems to have only been done through more traditional, micro-scale means. The product would be made by individual processors in informal settings (at markets or homes), whereas now, industrialized means of fish processing are being introduced. Dried fish is starting to be made in factory settings and sold in groceries stores in vacuum sealed packaging. There is potential for both positive and negative outcomes for rural livelihoods in this shift towards industrialization.

There is an opportunity to improve the well-being of some fish processors as their labour is incorporated into a better paying, more consistent, industrialized versions of their work. However, there will be many fish processors who do not have access to this work due to proximity to factories and will continue to lack the resources to compete. Additionally, many interviewees would prefer to work near their homes, primarily due to socio-cultural constraints such as household duties. Arguments in agrarian change theory suggest that improving life for those at the Tonlé Sap means creating new opportunities outside of fish work, to move away from dependency on fish (Harriss, 2023). So, while Cambodia aims to industrialize fish processing on the unspoken basis of trickle-down economics, this is not necessarily the best approach to reducing poverty in an unsustainable sector.

The development of fish farming as a bimodal system in Cambodia is taking a similar path to that of dried fish through the UNIDO program, but with some differences. Independent of UNIDO, the government has been approaching aquaculture as a sector to be industrialized and contribute to development and GDP growth. A National Strategic Plan was developed to build a sustainable and profitable aquaculture industry (MAFF, 2017). Between 1993 and 2003 annual aquaculture production remained under 20,000 tonnes; in 2004 production markedly started to increase over the next ten years to reach 112,000 tonnes in 2014 (Joffre et al., 2016). The state fisheries administration estimated the country produced 320,280 tonnes of aquaculture in 2024, showing the sector has continued to grow (Seangly, 2024).

The main issue with a bimodal system is that it allows for uneven development. The government concentrates resources and investments into medium and large-scale fish farms, potentially increasing productivity but exacerbating inequality for small-scale producers (Harriss, 2023). In Kampong Khleang fish farmers have not yet received formal training for raising various fish species, or about the use of aquafeed to improve fish productivity. Small-scale fish farmers are not incorporated into UNIDO's production targets, as their limited outputs would require significant subsidies to ensure quality control.

With deepening poverty, smallholders may be consolidated into larger operations or have to change livelihood activities altogether. Often, failing fish farms will choose to fold because the loss of money is too great, and they have alternative livelihood options to fall back on[41]. Fish processors, however, often do not have any alternative but to continue processing. In a scenario where medium to large-scale dried fish production becomes the dominant production source for the country, the implications for micro-processors are not straightforward. Factory made products will likely serve different markets; it is uncertain to what extent micro-processors' products might be displaced. What is clear, however, is that the declining availability of forage fish will further constrain their ability to compete or even sustain rural production.

People are impacted by forces beyond the local scale (Natarajan et al., 2022), as global processes of capitalism such as commodification, markets, accumulation, and wage-labour shape how rural livelihoods are created. A relational approach highlights that the inequality people experience is rooted in structural systems. Modifying one part of a dysfunctional system (e.g. improving market access), will not substantially improve livelihoods, there are many more aspects of well-being that need to be considered (Bebbington, 1999). A deeper look of structural determinants of poverty for people working in micro-scale fish processing and small-scale fish farming reveals environmental degradation, labour exploitation, and governmental mismanagement of natural resources

[41] Fish farmers at Kampong Khleang often had other business ventures such as a shop, motortaxi service, rice farm, or work outside the village. Many take out loans to start a pond so it is likely they have some financial collateral.

reproduces inequality. Micro-scale dried fish processors face little policy attention, and limited state support for infrastructure and social protections. Similarly, in advancing capitalist development, the state promotes capital accumulation while also managing social stability and keeping labor reproduction cheap and accessible (Campling et al., 2016). Addressing these underlying structural and relational issues is essential for meaningful change.

8.2 Gendered Labour in Agrarian Transformations

Agrarian transformations are gendered in practice: changes in rural areas are often experienced differently by women then they are by men. In the lives of women fish processors, policies, markets, and ecological pressures manifest in the everyday. Their labour becomes increasingly precarious, undervalued, and is marked by deepening inequalities. Women's work is perceived as having less value by both men and women alike (Ledgerwood, 1990). Many women at Kampong Khleang did not see their fish work and homecare as "real" work in the way men's labour is valued. This devaluation of women's labour contributions is problematic, not just in economic terms (as women earn less income) but also because narrow definitions of work ignore women's productive contributions and risk overlooking the needs of women fish processors in both policy and research (Kleiber et al., 2015). Within small-scale fisheries, and specifically the dried fish value chain, there is a lack of recognition of the non-capital relations that occur, negating the important place-based factors (social, cultural, ecological) that influence actors at all scales (Pradhan et al., 2022).

Value in the dried fish value chain is more than the financial contribution; value is the intangible, social and relational aspects that emerge from the everyday livelihoods of processors (Hapke, 2025). Value is also the tangible, but unaccounted for, contributions of women's unpaid reproductive labour. Women subsidize and internalize the hidden costs found within value chains. This is particularly apparent in the dried fish value chain where socio-cultural norms embedded in Cambodian institutions reinforce the idea that caregiving, in addition to fish processing, is simply part of women's duties (Ledgerwood, 1990). Markets and companies take advantage of this; women not only supply their own cheap labour for fish processing, but their reproductive unpaid labour at home supports the maintenance of the workforce, reducing costs for employers and enabling higher profits (Dunaway, 2020).

Despite the rapid change in Cambodia's economic structure, with women increasingly taking on roles outside of the domestic realm, traditional gender imaginaries persist (Ledgerwood, 1990). Teachings such as the 'Chbap Srey' and proverbs like 'women are cloth, men are gold, once the cloth is dirty it cannot be cleaned, but gold can be polished'

(Ledgerwood, 1996), or "having a daughter is like having a pot of 'prahok'[42], while having a son is like having pure gold" (Tann, 2024, p. 8) continue to shape social expectations. The devaluing of women is rooted and perpetuated through patriarchal norms (Pedroza-Gutiérrez & Hapke, 2022). These notions continue to circulate in Khmer culture, reinforcing the idea that women and their work hold little value.

Assumptions in the development literature point to increasing education and employment opportunities and economic growth would lead to improved gender equality; this however, is not always the case, patriarchal notions embedded in society persist (Hapke, 2013). In agrarian transitions, socio-cultural norms are slow to change alongside economic advancements. Evidence shows that upgrading of value chains does not equate to an improvement for all those involved (Ponte, 2022). Men occupy positions in value chains where profit margins are higher; furthermore men tend to participate in more capital and resource intensive value chains (Pyburn et al., 2023). The intensification of fish products is happening within an overfished and unstable ecosystem, which adds additional risks and constraints to the livelihoods of women.

This can be seen in the divergence of gendered roles in the forage fish value chain where men are more likely to work in aquaculture, and women remain in the lower-paid segment of fish processing. This research shows that a significant amount of forage fish resources is being directed away from fish processors towards fish farming, further emphasizing the gendered divide in access and opportunity in the value chain. There is limited research on the gendered division of labour in Cambodia's aquaculture sector. It is still to be seen how it will fully materialize, but as it stands from a rural commune perspective, men are the predominant workers in this section of the forage fish value chain. Why this is can be attributed to the gendered constraints of women's homecare, limiting their time and mobility, a lack of attention to education and skills development for women and girls, and the perception of fish processing as 'women's work'.

What a feminist agrarian perspective shows is that transitions among livelihoods have gendered implications, especially in a context where socio-cultural norms consistently devalue women's work. Development program outcomes are shaped by the societal structures that ultimately inform who benefits and who loses (Hapke, 2025). Low pay for fish processing is seen as normal; many women know the pay is unfair but feel that there are no alternatives open to them. Even when women recognize injustice, it is difficult to enact change within the system. Change requires both local-level agency and institutional shifts, such change is slow (Pearse & Connell, 2016). Transformative change in women fish processors' livelihoods requires addressing how gender perceptions are systematically woven into everyday life rather than treating gender as a technical issue (Vigil, 2024).

[42] Although 'prahok' is an important commodity, provides essential nutrition, and is a staple of Khmer cuisine, its strong odor is socially associated with negative perceptions of women.

8.3 Future Trajectories of Dried Fish Processing

This research points to the risk that traditional, artisanal 'prahok' production will disappear. As with the decline of 'trey neat' production at the Tonlé Sap, village-made 'prahok' may struggle to compete with factory-made versions. Larger factories can produce 'prahok' more cheaply and in greater volume, giving them an advantage through economies of scale. While many people prefer the taste and texture of homemade 'prahok', especially from Tonlé Sap villages, traditional versions may survive only as food for family use or as a higher-priced product for a small market of buyers who can afford it. With less wild-caught fish available overall, and the large amounts of forage fish going towards fish feed, it is unclear whether 'prahok' will remain a viable source of income for rural livelihoods in the future.

This begs the question, is the artisanal production of 'prahok' romanticized and should development solutions focus on sustaining this low-paying, difficult job? Looking at other food production methods globally and historically, many foods once made in small batches now have industrialized versions. Soy sauce, for example, is a similar food that traditionally requires a long fermentation time and microbial activity to develop its distinctive flavour (Sassi et al., 2021). Soy sauce production was once entirely done by hand, outdoors in earthen ware pots or wooden vats, (Kikkoman Corporation, n.d.), similar to how 'prahok' is made in Kampong Khleang. In the 1920s a new manufacturing process for soy sauce was introduced that allowed the product to be created in a matter of days, compared to months, and over the next couple of decades the process was more commonly done indoors, in heated rooms using steel or concrete vats (Shurtleff & Aoyagi, 2004). Still, there remains a demand for traditional soy sauce, and many large manufacturers continue to use traditional fermentation methods, but use highly automated factories (Kikkoman Corporation, n.d.). In this sense, the artisanal product of soy sauce is romanticized, but the method itself is not. While the traditional method is lost, the cultural importance and demand of traditional soy sauce remains. Perhaps this is the trajectory for fish products like 'prahok' in Cambodia, where the methods of production evolve while retaining the cultural significance of the product.

Value chain upgrading provides improved work opportunities for some, but there are hidden costs (Ponte, 2022). The hidden costs of compliance and certification often fall on weaker, upstream actors, which means more work for them while value is captured by downstream actors (Ponte, 2022). This dynamic may emerge in Confirel's plan to source fish directly from processors at the lake, where women would need to invest time, money, and labour into meeting certification standards. Many enterprises use similar forms of decentralization and outsourcing, relying on an abundant supply of women workers (Benería & Floro, 2005), while households absorb production costs such as equipment and electricity (Dunaway, 2020). Although framed as providing employment, unless processors are paid more than they

would earn independently, the value of their labour will continue to be captured, potentially even more than before.

Some fish processors will benefit as their work moves into factories, where there can be opportunities for higher and more consistent pay. However factory work standards in Cambodia still need significant improvement (Saxena, 2022). Outcomes will depend on how the labour side of the Capfish Capture program and other fish processing factory businesses evolve alongside policy. Currently, labour rights have not been a part of the conversation, with regulations primarily focused on food safety. The development of cooperatives would be ideal; research shows they are best placed to advance local sustainability goals through knowledge exchange, and advocating for rights, subsidies, access and loans (Partelow et al., 2023), but the current political climate constrains their development.

While some micro-scale processors will move into fish factory work, there is not enough jobs for all those who currently process. It is important to consider what other jobs these women can transition into. As the government pushes to industrialize the sector, it must also ensure more livelihood options outsides of fisheries are available for rural communities. As automation and technological advances drive agrarian transitions, the entire economy needs to evolve, along with an understanding of what this means for the socio-cultural impacts on the population (Harriss, 2023). The changing dried fish economy may mean less work is available for women but could be a catalyst for women to move into more formalized and better paying roles, challenging rural gender norms.

While micro-scale women fish processors are the most affected by the current trajectory of the dried fish economy, some opportunities are emerging. The gendered focus approach of the Capfish capture project is beneficial. Although the project primarily targets medium and large-scale producers, it is helping to change perceptions of fish work and women's capabilities in general, an important shift in the long-term. Updates from the project are frequently featured in Cambodia's news outlets and offer insights into the impressive growth and success of some fish processors. One story details how Someng, a small-scale fish processor, used to sell only within her local community, but has now grown her business with financial support from Capfish, and produces high-quality dried fish that was recently certified with the CQS (Seavmey, 2025). Someng's business has created jobs in her community, and she is focused on hiring local women who want to earn an income and work outside their domestic care roles (Seavmey, 2025). While more support is needed for micro-scale fish processors, examples like this show that when higher-level funding is applied effectively, it can ultimately benefit more marginalized groups.

Despite little focus on the long-term environmental viability of producing farmed fish and fish products for export, UNIDO programs have brought some benefits to micro and small-scale fish processors. One example highlights a woman from the Tonlé Sap area who started

a women's fish processing group (the word collective is notably absent), Unica, to bring fish products from the lake to markets. With Capfish funding, Unica grew from a small business to securing agreements with major domestic supermarkets and is now in discussions about exports to South Korea and New Zealand (Khim, 2024). The next stage of project funding should prioritize the sustainability of fish resources while also addressing systemic challenges faced by the most marginalized actors in the value chain, such as access to clean water, infrastructure, and education to ensure they can participate and benefit equally. A focus on smallholder production is needed to avoid a complete dominance in the bimodal system of large-scale producers outcompeting and extracting labour from micro-scale processors while also dispossessing rural populations of their access to resources.

8.4 Policy Recommendations

As Cambodia transitions into a lower-middle income country, there are many opportunities to improve the livelihoods of the most marginalized. Lessons from other countries suggest that strong state intervention can support smallholders (Boestel et al., 2013). However, decades of neoliberal influence have shaped poverty-reduction projects, embedding market-oriented approaches as the default. Consequently, strategies to address growing inequality are typically framed as economic solutions for the public good, but are not reaching the most marginalized, and often benefit elites (Scheidel, 2016). The mentality of the state's governance can be summed up in a quote by then Prime Minister, Hun Sen in 2013. "If the country has no millionaires where do the poor get their money from?"(Strangio, 2014).

It is difficult to think outside the confines of economic development as the dominant path to improving livelihoods when society is so deeply embedded in capital markets, where access to jobs, income, and financial resources is necessary for survival. While some argue that economic development and growth drive institutional development, rather than the other way around (Grindle, 2004), Cambodia's current system of patronage prevents citizens from benefiting from that growth. The state presents an image of good governance, creating policies and reforms that appease donors without addressing the system of patronage (Strangio, 2014) or the underlying barriers to equitable development and well-being.

The interventions proposed here take place within complex and shifting conditions and amongst a multitude of actors. Fisheries governance is intertwined with larger Mekong basin dynamics. The Mekong River Commission's role in transboundary management is therefore critical, and local interventions cannot be isolated from these wider political-ecological processes. Literature on agrarian change and feminist political ecology warns that interventions favour larger-scale actors, often excluding micro-scale actors (Bernstein, 2021; Chant & Sweetman, 2012). Furthermore, a feminist perspective brings to light how socio-cultural contradictions of the value women create intersects with socio-economic progress; women continue to be expected to abide by traditional ideals (Ledgerwood, 1990).

Following this research's theoretical framework, the policy recommendations are aimed towards change within broader social and political structures (Gonda, 2019), and an emphasis on marginalized actors, focusing on 'putting the last, first' (Chambers, 1983). While these recommendations would likely have the greatest impact if implemented at the state level, in practice, grassroots and local-level actions are more likely to occur and produce more immediate impacts.

1. **Institutions**: There is much work to be done to improve institutions (and their associated infrastructure) that would support millions of Cambodians, including micro-scale fish processors and small-scale fish farmers. Key areas such as education, healthcare, and rural development have historically been neglected by the State partly because they do not offer the same opportunities for illicit revenue generation as other sectors (Strangio, 2014). While these areas do receive aid from donor organizations, the impacts are not reaching villages. This is seen in the lack of low-paid, undereducated teachers in rural areas and subsequent hidden privatization of tutoring that creates primary education stratification (Brehm & Silova, 2014). Donor agencies need to go beyond apolitical goals within their projects and address systemic issues such as the socio-cultural devaluation of women and girls. For example, girls not being taught how to swim leads to them not being allowed to go to school when the floods are high. Without confronting these structural barriers, aid and investment into these key areas will not meaningfully reach marginalized groups.

2. **Women leadership**: Local, women leadership should be fostered to manage the integration of development projects at the community level. The current approach enables GDP growth for SMEs but excludes those operating at a micro-scale. Promoting women's involvement in local-level project management gives more decision-making power to a group that is frequently overlooked despite constituting the majority of workers in the fish processing sector. From a governance perspective, it is important to know how women's livelihoods are organized within dried fish value chains and the local challenges they experience in order to support community well-being (Galappaththi et al., 2023). However, it needs to be kept in mind that the emphasis on women as agents of change through neoliberal practices is not sufficient nor desirable, as it does not address gender and power relations embedded in social, political, and economic practices; meaningful transformation needs to occur in these realms (Parpart, 2013)

3. **A micro-scale focus**: Government and donor agencies must provide stronger action in support of micro-scale actors. For example, Japan supported smallholders through land reforms, institutional support and technological and financial interventions (Byres, 1986) which allowed income distribution, infrastructure, and levels of education and welfare to grow equally across the population (Boestel et al., 2013). Apart of smallholder support also means recognizing the socio-cultural benefits of traditional dried fish, including

food and nutrition security, local knowledge, and cultural importance. For micro-scale fish processors looking to move out of fish work, targeted microfinance programs for women processors could further expand livelihood options.

4. **Rural livelihood opportunities:** For people, especially women, who want to move out of fish work, the government should create new job opportunities in rural areas. If factories for processing are to be built, companies should consider building directly in rural communities. Furthermore, fish processing and drying facilities could be built as community facilities, where women can remain independent processors if they wish, but have a place to create hygienic, competitive products. Improved road infrastructure can help people commute short distances for work, but the focus should remain on developing local, sustainable, community-based work as much as possible.

5. **Attention to rural inequalities:** Policymakers must address the barriers preventing micro-scale processors from participating in economic development projects. Tying into the first policy recommendation, infrastructure development would support a significant proportion of the rural population in being able to access livelihood opportunities. For micro-scale processors, some root causes of their inaccessibility to emerging markets are access to clean running water, electricity and sanitary facilities in the village where they can make, store, and package their products. For example, if processors have access to a consistent source of electricity (compared to a generator), they could use ice or cold storage more readily. Storing fish in cold temperatures creates a lot of change, not only is it more hygienic and extends product shelf life, but women do not have the same time pressure to process and may have more bargaining power if they do not need to sell immediately to prevent spoilage.

6. **Bimodal system support**: Large-scale industrial versions of fish processing can help strengthen the micro-scale processing, artisanal sector. Tax revenue from SMEs can be used to feed back into interventions for micro-scale processors. For example, buildings that meet the basic CQS requirements for processing could be built near villages with a high number of processors who could then take their fish there to process. This would allow micro-scale processors to maintain their locally based livelihoods while learning and adhering to safety and quality regulations, giving them a chance to sell their artisanal products. Further funding could be directed to local salaried workers to aid processors in adhering to CQS requirements, helping to navigate literacy and technical barriers.

7. **Forage fish and environmental protection**: Non-human actors play a significant role in everyday livelihoods yet are given little consideration in their intrinsicality. In the interconnected dried and farmed fish value chains, researchers and policymakers must consider economic, social, environmental, and cultural factors holistically. This includes how households participate and how macro scale forces, like capital markets, climate

change, and international policies and programs affect the system. While environmental sustainability remains a long-term challenge, conservation efforts at the Tonlé Sap must continue. Measures such as banning snakehead farming and the use of small pelagic fish for direct feed could strengthen both fisheries sustainability and dried fish processing livelihoods, particularly for women at the Tonlé Sap. Authorities must monitor and regulate fish catch while recognizing that this can reduce rural incomes and that alternative revenue options must be developed for affected communities.

8.5 Future Research

This research has focused on micro-scale fish processors and the larger systems they are apart of and create their livelihoods within. This study expanded more than expected, from a narrow focus on dried fish processors, to include other actors in the value chain and the intersecting farmed fish value chain. Given the broad view, many questions were raised that could not be explored and warrant future research:

1. **Women's livelihood opportunities:**
   Future research should investigate alternative livelihood options for women beyond fish processing. Building on this study's understanding of drivers of change, research can identify women's constraints and opportunities and inform interventions. A focus should be on grassroots business developments that support women's equitable participation in the livelihood options they choose.

2. **Fishmeal and fish oil production in Cambodia:**
   a) This research found that processors increasingly sell their forage fish to fish farmers. While interviews were conducted primarily at the individual level, household-level research could provide deeper insights into decision-making around whether to process fish for food or sell forage fish as direct feed for farmed fish. When fish is sold directly as feed, this may be another indicator of poor people needing immediate cash.

   b) The growing diversion of fish into feed warrants further research to understand the environmental impacts this will have on fish species amidst the collapsing biodiversity of the Tonlé Sap. Studies (Chevalier et al., 2023) at the Tonlé Sap often use fish catch data to draw conclusions on ecosystem issues, however aggregating fish catch data to see what the fish is being used for would be useful for policy development to assess how much of that catch is going towards the FMFO (fish meal, fish oil) industry. This has real food security and nutrition implications, since so many rural people rely on fish for food and health. Such research can be further expanded to the marine forage fish value chain, where there is limited research on how the FMFO industry operates along Cambodia's coastline.

3. **Market analysis:** This research found that certain fish products are no longer made in the commune, and 'trey neat' is made almost exclusively from farmed fish, in particular snakehead and catfish species. A well-designed survey could examine how processed fish products from aquaculture affect demand for wild-caught processed fish, and whether this dynamic differs between urban and rural areas. Research into market demand could help identify consumer preferences, and how declining fish resources shapes choices. This could inform strategies to support important socio-cultural processing practices that are at risk of disappearing.

4. **Value chain analysis**: Labour in the dried fish value chain is exploited; a large amount of product value is captured by downstream actors. More research is recommended to assess in detail the wages and earnings of value chain nodes that this study did not focus on or have enough data on to make firm conclusions (grocery stores, domestic medium and large-scale enterprises, international exporters). A comprehensive value chain analysis can provide evidence to justify wage increases for upstream actors. Such information must be disseminated to micro-scale processors so they can use the information to advocate for themselves.

5. **Sustainability in a vulnerable ecosystem:** Broadly, questions of sustainability for whom arises at different points in this research. The sustainability of the lake and its species is framed as a means of supporting humans, seen as a commodity. Research is emerging on relations between humans and fisheries and how they are shaped by systems of capitalism, colonialism, and patriarchal hierarchies (Knott et al., 2022). The Tonlé Sap could be explored as a case that highlights the issues of ethics and justice for marginalized groups and more than human actors. Sustainability in the sense of food supply also warrants further attention as market access is increasingly demanding certifications and eco-labels to draw in consumers (Havice & Campling, 2021).

6. **Fisheries management:** This research should be expanded to address management priorities for forage fish. With growing fishmeal production in Thailand and Vietnam, Cambodia could soon face similar pressures. Without strong regulation, fish species in the Tonlé Sap risk collapse, threatening not only rural processors but the broader ecological and economic stability of the region. Urgent research on socio-ecological and economic trade-offs is needed to guide policies that sustain both the fishery and the livelihoods that depend on it.

8.6 Conclusion

This thesis set out to examine how socio-economic and ecological drivers are transforming dried fish processor livelihoods and to highlight the importance of this resource in livelihood production. From this analysis, an understanding of the rural forage fish value chain has

emerged, revealing that micro-scale women fish processors are disadvantaged within these shifts, and that systematic socio-cultural norms reinforce the undervaluation of their labour. At the same time, downstream value chain actors capture greater benefits and opportunities, reinforcing existing inequalities within the sector. Women's continued engagement in low-paid, informal fish processing work reflects the persistence of smallholders under ecological and economic strain. Meanwhile, the expanding aquaculture sector alongside the scaling up of dried fish products illustrates how bimodal systems have uneven effects. Women's labour makes agrarian transformation visible, showing how broader economic and ecological changes are experienced through unequal gendered divisions, access, and opportunity marked by socio-cultural norms.

Key findings show that a decline in large wild fish species has triggered cascading shifts. Wild-caught 'trey neat' production is no longer done at scale in the village. Processors in Kampong Khleang now almost exclusively make 'prahok'; and smoked fish, products that use small pelagic forage fish. At the same time, the decline in overall species is pushing many processors to become wage labourers, earning less and surviving on the margins. Wild-caught fish declines have increased the demand for aquaculture, which requires forage fish, reinforcing a cycle of overfishing. Urban markets in Cambodia almost exclusively sell farmed 'trey neat', marking a significant shift in fish production in the country. Imported aquaculture products further adds complexity and pressure to these value chains. Weak regulation and enforcement of forage fish species exacerbate the sustainability crisis at the Tonlé Sap. The intensification of fish farming undermines the ability of micro-scale processors to sustain their livelihoods. Although small-scale fish farmers reduce forage fish stocks, the root challenge lies in fragmented and market-driven fisheries governance.

This thesis makes a conceptual contribution to understanding agrarian transitions by illustrating how a bimodal system emerges in a resource-based economy, where micro-scale and larger-scale actors coexist but experience unequal access and outcomes. The case of dried fish processing at the Tonlé Sap demonstrates that livelihoods are relational: they are mutually shaped by ecological conditions, market pressures, gendered norms, and policy environments. By tracing the interconnections across value chains, from dried fish to aquaculture production, this research highlights how resource diversion and commodification can generate differentiated risks, benefits, and forms of dispossession.

Ultimately, the story of dried fish at the Tonlé Sap is not only about species decline or value chains, but about rural futures under pressure. As micro-scale processors navigate uncertainty, their resilience is undermined by economic priorities that privilege growth over equity and the value of women's work. Without attention to persistent gendered inequalities, the value women create, and the disregard for long-term resource sustainability will continue to constrain livelihoods and threaten the resilience of rural communities.

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Appendix A. Question Templates

Template 1: Questions for fish processors (village)

A. Introductory Questions

1. Details about the person: name, age, how long have you lived in the area?

2. Who lives in your household? What does your wife/husband do for work? Are your children in school or working?

3. How important is dried fish to you and your household? (1 – very important, 2 – important, 3 - neutral, 4 – not important)

4. Income
    a. What is the main source of income for your household?
    b. What percentage is dried fish?
    c. What other work do you do for your household (paid or unpaid)?
    d. What percentage of household income comes from your work?
    e. How do you see your household in the village? (1 - rich, 2- well-off, 3-moderate, 4- poor, 5-very poor)
    f. Who makes the decisions in your household (work, money, education)?

B. Fish Processing

5. What fish species are you drying? Why these specific species?

6. For those processing smaller species - would they switch to farmed fish or a different type of species if the smaller ones are not available?

7. What are the steps involved in your dried fish operation (buying, degutting, washing, salting, drying)? Which drying methods do you use? (smoking, sun, fermentation)

8. Do you dry fish just for your household?
    a. If no, who do you sell or give dried fish to?
    b. How much dried fish do you produce per month (estimate in kilograms)?
    c. If you sell, who buys it? (percentages: market, trader, wholesaler, restaurant retailer).
    d. Where does it go?(local market, city, outside of the country)
    e. How much are you paid for drying this fish? (or how much do you sell it for?) how much does it sell for at the market?

9. Do you hire anyone to help you dry fish? Do other family members dry fish with you?

10. Do you use aquaculture fish for drying?
    a. If so what percentage is aquaculture and what percentage is wild caught?

b. Who do you get your aquaculture fish from? Who do you get wild caught fish from?
c. How long have you been using aquaculture fish for drying?

C. Environment

11. What environmental changes have you noticed at Tonlé Sap Lake in the last 1, 5, 10 years? How does the water change over the year?
    a. Have there been any changes to dry fish processing in the last 1, 5, 10 years?
    b. What species do you not see anymore? Does that matter to you?
    c. Have these changes impacted the amount or type of fish you process?
    d. What do you think is causing these changes? Elaborate on factors, drivers of change (local, non-local, political, economic, ecological, etc.)
    e. Have you adapted (or are thinking of adapting) any of your work because of these changes? If so, how?

D. Policy/Governance/Organizations

12. Who makes the rules for fishing?
    a. Does anyone (or group) control access to the fish?
    b. Are certain species regulated? If so, does it impact your access to fish for processing? (are prahoc species regulated?)

13. Are there any community associations?

14. Are there any policies that you would like the government to enact or change?

E. Community/Social

15. What is the greatest challenge you have experienced in life?
    a. What is the most important challenge that women face in dried fish work? Are there any other issues related to your gender? (access to resources)
    b. How would you feel if you could not do dried fish work anymore? (if you had to switch to another job)

16. What does a good life mean to you? (Ask them to expand on any aspects mentioned: health, safety, etc.).

17. Do you think the importance of dried fish is changing? Are less people eating it?

18. What social connections have you made through your work? Is it important you?

19. What is your satisfaction level with dried fish processing in supporting you and your household? (1- very satisfied, 2- satisfied, 3 – neutral, 4 - unsatisfied, 5 - very unsatisfied)

20. Do you plan to keep working in fisheries? If not, what would you like to do? Would you like your children to follow the same trade?

Template 2: Questions for those who have left fish processing (village)

A. Introductory Questions

1. Details about the person: name, age, how long have you lived in the area?

2. Who lives in their household? What does your wife/husband do for work? Are your children in school or working?

3. How important is dried fish to you and your household? (1 – very important, 2 – important, 3 - neutral, 4 – not important)

4. Income:
    a. What is the main source of income for your household?
    b. What percentage is dried fish?
    c. What percentage of household income comes from your work?
    d. What other work do you do for your household (paid or unpaid)?
    e. How do you see your household in the village? (1 - rich, 2- well-off, 3-moderate, 4- poor, 5-very poor).
    f. Who makes the decisions in your household (work, money, education)?

B. Fish Processing

5. When did you leave fish processing? Why? Would you have liked to continue that work?

6. Who did you get your fish from? Who did you sell dried fish to (percentages: market, trader, wholesaler, retailer)? Where did it go (local market, city, outside of the country?)

7. Which drying methods did you use? (smoked, sun, fermentation etc.) What species did you use?

8. What are you doing for work now? Does it provide more income, or a more stable income?

9. Did you have to leave your home when you left fish processing?

10. Do you know other people who have stopped drying fish?

11. What would like to see change in the dried fish industry?

12. Did you use aquaculture fish for drying?
    a. If so what percentage was aquaculture and what percentage was wild caught?

b. Who did you get your aquaculture fish from? Who did you get wild caught fish from?
c. How long had you been using aquaculture fish for drying?
d. What fish species does aquaculture use, are they species you also used?

13. Do you think the nature of processing changed over time with regards to demand (consumer) and supply (production) in the last 5-10 years? What has changed?

14. Was there a time when you did not have access to the same fish and natural resources as others? Does everyone have the same access?

C. Environmental

15. What environmental changes have you noticed at Tonlé Sap Lake in the last 1, 5, 10 years?
    a. Have these changes impacted your new line of work?
    b. What do you think is causing these changes? Elaborate on factors, drivers of change (local, non-local, political, economic, ecological, etc.)
    c. Have you adapted (or are thinking of adapting) any of your work because of these changes? If so, how?

D. Community/Social

16. What is the greatest challenge you have experienced in life?
    a. How did you overcome it?
    b. What is the most important challenge that women face in dried fish work? Are there any other issues related to your gender?
    c. Have you been able to change your access to resources?

17. What does a good life mean to you? (Ask them to expand on any aspects mentioned: health, safety, etc.).

18. Do you think the importance of dried fish is changing? Are less people eating it?

19. What social connections have you made through your work? Is it important you?

20. Are there any policies that you would like the government to enact or change?

21. What was your satisfaction level with dried fish processing in supporting you and your household? (1- very satisfied, 2- satisfied, 3 – neutral, 4 - unsatisfied, 5 - very unsatisfied)

22. What are your hopes and aspirations for you and your family in the future? Would you like your children to follow the same trade?

Template 3: For those selling dried fish (market)

A. Introductory questions

1. Details about the person: name, age, how long have you lived in the area?

2. Who lives in your household? What does your wife/husband do for work? Are your children in school or working?

3. How long have you sold fish (or other) at the market?

4. How important is dried fish to you and your household? (1 – very important, 2 – important, 3 - neutral, 4 – not important)

5. Income:
    a. What is the main source of income for your household?
    b. What percentage is dried fish?
    c. What percentage of household income comes from your work?
    d. What other work do you do for your household (paid or unpaid)?
    e. How do you see your household? (1 - rich, 2- well-off, 3-moderate, 4- poor, 5- very poor)
    f. Who makes the decisions in your household (work, money, education)?

6. Who do you get your fish from? Who dries it? Why this source?

7. What fish species are you drying? Why these species?

8. For those processing smaller species - would they switch to farmed fish or a different type of DF if the smaller ones are not available?

9. What are the steps involved in your dried fish operation (buying, degutting, washing, salting, drying)? Which drying methods do you use? (smoked, sun, fermentation etc.)

C. Market and trade

10. Do you hire anyone to help you? Do family members work with you?

11. Who do you sell to (percentages: individuals, wholesale, retail)? Where does it go (household, restaurant, shop, city, outside of the country?)

12. Do you sell aquaculture fish?
    a. If so what percentage is aquaculture and what percentage is wild caught?
    b. How long have you been selling aquaculture fish?
    c. What fish species does aquaculture use, are they species you also use?

13. What sells better, aquaculture or wild fish? Why? What is the price difference?

14. Has there been a time when you did not have access to the same fish as others? Does everyone have the same access?

15. Has the nature of selling (and/or processing) changed over time with regards to demand (consumer) and supply (production) in the last 5-10 years?

D. Environment/ Policy

16. What observable environmental changes have you noticed in the area?

17. Have there been any changes to dry fish processing in the last 1, 5, 10 years?
    a. What species do you not see anymore? Does that matter to you?
    b. What do you think is causing these changes? Elaborate on factors, drivers of change (local, non-local, political, economic, ecological, etc.)
    c. Do you think these changes impacted the amount or type of fish you are able to sell (and/or process)?
    d. Have you adapted (or are thinking of adapting) any of your work because of these changes? If so, how?

18. Are there any community/market associations?

E. Community/Social

19. What is the greatest challenge you have experienced in life?
    a. How did you overcome it?
    g. What is the most important challenge that women face in dried fish work? Are there any other issues related to your gender?

20. What does a good life mean to you? (Ask them to expand on any aspects mentioned: health, safety, etc.).

21. Do you think the importance of dried fish is changing? Are less people eating it?

22. What social connections have you made through your work? Is it important you?

23. Do you plan to keep working in fisheries? If not, what would you like to do? Would you like your children to follow the same trade?

<u>Template 4: For those who have left fish processing/selling (at the market)</u>

A. Introductory Questions

1. Details about the person: name, age, how long have you lived in the area?

2. Who lives in their household? What does your wife/husband do for work? Are your children in school or working?

3. How do you see your household? (1 - rich, 2- well-off, 3-moderate, 4- poor, 5-very poor).

4. How long have you been selling at the market? How long did you sell dried fish for?

5. How important is dried fish to you and your household? (1 – very important, 2 – important, 3 - neutral, 4 – not important)

6. Income:
    a. What is the main source of income for your household?
    b. What percentage of household income comes from your work?
    c. What other work do you do for your household (paid or unpaid)?
    d. Who makes the decisions in your household (work, money, education)?

B. Fish processing

7. When did you leave fish processing? Why? Would you have liked to continue that work?

8. Who did you get your fish from? Who did you sell dried fish to (percentages: market, trader, wholesaler, retailer)? Where did it go (local market, city, outside of the country?)

9. Why type of dried fish did you sell?

10. What are you doing for work now? Does it provide more income, or a more stable income?

11. Are people in your household still involved in fish processing? If so, what percentage of household income comes from dried fish work?

12. Do you know other people who have stopped processing fish? Do you know why they stopped?

13. What would like to see change in the dried fish industry?

14. Did you use aquaculture fish for drying and/or selling?
    h. If so what percentage was aquaculture and what percentage was wild caught?
    i. Who did you get your aquaculture fish from? Who did you get your wild fish from?
    j. When did you start using aquaculture fish?
    k. What fish species does aquaculture use, are they species you also used?

15. Has the nature of processing changed over time with regards to demand (consumer) and supply (production) in the last 5-10 years?

C. Environmental/Policy

16. What environmental changes have you noticed in the area?

17. Have there been any changes to dry fish processing in the last 1, 5, 10 years?
    a. What species do you not see anymore? Does that matter to you?
    b. What do you think is causing these changes? Elaborate on factors, drivers of change (local, non-local, political, economic, ecological, etc.)
    c. Have these changes impacted your new line of work?
    d. Have you adapted (or are thinking of adapting) any of your work because of these changes? If so, how?

18. Are there any community/market associations?

19. Are there any policies that you would like the government to enact or change?

D. Community/Social

20. What is the greatest challenge you have experienced in life?
    a. How did you overcome it?
    b. What is the most important challenge that women face in dried fish work? Are there any other issues related to your gender?

21. What does a good life mean to you? (Ask them to expand on any aspects mentioned: health, safety, etc.).

22. Do you think the importance of dried fish is changing? Are less people eating it?

23. What social connections have you made through your work? Is it important you?

24. Did you have the same access to fish as other sellers? If not, why?

25. What was your satisfaction level with dried fish processing in supporting you and your household? (1- very satisfied, 2- satisfied, 3 – neutral, 4 - unsatisfied, 5 - very unsatisfied)

26. What are your hopes and aspirations for you and your family in the future? Would you like your children to follow the same trade? Why?

Appendix B. Nvivo Codes

After the second stage (Dec 2023)

Adaptation - Alternatives	Comments on ways people adapt to situations or alternative livelihood activities or approaches they have or will take	35	54
Environment	Comments on the natural environment	11	12
Change	General comments on environmental changes, uncertain as to why things have changed	20	28
Overfishing	Comments about overfishing	8	10
Water and Weather	references to floods, water quality, quantity - ponds or at the lake, and weather	17	22
Fish		0	0
Access	Comments on access to fish and related related resources (nets, processing materials, education etc.)	19	26
Amounts	Comments on the amounts of fish they get for processing or sell	30	38
Price	Comments on prices for buying and selling	54	83
Species	Species mentioned (wild, aquaculture, not seen anymore, preferences etc.)	77	125
Wild caught	General comments on wild caught fish	29	39
Future plans	Quotes on what people would like to do or how they think their future livelihoods or environment will be	36	49
Gender	General comments on gender, includes descriptions of when men are doing certain fish processing tasks or supportive processing work (carrying fish).	27	39
Inequality - equality	Examples of inequality or equality (ex. sharing of tasks)	8	10
Income	Income from fish or other sources	40	65
Loans	Comments relating to loans	10	14
Livelihood activities		0	0
Aquaculture	General comments on aquaculture	56	91
Feed	Comments on feed for aquaculture (wild caught fish, pellets)	42	56
Process	Description of how aquaculture is done, harvesting, feed schedule, buying, selling	16	29
Dried fish	General comments on DF	12	13
Change	Comments on changes in dried fish, activities, amounts	13	14
Importance	Examples of the importance of DF	25	40
Labour (DF)	Descriptions of labour relating directly to DF	42	73
Value-Supply Chain	Some quotes are similar to the labour category, but are here because they discuss more of a value add aspect from the labour. Other quotes capture movement of fish between people (supply). During movement of fish some value may be added through extra processing, packaging etc. Also the value of simply moving it over far distances can be considered.	21	31
Homecare	Descriptions of homecare labour and activities	16	17

Labour (non-DF)	Includes any labour that is not directly a type of fish processing (ex. does not include fish)	48	74
Prahok	General comments on Prahok	33	57
Change	Things that have changed related to prahok	11	13
Labour - Process	Description of activities to make prahok	15	24
Value-Supply Chain	Description of the value chain or supply chain process, movement of goods between people, especially buying and selling with middlemen. While processing adds value that category is kept separate under labour - process	21	25
Subsistence	Comments on livelihood activities for subsistence	13	16
Market	General comments on the market	12	15
Change - Challenges	Comments on change or challenges relating to the market	14	18
Value-Supply Chain	Description of market supply or value chain	42	62
Memorable quotes		28	37
Perceptions		23	30
Policy, management	Comments on government, policy, management activities	26	46
Poverty - Wealth		8	10
Social		0	0
Change		20	30
Conflict		12	15
Connections - Community		28	45
Culture		21	26
Local knowledge		12	13
Organizations - Associations		26	32
Well-being		24	32
Benefits of DF work		5	5
Hardship		16	26
Health		14	15
Safety - Hazards		6	6

Appendix C: Ethics certificate

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	S-09-22-8401
Titre du projet / Project Title	Cambodia's dried fish economy: Understanding livelihood resiliency in an uncertain, changing environment.
Type de projet / Project Type	Recherche de professeur / Professor's research project
Statut du projet / Project Status	Approuvé / Approved
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	14/10/2022
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	13/10/2023

Équipe de recherche / Research Team

Chercheur / Researcher	Affiliation	Role
Melissa MARSCHKE	École de développement international et mondialisation / School of International Development and Global Studies	Chercheur Principal / Principal Investigator
Colleen CRANMER	École de développement international et mondialisation / School of International Development and Global Studies	Étudiant-chercheur / Student-researcher

Conditions spéciales ou commentaires / Special conditions or comments

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

Le Comité d'éthique de la recherche (CÉR) de l'Université d'Ottawa, opérant conformément à l'*Énoncé de politique des Trois conseils* (2014) et toutes autres lois et tous règlements applicables, a examiné et approuvé la demande d'éthique du projet de recherche ci-nommé.

L'approbation est valide pour la durée indiquée plus haut et est sujette aux conditions énumérées dans la section intitulée "Conditions Spéciales ou Commentaires". Le formulaire « Renouvellement ou Fermeture de Projet » doit être complété quatre semaines avant la date d'échéance indiquée ci-haut afin de demander un renouvellement de cette approbation éthique ou afin de fermer le dossier.

Toutes modifications apportées au projet doivent être approuvées par le CÉR avant leur mise en place, sauf si le participant doit être retiré en raison d'un danger immédiat ou s'il s'agit d'un changement ayant trait à des éléments administratifs ou logistiques du projet. Les chercheurs doivent aviser le CÉR dans les plus brefs délais de tout changement pouvant augmenter le niveau de risque aux participants ou pouvant affecter considérablement le déroulement du projet, rapporter tout événement imprévu ou indésirable et soumettre toute nouvelle information pouvant nuire à la conduite du projet ou à la sécurité des participants.

The University of Ottawa Research Ethics Board, which operates in accordance with the *Tri-Council Policy Statement* (2014) and other applicable laws and regulations, has examined and approved the ethics application for the above-named research project.

Ethics approval is valid for the period indicated above and is subject to the conditions listed in the section entitled "Special Conditions or Comments". The "Renewal/Project Closure" form must be completedfour weeks before the above-referenced expiry date to request a renewal of this ethics approval or closure of the file.

Any changes made to the project must be approved by the REB before being implemented, except when necessary to remove participants from immediate endangerment or when the modification(s) only pertain to administrative or logistical components of the project. Investigators must also promptly alert the REB of any changes that increase the risk to participant(s), any changes that considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project or the safety of the participant(s).

Riana MARCOTTE
Responsable d'éthique en recherche / Protocol Officer
Pour/For **Barbara GRAVES** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences sociales et humanités / Social Sciences and Humanities Research Ethics Board**

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