

From Wild Capture Fisheries to Fish Cages: Intimate Water Governance in the Lower Songkhram River Basin

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Abstract

This paper examines the trends and causes of socio-economic differentiation through aquaculture development in a village located in the Lower Songkhram River Basin in Northeast Thailand. Employing a mixed-method approach (household surveys and in-depth interviews), this paper shows how the fish farming households, only one-third of the total village households, were able to enter into the fish farming business via the use of public water resources. The paper also points out that fish farming and the associated market opportunities created benefits for fish farming households, while water pollution generated by fish farming were common problems for both fish farming and non-fish farming households. However, in a context where villagers are neighbors and kin, intimate water governance and unequal access to markets and capital supported some households to gain benefit from the common pool river. This paper provides a better understanding of water governance and livelihood change in Northeast Thailand and the current characteristics of a Thai village that is increasingly connected to external markets, where livelihood strategies are increasingly driven by migration, remittances and market opportunities.

Introduction

As one of the most fertile river basins in Northeast Thailand with no dam, the Songkhram river basin (SRB) is famous for its high biodiversity and wetlands. Communities living along the SRB are heavily dependent on natural resources, especially wild-capture fisheries, which ensure food security and have played an important economic role for centuries. The SRB is also known as the home of freshwater fish, with the second largest catchment in Northeast Thailand (Blake and Pitakthepsombut, 2006). The river length and the basin area are 420 km and 13,081 km², respectively. The upper SRB comprises rich agricultural land, the mid-basin is a relatively dry and sparsely populated highland area, while the lower basin, which covers approximately one-third of the entire river basin, is a floodplain with freshwater swamp forests (Shrestha and Muangthong, 2014). The rich aquatic resources of the Songkhram River are reflected through the knowledge of local communities on fisheries and ecology. Research conducted by villagers using Thai Baan research methodologies or research that allows villagers to investigate and document natural resources in their own language and on their own terms, reveals that there are 208 kinds of plants and fungi, 124 fish species, six turtle species, four shrimp species, ten mollusk species, four crab species, and six types aquatic insects in the SRB (MWBP, 2005). Villagers have also developed their specialization in catching fish through the use of different fishing gears. The Thai Baan research identifies seventy-nine kinds of traditional fishing gears, many of which were made locally, but eight of them are no longer in use (Ibid).

However, within the context of an increasing population and socio-economic changes, many researchers have shown that local livelihoods in the SRB are threatened by many factors, for example: the decline of fisheries; the destruction of the seasonally flooded forests to expand agricultural land; and conflicts between fishing, agriculture, and environment conservation (Blake and Pitakthepsombut, 2006; Hortle and Suntornratana, 2008; Khumsriet al., 2005; and Khumsriet al., 2009). Studies on livelihoods in the SRB demonstrate an ongoing period of rapid change driven by factors such as increasing population, market integration, infrastructure development, and ecological change. A report

by Friend et al. (2006) focused on livelihood strategies in the SRB revealed that people are involved in a wide range of livelihood activities including rice farming, fishing, fish farming, collection of non-timber forest products, processing and trading natural resources, raising livestock, cultivating river bank gardens, and the cultivation of eucalyptus and rubber. In addition, people are increasingly connected to external markets, and livelihood strategies are increasingly driven by market opportunities. As with other northeastern Thai villages, migration of people living in the SRB to various industrial zones in Thailand and destinations abroad, especially the Middle East, Singapore and Taiwan has become a common situation (Blake and Pitakthepsombut, 2006). An additional study by Blake et al. (2010) on landscape transformation of the SRB challenges the traditional stereotypical images of rural livelihoods that embed villagers in farming, since in practice, they have diversified their income generation activities to both on and off-farm sources. It is difficult to categorize whether villagers are ‘rice farmers who fish’, fishers who farm rice, or ‘wetland product harvesters who occasionally practice agriculture’ (p. 195).

Under the circumstances of ecological change and fisheries depletion, this paper seeks to reveal the nature of livelihood changes and the context producing unequal access to, and control over, water resources through the experience of villagers in the lower SRB where fish farming has been mostly concentrated. It highlights how villagers are attempting to diversify their income generation away from a reliance on wild-capture fishery resources and agriculture. As out-migration to off-farm jobs has become an important strategy that supports income, investment and consumption patterns in Thai rural areas (Rigg and Salamanca, 2011; Rigg 2016), this paper shows that majority of villagers who have been able to invest in fish farming business have use a strategy of out-migration so they have transformed remittances labour in other locations to financial capital. Based on many studies on rural change in Northeast Thailand which suggest that rural livelihoods have moved away from being predominantly agrarian and few farmers in Thailand today rely solely on agriculture to meet their needs (Kittiarsa, 2014; Keyes 2014; Rigg and Salamanca, 2011), highlight

migration and remittances as a significant capital input into the expansion intensification of aquaculture.

The forms of livelihood changes investigated for this paper involve the intensive cage culture of fish, in a village in the LSRB and the socio-economic implication that remain understudied. I pursued an argument on aquaculture, rural differentiation and its impact to environment that is not new. There is already evidence that suggests that aquaculture widens income disparities in rural areas (Huy, 2014), and changes human relationships with ecological resources (Saguin, 2015). However, this paper also shows that access to resources for fish cage aquaculture activities is quite exclusive and only for people who have capital to invest, but water quality depletion has become a common problem for all. Based on the concept of intimate exclusions suggested by Hall et al (2011), some villagers were able to accumulate capital at the expense of their neighbors and kin who share common histories and social interaction. This paper reveals the condition of intimate water governance or how the common pool water resource are governed not just through formal village institutions, but also through the considerations of an intimate networks. Thus, unequal access to resources such as land, water, financial capital and markets in many areas has widened inequalities in the countryside.

The paper proceeds as follows. First, it gives an overview of livelihoods in the lower Songkhram river basin, the case study site, and the research methods used followed by an analysis of the development of cage aquaculture and the types of fish cage aquaculture farmers. Then, it focuses on a discussion of the socio-economic impacts of cage aquaculture. The final section of the paper addresses some conclusions and possibilities for promoting sustainable livelihood development in fish farming communities.

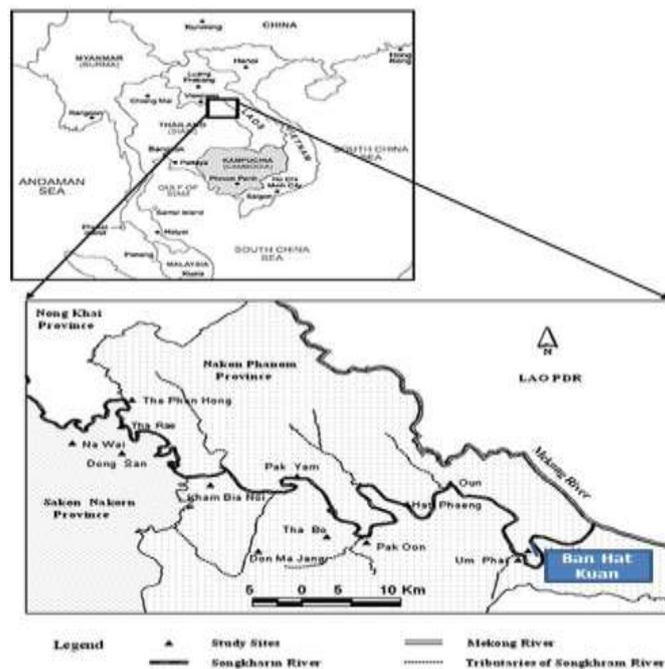
The case study site and research approaches

Ban Hat Kuan is located near the Songkhram River in ThaUthen District, Nakhon Phanom Province in Northeast Thailand. The village is approximately

745 km from Bangkok and approximately 7 km from the river mouth at Ban Chaiburi. The choice of Ban Hat Kuan as the site for the fieldwork was based on the fact that the village has the most intensive cage aquaculture in the basin. When the research was conducted in August 2015, one-quarter of the total households (67 out of 237 households) were involved in fish cage farming. Therefore, Ban Hat Kuan was selected as a study site that provided a particular context for investigating socio-economic impacts and implications of livelihood changes.

The fieldwork was conducted between August 2015 and June 2016. Data collection began with fifty fish farming households and thirty non-fish farming households. This was supplemented with substantial data collected through informal and in-depth interviews and participant observation. A formal meeting in the village was also conducted to share the research findings and to promote further discussions on risks and environmental changes.

Figure 1 Map of SRB showing location of Ban Hat Kuan as a study site



Source: adapted from Khumsriet *et al.* (2009)

From wild capture to fish cages

Based on a report from the Department of Fisheries (see Table 1), Thailand's freshwater fish production originated mainly from wild-capture fisheries until 1990 when the fish from freshwater aquaculture almost reached parity with freshwater wild-capture fisheries. Fish production from aquaculture has continuously increased to more than double that of production from wild capture fisheries over the last twenty years. The growth of aquaculture production in Thailand was influenced by greater demand of fish for consumption, government export-oriented policy, and an increasing population. Introduced to small-scale farmers with the aim of reducing poverty by the Department of Fisheries, Nile tilapia, or Pla Nin has now become the major species in the fisheries sector constituting around 30 percent of total freshwater fish caught in Thailand (ADB, 2005).

Annual Time Series Data of Fishery Statistics

Fisheries production in quantity by sub-sector, 1994-2013

Unit: 1,000 Tons

Year	Total	Capture		Culture	
		Marine	Inland	Coastal aquaculture	Freshwater aquaculture
1994	3,523.2	2,800.4	202.6	345.8	170.4
1995	3,572.6	2,827.4	191.7	357.5	196.0
1996	3,549.2	2,786.1	208.4	326.0	228.7
1997	3,384.4	2,670.5	205.0	299.7	260.2
1998	3,305.8	2,709.0	202.3	367.6	226.9
1999	3,625.9	2,725.2	204.9	441.2	252.6
2000	3,713.2	2,773.7	201.5	467.0	271.0
2001	3,648.4	2,631.7	202.3	534.3	279.7
2002	3,797.0	2,643.7	198.7	660.1	294.3
2003	3,914.0	2,631.2	198.4	703.3	361.1
2004	4,099.6	2,635.9	203.7	756.3	325.7
2005	4,118.5	2,615.6	198.8	768.7	539.4
2006	4,051.1	2,686.8	214.0	826.9	527.4
2007	3,673.4	2,079.4	225.6	845.8	523.1
2008	3,204.2	1,646.8	228.6	868.3	522.5
2009	3,287.3	1,643.8	206.8	894.8	521.9
2010	3,062.6	1,601.3	209.3	755.0	496.6
2011	3,036.5	1,610.4	224.7	817.0	364.4
2012	2,991.6	1,500.2	219.6	817.7	454.3
2013	2,822.1	1,616.5	210.3	561.5	455.8

Remark : Coastal aquaculture included green mussel from bamboo stake trap since 2001

Source: Department of Fisheries, 2015, p. 13.

This section depicts the transformation from wild-capture fisheries to the intensive breeding of Nile tilapia in cages in the river at Ban Hat Kuan. As with

other villages in the SRB, wild-capture fisheries and rice farming were the traditional occupations for villagers in Ban Hat Kuan for many decades. These could be defined as small-scale and subsistence activities. Despite habitat modification and the spread of markets as an alternative food sources, wild-capture fisheries have remained the major source of animal protein for most households (Blake and Pitakthepsombut, 2005; Hortle and Suntornratana, 2008).

Villagers in Ban Hat Kuan have engaged in wild-capture fishing activities, fish processing, rice cultivating, raising cattle and collecting forest products. Living near the river but lacking irrigation, villagers rely on rain-fed agriculture, which produces only one annual crop. The predominant crop is sticky rice. Villager's houses are approximately 200 meters away from the river because of annual flooding in the rainy season from a backwater effect from the Mekong River. Before and after the flood period is the peak season for wild-capture fisheries (May, June, July and November). However, villagers mention that the village had not been flooded for approximately seven years. They assume that the dams in the Mekong River are controlling the water level.

From the 1960s onwards, Thailand's economic development increased non-farm jobs and the migration of villagers from rural areas to industrial towns. The expansion of transportation routes also intensified the possibility of the northeastern Thai population to be incorporated into the national and global economy (Phongpaichit and Baker, 1995). For example, in the 1970s, a road connecting ThaUthen District and NakhonPhanom provincial city was built. Faced with less opportunity to earn more income from limited access to the market, villagers from Ban Hat Kuan began to migrate to Bangkok and its vicinities. In the late 1980s, fifteen men from this village took up jobs in Saudi Arabia. Searching for non-farm jobs and going abroad became a common experience among villagers. As Rigg and Salamanca (2011) and Keyes (2014) have observed in their studies, migrants from Northeast Thailand were circular and usually returned to their home village. If they migrated permanently within Thailand, they usually remitted earnings back to their home communities.

Villagers in Ban Hat Kuan also practiced circular migration for several months or even many years and usually remitted their earnings to their families.

As much of the literature suggests, migration can be a means for income generation to reduce poverty, not only for the migrants but also for the family members left behind (Kelly, 2011, 2012; World Bank, 2006, 2008). Keyes (2014: 154) has pointed out that the households with largest amounts of disposable cash were either those with members employed outside the village or those that had generated incomes from enterprises that were originally set up from capital accumulated from work as migrants. In Ban Hat Kuan, the first family who was able to invest in fish cages had a migration background. Mr. Kian, a 65-year-old fish trader and the first member of the village who started rearing fish in the cages in 2000, said:

“I went to Saudi Arabia in 1990 and returned in 1998. I was thinking what to do to earn money besides farming. At that time, the Department of Fisheries and the Chareon Pokapan (CP) Company came to promote rearing tilapia in the river. So, I first made a contract with CP for two years and invested in six cages. At that time, not many people reared fish and the water quality was good, I earned very good profit”¹.

Mr. Kian explained that to make a contract with CP, he had to invest in cages. CP supplied fish meal, vitamins and medicine. After four months, CP staff came to purchase fish, but selectively picked only fish with an exact weight. The problem of rearing fish under contract was CP staff often did not come as scheduled so he was required to feed the fish daily while waiting, wasting money on fish meal. In addition, he had not planned what to do with the surplus fish that were either above or below the standard weight determined by CP. Finally, he discontinued the contract and started to sell his own fish. As the initial fish trader, Mr Kian made connections with fish sellers in the nearby market in Nakhon Phanom Province and had become the biggest fish supplier in the village. His customers included fish sellers and restaurant owners.

¹Interview with ‘Mr. Kian’, 11 October 2015.

According to the survey, there were five main fish traders in Ban Hat Kuan. Each of them invested in fish cages in the early 2000s and had contracts with CP. Rearing fish in cages was very popular in the lower SRB, and was mostly concentrated in villages along the river between Srisongkhram District town and the Mekong confluence at Ban Chaiburi, ThaUthen District. A survey by the Department of Fisheries found that, between 2001-2002 there were 420 cages along the river (Blake and Pitakthepsombut, 2005: 44). In August 2016, when this research was conducted, the Head of the Fisheries Unit in ThaUthen District estimated that there were more than 1,000 cages along the river, which were mostly concentrated in Ban Hat Kuan. Asked why the fish cage business was popular in this village, the Ban Hat Kuan Village Head replied:

“Because we had money to invest. More than half of villagers went to Middle Eastern countries to earn money. The Fisheries Unit and CP approached us because they knew we had money. Since we were the pioneer of fish cage business, we made the first connections with fish buyers in the market and established a monopoly as a fish supplier in the markets in Nakhon Phanom and Sakhon Nakorn Provinces. Anyone can invest in fish farming, but how can they reach the market and buyer? If you are a newcomer, you need to find further markets in new areas”.²

² Interview with ‘Ban Hat Kuan Village Head’, 11 October 2015.

Table 1: The number of household fish cages in Ban Hat Kuan

Number of fish cages per interviewed household (N=50)	Percentages
<5	4%
5-15	76%
15-25	10%
> 25	10%

(Survey August 2015-May 2016)

Since this initial period, the numbers of fish cages in Ban Hat Kuan had been continuously growing. Based on the survey, the total numbers of cages for fifty households had reached approximately 700. The lowest number of cages in fish a farming household was four cages. On average, villagers ran at least 5-15 cages of tilapia (see Table 1). Currently, no one in Ban Hat Kuan has a contract with CP. There were two types of fish cage systems in Ban Hat Kuan: contract fish arming with fish traders and independent farming as shown in the below table:

Table 2: Types of Fish Farmers in Ban Hat Kuan

Type of Fish Farmers (N=50)	Percentages
Semi-contract Farmers	60%
Independent Farmers	40%

(Survey August 2015-May 2016)

The semi-contract fish farmers were people who receive fish meal, vitamins and medicine from fish traders. Then, they are required to sell their crops to the fish traders. In other words, this contract is considered as similar to a CP contract because farmers are obliged to buy fish supplies from and sell all crops to one particular trader.

In terms of the independent farmers, they are people who rear and sell fish on their own terms. These people can select to buy fish meal and other supplies freely. They can sell their harvests to the local traders in the village or direct to the market, if they have a car and know the buyers. They earn more money than the contract fish farmers but need to have the networks required to operate on their own. An independent farmer who also served as a local CP trader in the village is able to earn money from selling fish and other supplies at approximately 10% more than wholesale market price to fish cage farmers who promised to sell crops to them.

Fish cages generate considerable returns for farmers. Villagers stated that while they earned good money from selling fish compared to their level of investment, they did not include their labour input as a part of their investment cost. In the last five years, they started to face problems including sudden changes in water levels, droughts, heat, and fish diseases. For example, in June 2014, heavy rain caused a sudden change in water levels totally destroying local fish crops. Many farmers subsequently abandoned fish farming after incurring substantial losses.

Fish cages, gender division of labour and income disparities

Literature focusing on gender incapture fisheries and aquaculture has recognized the contribution of women to fisheries and other related activities (Lebel et al, 2010; MRC, 2006). In Ban Hat Kuan, women generally had important roles in various activities including rice farming, cage culture, and livestock. According to the survey, most of the fish farming households indicated that both men and women share responsibilities and decision making processes but men were more involved in the harder labour work than women. Importantly, most fish farming

households pointed out that the money generated from trading fish was taken care of by women because they were better with negotiating transactions than men. However, when looking closer at the survey on labour division in the households, every household replied that all unpaid activities related to housework were done only by women. In this case, it was obvious that while women were adding important value to the fish cage business and relations between men and women regarding natural resource management was cooperative and coexistent, the primary role of women as housewives remained based on restrictive social norms.

Important factors that create differential access to aquaculture in Ban Hat Kuanare capital and labour. Investing in fish cage farming demands for a certain amount of money. Investment costs are high as the villagers are required to buy all materials upfront. According to the survey, investment costs are approximately 30,000 TB per cage. The return could be 15,000 – 20,000 TB per cage per annum after deducting the investment cost. The source of funding for investment in fish farming is shown in Table 3.

Table 3: The source of funding for investment in fish farming in Ban Hat Kuan

Source of fund*	Percentages
(N=50)	
Remittances from migration	42%
Bank of Agriculture and Agricultural Cooperatives (BAAC)	36%
Village's Agricultural Cooperatives	4%
Village Fund	18%
Make a loan with relatives	4%
My own saving	10%

*each household might have one more source of capital

(Survey August 2015-May 2016)

The results of the survey conducted as part of this study in Ban Hat Kuan show that out of fifty households, 21 (or 42%) had at least one family member who had migrated to work out of their home village for a period of time (see Table 3). The majority of the fifty fish farming households had at least one person in the family who was currently working out of the home village. When the villagers were asked whether they took loans from the fish traders to invest in fish farming, it was found that loans were not provided by fish traders for materials, nor did they hire labourers to work for them. Fish farming was considered a risky business. Businesses were prone to lose money from occasional fish deaths. Villagers who did not have enough capital would not invest in fish farming. At the same time, existing fish farmers are required take care to protect their farm. They often need to build small temporary huts to sleep on the river bank to look after the farm during the night.

These reasons becomes barriers to new entrants who wish to invest in fish farming, and the poor are often not able to participate. The survey findings in Ban Hat Kuan revealed that fish farming households generated more income than non-fish farming households. Most surveyed households in Ban Hat Kuan owned a certain amount of land for rain-fed subsistence rice farming. However, more than half of families that ran fish farms earned more than 10,000 TB per month. With regards to non-fish farming households, which constitute three-quarters of the village, the majority earned less than 10,000 TB per month (see Table 4).

Table 4: Range of Monthly Incomes of Fish Farming Households and Non-Fish farming Household in Ban Hat Kuan

Range of income (baht)/month	Fish Farmers (N=50)	Non-Fish Farmers (N=30)
> 5,000	6%	46%
5,000- 10,000	38%	46%
<10,000	56%	8%

(Survey August 2015-May 2016)

The majority of non-fish farming households (twenty out of thirty) replied that they could not participate in fish farming because they did not have capital. However, capital was not the only the factor that impeded villagers from participating in fish farming. Age and availability of labour also determines a families' decision. Households with elderly people indicated that maintaining fish cages was physical work and they were not capable of carrying fish meal to the river three times per day.

One interviewee, a widow living alone mentioned that female fish farmers could not manage fish cages without male labour. Besides transporting fish meal to the river bank, women could not stay safely in the temporary shelters to look after

the fish in the night time. However, to state that fish farming is male role because it is too tough for women to manage it alone might be over simplified. The case of Mrs. Gee, a 27-year-old fish farmer is a good example. Mrs. Gee was originally from Mae Sot District in Tak Province in the western region of Thailand. She met her husband in a workplace in Bangkok, married and moved to live in Ban Hat Kuan for five years. Her husband was currently working in South Korea and remitted 20,000-30,000 TB per month to her. She planned to build a new house from the remittances. At the same time, she had also invested in four fish cages and operated these on her own. Each morning, she woke at 5 am and rode her motorbike to the river to feed the fish. Then, she came home to send her two sons to school. She returned to feed the fish at noon and in the evening after collecting her sons from school. Mrs. Gee asked her father in law who also owned fish cages to take care of her cages overnight. She claimed her small business operated well and she earned approximately 15,000-20,000 TB every five months. In this case, access to aquaculture came from the availability of capital, the location of her house close to the river bank, and the knowledge to manage and to sell the harvest.

Fish Cages, environmental implications and water governance

The Songkhram River is generally considered an open-access resource and all local inhabitants are able to practice wild-capture fishing. Commercial fish cages in the public river have always raised concern regarding water resource management and pollution (Lebel, 2010, 2013). In Ban Hat Guan, although fish cage aquaculture has created jobs and income for fish farming households, waste from the cages has also been a source of water contamination which has affected local ecosystems. Unfortunately, there is little scientific data on the impact of fish cage farming in the SRB in regards to water quality and pollution. The observation of the villagers is that the density of the fish cages has created a lot of sediment, which has resulted in the water in the river turning dark green from phytoplankton blooms.

According to the survey, all respondents, both fish farming and non-fish farming households (N=80), have witnessed changes in the Songkhram River over the last ten years. A majority of people mentioned that they had stopped using water from the river in their daily lives for many purposes, for example: drinking and cooking, swimming, and washing clothes. Over the last ten years, all respondents complained of a deterioration in water clarity and quality. In the dry season, they observed that water turned dark green. Many said swimming in the river was prohibited because it would cause skin rashes. Twenty-seven out of thirty non-fish farming households said they thought fish cages caused water pollution. However, they only complained without any action. One said:

“I cannot say much. It will lead to fighting. People who rear fish are all my relatives. We eat fish from their cages too”.

Hall et al. (2011) studied the tensions regarding land access in Southeast Asia and demonstrated the processes by which social intimates, neighbors and kin, exclude each other from access to agricultural land. In this intimate setting, some people are able to accumulate capital at the expense of their neighbors and kin. Therefore, exclusion from access to natural resources is not necessarily from powerful external actors. Rather, it could be domestic actors who exclude others through everyday practices. The case was exemplified through interviews the villagers who practiced wild-capture fishing. Three out of thirty non-farming household responded that they still practiced wild-capture fishing. One of them, Mr. Pu, a 78-year old fisherman, mentioned that the river with cages is still a public space. He could capture fish from where ever he wanted. However, cage owners would not be happy to see him catching fish near their cages as they would be concerned that Mr. Pu might steal their fish from the cages. He said:

“Over the last 30 years, it was easy to catch fish. After the rain, I only stayed in a boat doing nothing, the fish jumped into my boat. Because there was plenty of fish, the price of it was so cheap. We did not sell it to anyone. We just caught fish and shared them in the village. Now, things have changed. I have not seen a big fish that weighs

*more than 10 kg for a long time. Some species have disappeared. The water has become very dirty too”.*³

Mr. Pu also showed his arms and legs that got skin rash from the river.

*“It is itchy. I went to see a doctor and got a cream but it does not help. I still go fishing every day. If I have more energy and money, I might invest in fish cages too. I want to be rich”.*⁴

Fish cage farmers reported more risk due to infected fish due to water quality and a more severe climate. A majority (thirty-five out of fifty) reported an increased use of medicine for fish over the past five years. They suspected that cause was water pollution from their cages but also believed that pollution was caused in the early rainy season from the heavy use of pesticides and chemical fertilizers from intensive agriculture along the SRB. The village head of Ban Hat Guan said that regulations existed to prevent fish farmers from disposing dead or infected fish into the river, but in reality, fish farmers did not follow these restrictions. Up to now, there has been no regulations restricting access of the use the river by the Marine Department in charge of the river bank. However, the law requires the Tambon Administration Organisation (TAO) to take care of the local environment. Permission to conduct aquaculture activities in public space in the river requires permission from the TAO, but in reality, there is no enforcement of this process yet. The head of TAO, who is also involved with operating fish cages said:

*“I know that TAO is now in charge of collecting a tax on fish cages in the public river. The Marine Department has mandated a tax 50 TB per square meter of fish cage. However, if the local law is issued by me, how can I be elected next term?”*⁵

The case study from Ban Hat Kuan presents the necessary process transition of livelihoods and income diversification through investment in aquaculture.

³ Interview with Mr. Pu, 25 March 2016.

⁴ Ibid.

⁵ Interview with the Head of TAO, 10 October 2015.

Nonetheless, the question remains, how can aquaculture be conducted in an environment friendly way? How can the capacity of the river to provide benefits to both fish farmers and the communities whose livelihood depends on it be sustained?

As Lebelet al. (2013) has detailed, factors that determine the success of fish farmers including access to markets and climate and environment-related risks. The increased problems with disease and use of medication are key challenges for aquaculture, but the sensitivity of water resources to pollution from within the watershed or river can be seen as a positive pressure to improve sustainability. Therefore, caution should be taken when authorizing cage culture in the public river. Stimulating shared concern and incentives for collective action in support of more sustainable practices is required.

Conclusion

In this paper, research was conducted in Ban Hat Kuan Village in the lower SRB of northeast Thailand to understand the development of aquaculture fish farming and the implications regarding livelihood changes as a part of the process of diversification of rural incomes. This paper indicates three key transformative trends and socio-economic conditions in the study area:

First, the paper reveals the intensification of aquaculture which has concentrated in the hands of individuals who have access to capital. In this case, the majority of fish farming pioneers are those who experienced out-migration to Bangkok and its vicinities and destinations aboard. They returned to Ban Hat Kuan over the last ten years during the period when the Fisheries Department in coordination with the CP Company heavily encouraged farmers to invest in tilapia farming as a growth industry to supply local markets. The early fish farmers in Ban Hat Kuan held contracts with CP but have subsequently become independent farmers and fish traders. At present, no farmer was currently contracted with CP. A majority of fish farmers in this village were contractors

who were obliged to buy fish supplies from one particular fish traders from the village and sell their harvest to the same trader.

Second, the research reveals that the transformation from wild capture fishing to fish farming has eventually resulted in socio-economic changes for the villagers. As with other areas of Northeast Thailand, villagers are increasingly connected to external markets. Their livelihood strategies as a result are increasingly driven by market opportunities. Importantly from the research findings, fish-farming households were shown to be able to earn more income than the non-fish farming households so income disparity issues from differential access to aquaculture production needs to be further addressed.

Finally, this paper has demonstrated the environmental implications and exclusion that has occurred due to expansion of aquaculture production. Waste from fish farms such as uneaten food and dead or diseased fish can accumulate and pollute the river. In addition, the overuse of antibiotics is harmful for the water and human health. However, conflicts between fish farmers and non-fish farmers who still practiced capture fisheries appeared to be rare due to their social intimacy. Since water quality is the significant factor for fish farmers to succeed in production, stimulating shared concerns and incentives for collective action in support of more sustainable aquaculture is required.

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