CHAPTER III
COMPLEX ECOLOGY AND MANAGEMENT OF FISHERY RESOURCES IN STUNG TRENG PROVINCE

This chapter explains the general characteristics of the Mekong River in Stung Treng province where it serves as the natural ecological link and forms the upper part of the Cambodian Mekong. It also examines the livelihood of the fishers and the reasons underlying the use of fishery resources.

The chapter is divided into three main parts. The first part describes the historical and ecological perspective of the Mekong River in Stung Treng province by showing how the outsiders perceived this province in the past and the present. The second part of this chapter deals with the complexity of the ecological zones and the different uses of these zones. The last part describes the patterns of fish migration through out the Mekong River and its tributaries and stream in the province by showing how they link to human adaptability in the province. It presents the broad social setting and different forms of access to fisheries resource by different fishing communities and different ethnic groups along the rivers and tributaries.

3.1 Historical and Ecological Perspective of the Mekong River in Stung Treng

Stung Treng is one of the remote provinces situated in the northern part of the Cambodia about 455 kms from Phnom Penh. Geographically, the province has been shaped and characterized by the flow of the Mekong River through Khone Falls in Lao PDR experiencing an elevation drops 21 m (Rainboth 1996) and then meets with other three main tributaries: Se San, Sre Pok, and Se Kong in the provincial town.

The confluence of the Mekong and the tributaries create vast natural resources for both human and fish ecologies. It also forms the upper part of the Mekong in Cambodia which is characterized by the altering rapids, deep pools, and scattered sandbars along the river (see Map 3-1 next page). By looking to the past, the Mekong River has been the central part of Southeast Asia's history before its existence was known to the Western world. Later on its lower reaches had been the setting for European rivalry both commercial and religious and that its existence was then almost

forgotten by the world away from Asia (Osbone 2000). However in this part, I would like to divide it into two sections by focusing on how the outsiders and the insiders view the Mekong in Stung Treng province of Cambodia.

Map 3-1: Showing Flow of the Mekong into the Lower Mekong Basin
Source: Ahmed, M. and Hirsch, P. (2000)

3.1.1 The View From Outsiders

During the French protectorate on Cambodia from 1863 to 1953, the French interest was to search for raw materials and markets for its finished products. The other reason for French interest in Cambodia was the desire to control the Mekong River which thought to be the nearest and the shortest route to the coveted Yunnan in south China. There had indeed been a “constants and bitter” competition between England and France to enter Yunnan. The French strongly believed in the possibility if they gained control over the Mekong. Strategic and economic motives like these coupled with sentiments of national pride led the French in Cochin-China to make strenuous efforts to gain control over Cambodia (Reddi 1970).

But the French were unaware of the complex geography of the rapid flow of Mekong River from Kratie to Stung Treng in northern Cambodia and the Khone Falls which together constitutes an obstacle and make it impossible to travel by ships along the entire river (Öjendal 2000). The French Mekong expedition, which began in 1866 and came to an end two years later, was an epic endeavor in an age of heroic explorations. Even now, the fact that the Mekong was explored by Frenchmen seems to weigh against the expedition receiving the credit it deserves.

At one level of description, De Carné traveling-account (1866-1868) during the French Expedition along the Mekong Mainstream revealed the characteristic of the Mekong from Kratie to Stung Treng that:

> The stream is sow with islands, which divide it into great many arms. The opposite bank could only be seen in the foggy distance. The waters, dishing against rocks which formed an almost uninterrupted series of rapids, made a great thundering in the air. Between the islands, these rapids offer a singular appearance; for an incredible quantity of shrubs have taken roots on the rocks and shoals, and rise above the surface, their stems bent by the current, as if a forest had been flooded. Some high trees seem to hold on to the earth only by creepers, which bind them to the bank like airy roots. The channels of the river were so twisting where in some places the water boiled as it rushed passed.
>
> (De Carné 1872:49)

By July16, 1866, the party had reached the most difficult section of the rapids of Sambor in Kratie province. Garnier who was the member of expedition team also wrote that his dream of the Mekong as a route to the richest of China ‘seemed from this moment gravely compromised’. There was no way of knowing where the main channel of the river lay, and the sudden alternation of depths and shallows promised little assurance that any deep-water would persist them long enough to make them

navigable. It took another three days before the party finally emerged into calm waters below the small settlement of Stung Treng (Osbone 2000:84). According to De Carné, the travel was taking 9 days duration from Kratie to Stung Treng.

From Stung Treng provincial town to Lao PDR border, the characteristics of the river still continues difficult. De Carné (1872) has described that in some places, the water flows so violently through the twisted channels where there were a lot of flooded forest along in the riverine. The river and forest joined one to the other and nothing is heard but noise of the wind in the high branches of trees, or the roaring of the waters round their roots. The account also shows that when the evening came, some fisheries show themselves by flickering light of torches, which illuminates them with the fiery-serpent-like beams it casts on the waters, and the dying voice of the wind. The fishing season is over, and the fish enjoy more peace throughout their entire domain. Elsewhere, the water spreads out, half veiled by charming trees, which bend over it, and dip their ever-fresh leaves, and white and rose flowers, in its coolness.

The other main route water way is from Sekong- Mekong River (tributary in Lao PDR and Cambodia). This waterway is navigable between the Lao PDR and Cambodia, providing an alternative international transit corridor to the Mekong, which is non-navigable through the Khone Falls. Based on the Francis Garnier's account (from 1866-1868) cited in Danconto (2001) shows that the Mekong has strong seasonal discharge and its course has widespread rapids: these feature made navigation always arduous and frustrated the trader's desire for a reliable commercial cargo route along the river.

This account and illustrations by expedition members still resemble the present-day appearance of the islands and channels. The records make clear that the explorer were disappointed by the experience of the Sambor rapids, they were not downhearted as they prepared to move further north toward the Khone Falls, an obstacle none of them had seen. Any hopes of navigation between the mouth of the Mekong and this region of southern Laos were at an end. From this point on the expedition's essential task became exploration.

At the present time, when people traveling by ship or boat from Kratie to Stung Treng provinces, they will notice the existing navigating poles made from huge

concrete established along the reviver channels showing the water depth of the areas. These poles are starting from Khone Falls down south to Kratie provincial town for the purpose of agricultural products, trading and goods/commodities/ transportation from Cambodia.

An elder person, who came to live next to Lao border since 1960s, explained to me that the poles have four signs of different color indicating the current condition of the rivers and water. For instance, the blue color indicating the deep water which the ship or big boat can go. The red color, it indicates the inland, shallow water where the ship or big boat could not go in that direction. The black color showing rocks, and rapid flow of water over the submerge rock in the riverine and the white color indicate sandbars and sandy bank which there will be no more way (Mr. Thuy Sorn: age: 73, April 2, 2003).

During my fieldwork, most of these colors have been washed up by the current flow of water and weather condition. Some poles had broken or fallen down as the result of the civil war and weather conditions. During the high peak of water, most of these poles as well as the trees have been submerged, and travel can be done by both big boats and small boats. When the water starts receding, the poles and the tree in the river start to merge up showing the rapid flow of water over theses poles and trees

The poles have its own number chronologically by starting from Khone Falls down to Kratie. Through my observation, the interval from each pole are not fixed, but depends on the ecological and the hydrological condition of the river. Some fishers explained that if the areas has rapids and is rocky, the distance of each pole has to be close to each other. However, most of the fishers do not know when these poles were established exactly, but only assumed that these were built during the French colonial period. According to Osborne ‘s account, he reveals that these markers were installed in 1930s, as the navigation aid along the river with splotches of faded green and red paint showing where a boat may or may not pass (Osborn 2000: 153).

In the book *The Mekong: Turbulent Past, Uncertain Future*, Osborne (2000) explains that by looking at the past, the Mekong was very much part of the war-torn contemporary world as the Second Indochina War, the American and Vietnam war that spread into Laos and Cambodia, raged ever more fiercely. The hostilities ensured

that there could be no possibility of the development plans so confidently proposed in the 1950s and early 1960s coming to fruition.

As a regular visitor to Cambodia and Vietnam in the 1960s and early 1970s, Osborne became used to traveling by the fixed-wing aircraft and military helicopters above the river to helter-skelter road trips along Mekong Delta roads through territory which passed into Vietcong control once darkness fell. When the American and Vietnam War ended, the Mekong again slipped from general consciousness. The American discovered the Mekong in 1965 and forgot about it in 1975. Not that the river vanished from mind of those who had fought on and around it- American Vietnam veterans could speak of 'being up the Mekong' as a metaphor of risk and danger (Osborne 2000:15).

3.1.2 The View From Insiders

Throughout the history of recent development, the northern river towns of Kratie and Stung Treng remained largely inaccessible until the United Nations Transitional Authority in Cambodia (UNTAC) was in place in the early 1990s. From then onward, the Mekong in Stung Treng has increasingly been viewed as an integral part of this wider, exotic world, rather than simply as an object of fascination in itself. As the areas become more and more integrated with the regional context, new speedboats[1] have been introduced since 2001. Its capacity could move as fast as the taxi along the river in a rush of spray and with ear-shattering noise. Normally, these boat take tourists, traders, and local residents from *Vuen Kham* to Stung Treng town through the exotic area of Ramsar site along the Mekong River. Most people prefer to travel by boat partly because of the Mekong sceneries and the roads are not yet developed.

The fascinating scenery along the Mekong River in Stung Treng include its islands, deep pools, Mekong dolphins, fishing activities and inundated forests, and its diversity of water birds are the major tourist attraction, particularly for those tourists visiting Stung Treng province. The number of people visiting Stung Treng on personal tours since there is not organized tour in the province, but it is indicative of the increasing integration of the area into the regional tourism market. Most of the

[1] This speedboat has bought from Vientiane of Lao which looks like the boat in the Golden Triangle where there is the confluence of Thai, Burma and Lao.

tourists are foreigners both come from Lao PDR and Phnom Penh as part of their Mekong Travel or Southeast Asia journey. This point and the others made above suggest the extent to which people living around the rivers and tributaries are becoming more closely tied into the market system both in Cambodia, and also within the regional economy.

In the provincial town, the market is active near the main landing port. At noon or by late afternoon around 4 to 5 pm, two or three speedboats arrive regularly from Kratie province and the landing briefly comes to life again. Taxis and motor taxi drivers come to transport passengers to provincial town for accommodation. Next to the Custom Office, close to the landing port, there are sign boats saying " *Fish Buying Stall*" which every small-scale fishers from everywhere in the province have to sell to these exclusive private companies who obtained the legal license from the government. Everyday, at the markets at the provincial town and the Cambodia-Lao border, large fish are taken from boats to be thrown on great blocks of ice before being sent to foreign markets.

The important feature of a fishing economy in the provincial town is that it requires communities to enter into some form of market exchange to obtain other foodstuffs, particularly rice and vegetables, money or other products which they do not produce by themselves. At the same time, fishing communities in the province are readily to enter into exchange relationships because the specialized production of fish requires them to secure supplies of other foodstuffs such as rice from land-based communities. In some isolated places, fishing can remain 'largely unmediated by money', without middlemen and with the continued use of traditional equipment for only household consumption.

The link of the Mekong to the provincial town is not just only a range of human activity that captured the attention. It has its own life marked by rises and falls of water according to the seasons (the difference between low and high water in the province). The flow of the water in the Mekong grows ever greater in the rainy season, all the stream, creeks and tributaries fill up not just by the rains, but also by the melting of the distant snows in Tibet of China. When the rainy season end, the water from the tributaries, streams, and creeks start to flow and rushed into the Mekong Mainstreams. And as it does, these tributaries, streams, and creeks carry with it a huge quantity of fish which are harvested by local fishers for several months.

During the dry season, whenever we travel by boat from Kratie to Stung Treng and then extend to Lao border, we will see fishermen gathered a round the rocky or poles close to the flooded forest. These show that the poles are not used only for showing the navigation system, but also show where the deep pools of fish spawning and habitats. Normally, fishers gather round during the day time under the flooded forest besides the poles and rocks waiting for the fish migrate up and down of the mainstream. These fishing activities are strongly dependent on the seasonality of the water hydrology and the movement of fish in the mainstream, which resulted by the complex ecology in the province as I am going to explain in the following section.

3.2 The Complex Ecological Zone of Mekong River in Stung Treng

As the Mekong meets and blocks the flow of the tributaries in the provincial town, the rivers' water enters the seasonally flooded forests, wetlands and rice fields of the low lying floodplains of the tributaries. The most well-known and by far the most dramatic example of this flow reversal and flooding occurs between the Mekong through the Tonle Sap River and the Great Lake. At other places along the Mekong, as in the vicinity of Khone Falls through Stung Treng stretch of river at Kratie, the Mekong itself floods into the seasonally flooded forests of the Mekong floodplain. A gain, the rising levels of water in Mekong often initially follow small tributaries inland, but also enter forest areas directly at points along the mainstream itself.

The tributaries in this section are notably significant stretches of the rivers in each catchments are fast-slowing upland rivers through forest upland watershed before becoming slower flowing, lowland rivers through the plat-land of the Korat Plateau from Thailand and Laos and extends to *Dangrek Mountain Ranges* before flowing through the broad river valleys of the Mekong floodplain in their lower stretches. However, the seasonal variation of Mekong River and its tributaries in Stung Treng create variety of ecological zones, systems and its biodiversity.

During May and June when the Southwest monsoon arrives, the water level in the Mekong River in Stung Treng increases gradually (figures 3.1) and starts to become very muddy, but does not widen noticeably. Longitudinal migrations of fish to spawning ground and also start spawning and migration to down stream.

In July to October the Mekong is at its highest levels, which ranges from 10.3m to 12.2 m which flooding large area of forest. Many fish, large and small, enter

the forest as soon as it is flooded, where they feed heavily on leaves and fruits, earthworms, insects and other terrestrial invertebrates, aquatic invertebrates including shrimp, crabs and mollusks, and other fish. The other stream originating from a chain of *Dangreks Mountainous Chain* also flows into this river in province through its tributaries.

Map 3-2: The location of Dangreks mountain chain in connection with the O'talast tributary of the Mekong in Stung Treng province.
Source: Mabbet and Chandler (1995)

In September, the water reaches its maximum level and started to flood the areas along the river and then flows down stream through Kraties and Kg. Cham province then reaches Phnom Penh known as *Charkto muk* (four arms) where the volume of water has been divided into other channels.

Some water flows through Tonle Basac River where the rivers run side by side until they spread out into 'the nine tailed dragons' of the Delta in Vietnam. Some flows northwestward through Tonle Sap River into the Great Lake which creates

flooded forest with the huge floodplain of 70,000km^2 and serves as habitat and spawning grounds for a multitude of fish species during the wet season (Öjendal 2000).

During November and December, the water level falls dramatically (Fig. 3-1). The level of the Mekong quickly drops to the point below the level of its tributaries and drains down from the flooded areas along the Mekong River and its tributaries, streams, and creeks in the province. Meanwhile, fish start to migrate out from the tributaries, creeks, and stream to the Mekong mains stream and continue migrating up and down stream.

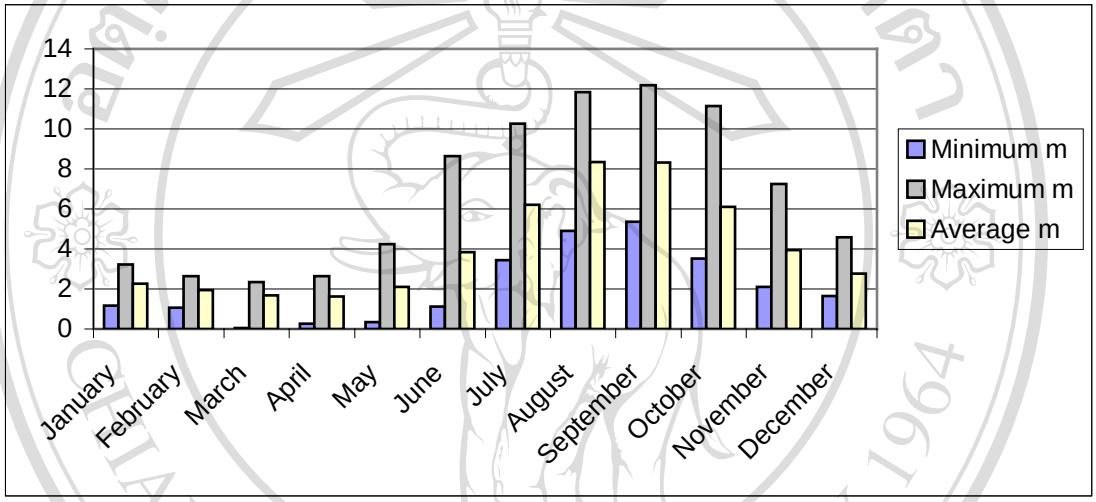

Figure 3-1: Monthly water levels of the Mekong in Stung Treng Province showing its maximum, average, and minimum.
Sources: Cambodian Wetland Team (1999)

The water level subsides slowly until January and February which ranges from 3.23m to 2.63m high and continues to gradually recede during March and April which the level of water decrease from 2.36 to 2.46m. Out-flow water from the floodplain and the lake increases the flow of water in the lower Mekong River, improving the condition of the Mekong estuary after saline intrusion during the dry season period.

In term of water resource, it is estimated that the Mekong brings water with the average of the year approximately 53.3% while Sekong, Sesan and Srepok rivers bring water down with an average of 16.7%. The confluence of the Mekong and its tributaries bring the water to Stung Treng annually in average of 37,484m^3/second (Cambodian Wetland Team 1999).

In addition, the annual flow of the water in the province has naturally created a complex ecosystem, in particular the wetland areas. In Stung Treng, the wetland is defined based on the real situation and types of wetlands[2]. There are large variety of different wetland habits, which shaped by the hydrological conditions of the Mekong River and its tributaries through out the web of its channels and over the seasonal river cycle. But to my knowledge, a group of wetlands habitats can be identified: (a) riverine (in-stream) habitat associated with the complex river morphology; and (b) floodplains seasonally wet habitats, and (c) the rice field paddy and the ponds or lake.

a) Riverine Wetland

This includes several types of riverine habitats, differentiated by morphological features and flow conditions within the riverine channels. In-stream flow characteristics of these habitats are still by and large underdescribed. The following main types can be identified based on general morphological and hydrological characteristics.

First, the morphological and hydrological characteristic refers to the perennial river channels which are ranging from the wider branches to the maze of sandbars channels separating the islands in the central. The wide river channels contain deep pools and generally have steep sandy banks, most of which are eroded and unstable. The sandbars and rocky outcrops emerge from the riverbed when the water level decreases: the minor alluvial deposits of sandbars and banks provide an ever-changing substratum only partially stabilized by the growth of riparian vegetation tufts.

Due to hydrological conditions, the morphology of the river channels and the associated vegetation cover are therefore every varied which include the steep sandy shores (often cleared of vegetation during the dry season and cultivated), the rocky shores of the narrow channels and the sandy beaches, which is occasionally found during the dry season along the riverine.

The second characteristic is referred to the rapid areas/places which are widely scattered along the rocky channels whose shores/rocks are seasonally submerged by fast-flowing water during the wet season and where riparian vegetation is

[2] According to the definition of Wetland in Ramsar Convention are: “the areas of marsh, fen, peat land or water, whether natural or artificial, permanents or temporary, with water that is static flowing, fresh,

characteristically bent over by the strong currents. Rapids also form in the extensive shallow sectors which start from Stung Treng down stream to Sambor in Kratie province.

Daconto (2001) shows that these riverine wetland types are composed of a large mosaic of different habitats, whose morphological and biotic features appear to be strongly dependent upon the interaction of river flow and the substratum. Because of this, the localized characteristics of flow regimens, substratum, depth and hence vegetation cover provide a wide variety of environmental conditions and habitats for the riverine fauna, and possibly also an ample set of niche conditions.

From northern Lao PDR to Kratie province, fishers remark on the importance for fish of rapids and deep pools in the Mekong and its tributaries and the seasonally flooded forests are the source of food and habitat for reproduction. According to local fishers, the rapids of the tributaries and mainstream are critically important ecosystems to the fishes of the Mekong. In general, the rapids are alternated by deep pools, in some places up to 60 meters deep (Hubbell 1999).

Fishers explain that during the low flows of the dry season, after water flows over these rapids, it has more oxygen and more food available to fish living the deep pools. According to Hill and Hill (cited in Hubbell 1999) deep holes in the mainstream of the Mekong would appear to be the primary rearing and dry season holding habitat for large catfish and carp. Fishers also report that certain species live and/or feed in rapids, other are believed to reproduce in the rapids, while young fish of some species seek refuge and food in the rapids.

Local fishers have developed an impressive body of ecological knowledge on ecological matters and accumulated its diversity with an impressive range of fishing gears and techniques according to the local and seasonal hydrological conditions and the great diversity and variety of life cycles of the Mekong fauna.

b) Floodplain Wetland Habitats

The seasonal floodplains of the Mekong River in Stung Treng comprises of variety of seasonally wet habitat types, which includes: the seasonal streams, creeks and tributaries.

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brackish or salt, including areas of marine water, the depth of which of which at low tide do not exceed

The first is the seasonal streams or creeks (O' in Khmer) which drain the floodplains and the larger islands: these often dry up after the rainy season, but small pools may retain humid conditions for a longer period. Flat alluvial land (both mainland and larger islands) is criss-crossed by a web of such streams, which often retain only a very narrow fringe of vegetation along their edges. According to the surveyed by the Cambodian wetland Team (1999), there are 47 streams and creeks in Stung Treng along the Mekong river and its three tributaries: Sesan, Srepok and Sekong.

During the peak of the flood season, river water may back up into these streams and flood the adjoining plain behind the steep banks. These streams and creeks play an important role in the reproductive behavior of laterally migrating fish species. The islands lying in the complex riverines and tributaries province contain a series of valleys corresponding to the fault lines, which also have humid habitats (stream, and pools, sometimes retained during dry season). The conspicuous vegetation cover conserved on these islands adds to the attractiveness of such habitats for both local people and outsiders.

c) The Rice Field or Paddy Fields

The rice field or paddy fields refer to the human-made wetlands, while they were until recently exclusively rain-fed; irrigation is rapidly expanding throughout the areas, both in the river plain and to the larger islands. As for the lake and ponds, these areas are scattered throughout the agricultural lands both in the larger islands and in the floodplain. These are typically element of farmers agricultural landscapes and play an important traditional role in increasing the farmers' food supply, through the seasonal harvesting of pond fish.

Some of these floodplain features are typical of agricultural landscapes throughout the Mekong River and its tributaries in Stung Treng province. In particular, the wetlands and Ramsar Site in Stung Treng are still remarkable in terms of natural landscapes and variety of agricultural activities. The diversity of habitats are still retained despite some human pressure, provides the local farmers and fishers with a range of resources, which they harvest according to the rhythms of the still relatively intact hydrological and ecological cycle.

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six meters" (Cambodia Wetland Team 1999).

Along the Mekong River and its tributaries, it can be described as the best-cultivated parts of the province. Farmers along the river, tributaries and streams generally adjust their farming systems according to the water level. These ecological conditions provide vital resources for most of the Khmers and other ethnic people living along the rivers and tributaries.

There are 16,444 ha of rice land in the province, where the average yield is 1-2 ton/ha. About 10,399 tons of rice is produced each year, while the requirement is 12,093 tons per year. Thus the province lacks 1,694 tons of rice per year which is transported from other provinces resulting in more costs (DoP 2001).

Even tough, farming and fishing are very important source of economy for local livelihood. About 95% of the provincial populations are farmers and fisher, while the remaining are traders, government, and non-government officials. These show that their livelihood strategies are not fixed with one activity, but it involves with the combination of rice, livestock, collection of forest products, cultivation of vegetables and fruit, seasonal migration, as well as fishing (DoP 2001).

Vannaren (2002) contends that about 90 % of the population in Stung Treng Province has scattered and lived along the river and its tributaries so their source of economic is not coming from only single activity. Fish is the second most important source of the diet of the people in this province which rarely undertaken as the primary economic activity, but is a component of household resource involving all members, moving in and out of different activities.

He also explains that the people catch fish every day for daily consumption as well as for selling the surplus product. Fishing activities are mainly active in dry season, from November to May. In this time people can fish from 1.5 to 10 kg per day per household. There are not so many fishing activities in the rainy season because local people are engaged in agricultural activities and the water level is high. So they can only fish occasionally that provides about 0.5 to 5 kg of fish per day per household. During this season the people use processed fish which they made in the dry season for daily food consumption (Vannaren 2002).

The confluence of the Mekong and its tributaries in the province not only provide a source of food for people, but also serves as the place for fish migration and

spawning. Based on these physical and ecological settings in the province, fish spawning and migration can be classified into three parts.

The first part is starting from the provincial town up to Lao border, which is known as the Ramsar Site. The ecosystem of the area has been described as good flooded forest (see also appendix B)[3] and complex geography which serves as multi-purposes: seasonal fishing, fish spawning zones, diversity of water birds, agriculture, and ecotourism.

The second fishing ecology is starting from Stung Treng provincial town to Kratie border. Within this area, several deep pools have been identified as the habitats for all fish species. Some are the spawning sites for *Probarbus jullieni* (Seven-line barbs; Trey Traw Sork in Khmer, *Giant barbs* (Trey Koul Reang in Khmer), *Iridescent shark-catfish* (Trey Pra in Khmer) and *Small scale croaker* (Trey Proma in Khmer).

The third fishing ecology is the Mekong tributaries: Sekong, Sesan, Srepok and Sekong where there are a lot of deep pools for fish spawning and migration. In Sesan tributaries, some important deep pools[4] areas have apparently become shallower during the past few years due to the increase silt deposition resulting from altered flow regimes after the construction of the Yali Dam in the upper part of the catchments. For instance one pools in *Voen Say* district in Ratanakiri was reported to have gone from 7-8 m deep to just haft a meter deep within the last three year and abundance for many fish species have been declined dramatically (Baird et al 2000).

Because of these ecological zones, there are at least two types of seasonal fish migrations found in the province. Thuok and Van Zaling (2000) explain that every year long distant migratory fish species drift (in case of fry) or swim (in case of adult fish) from their spawning ground from the Mekong in the northern Cambodia, and in southern Lao PDR to their feeding ground in Tonle Sap Lake and the Mekong

[3] The species represented in this forest type is less diverse than dry deciduous and/or mixed deciduous forests. In the Ramsar area, there is only single species emergent of the height at least 40 meters. Such flooded forest always flood in the water during risen water season, especially in the wet season. A density of the trees are less than in the dry deciduous and mixed deciduous forests (Personal interviewed with Mr. Ban Sok, the ecologist from Ministry of Environment in March 2003).

[4] Besides these deep pools in the river and its tributaries, there are five streams or creeks, which have been assigned as the priority spawning area. These areas, as shows in the map a bove, are O'Talash, Ramsar Site in Thalaboriwat district, O Smorng in Sekong Commune and O'Khampha in Thmar Keo commune of Siem Pang district, and O'Mras in Siem Bok districts.

floodplain in the lowland of the country and to the Mekong delta in Vietnam and then back again.

Phallavan and Pheng Bun (2000) show that the longitudinal nature of fish migration[5] begin to spawn in the Mekong River at the beginning of the rainy season (May-August). Fish eggs and fry are carried by the current and swept into the floodplain areas around the Tonle Sape Great Lake and the areas south of Phnom Penh. When the water recedes, most fish species migrate to deeper waters in the lakes, river, or tributaries (lateral migration), but many species will undertake longer migration (longitude migration) to the Mekong River as far as Stung Treng and Lao PDR.

For instance, *Pangasid catfishes* (Known as Trey Pra in Khmer) are thought to use deep pools and areas with rapids in the Mekong and possibly its tributaries, the Sekong, Sesan and Sre Pok tributaries in the province for spawning. Each female fish lays an enormous amount of eggs. They produce large number of eggs to counteract the very high mortality of eggs and larvae and juveniles caused by natural environment. Based on this pattern of fish migration, it shows that the Mekong and its tributaries in Stung Treng is not an isolated an entity, but it is linked to Lao and the Tonle Sap Lake as the fisheries in Southern of Phnom Penh linked to the Vietnam Mekong Delta (MRC 2002).

The other fish species are called *Trey Riel*[6] (*Henicorhynchus spp.*) is relatively abundant for the whole period of January through May. It is indicated that the Mekong River in Stung Treng has served as the dry season refuge and spawning ground for this species as well. A downstream migration of adults from June-August is not noticeable, but small number appears to trickle-down. However, nearly six months from the end of July to the middle of January almost no *Trey Riel* land in Stung Treng (Phallavan and Phen Bun 2000). Baird et al (2000) also reports that the peak migration of *Trey Riel* occurs in December, January and February in Stung Treng province below the Khone Falls around the new moon.

[5] These are Henicorhynchus spp (Trey Riel), *Cycloheilichthys Enoplos* (Trey Chhkok), *Cirrhinus microplepis* (Trey Proul), *Probarbus Jullinien* (Trey Trasork), and *pangasidnodon hypophthalmus* (Trey Pra).

[6] The term Riel is taken from the Khmer currency (Riel). This shows that the fish species is very important for daily socio-economic for rural people.

Table 3-1: Summary of the life cycles of fish migration in Stung Treng province

Seasonal variation	Major fish movement cycles
Flooded Season (July-November)	Lateral movement of Adults fish into flood plain such as creek, streams, and tributaries for feeding and grow up
Transition period (December-January)	Lateral movements of juvenile and adult fish from seasonal to permanent water bodies (mostly from creeks, streams, and tributaries to the Mekong River and its deep pools).
Dry season (February-April)	Longitudinal movement to dry season refuges, and dispersal. Also the confrontation of fish in the permanent water bodies.
Transition period (May-June)	Longitudinal migrations to spawning ground. Fish also start spawning and migration to down stream.
From June to July	Eggs and Larvae drift downstream with the water current and are distributed through out downstream floodplain areas, which provide optimal rearing condition for the young and fragile fish larvae.

The other unique fish in the province is also found migration using their route along the Mekong and its tributaries, in particular because of these rapid and fast-flow of the mainstream. This fish is commonly known as Pa Se Ee (*Mekongina erythrospila*), which exist only Stung Treng of the country (See also appendix I).

The term Pa Se Ee is not the Khmer word; it is a Laotian word. There are many explanations regarding to this fish specie. The local fishermen explain that this fish exists only in Stung Treng because of the confluence of the Mekong and its tributaries. Every year, the fish have to migrate from Se San and Sre Pok through Se Kong tributary and then to the Mekong upstream until the Khone Falls where the Cambodia-Lao borders.

They believe that every year this fish comes here in large schools in order to pay respect to the leg of a god called *Chuerng Preah Bath* in Phuchung of Preah Bath commune located at the confluence of Mekong and Sekong Rivers. In this place, there is a stone/rock shaped as the leg of Buddha in the riverbed. The oral story also continues that this stone is linked to the mountainous pagoda in the provincial town

known as *Wat Phnom* where local residents strongly believe in spiritual power of the pagoda. Every year in December, this fish come to pay respect to *Cheurng Preah Bath* in Phuchung commune and then to other place the Cambodia-Lao border called Khone Falls to pay the respect to the other gods.

According to Chan Samorn (2003)[7], he explains that the taste of this fish specie is so delicious which is similar to the lobster and it is exist only in Stung Treng province of Cambodia. That is why in 1993 and 1994, the first governor (H.E Li Sue) of the new coalition Government of Cambodia decided to build its statue as the symbol of the province at the provincial town.

Rainboth (1996) shows that this fish species could have the size up to 45cm. It has been considered as a Mekong endemic, which inhabiting rapidly water in medium and large sized rivers. The species feed on periphyton and phytonplankton. It is a valuable and highly desired food fish in northern province, Stung Treng, in particular in Phnom Penh. The species can be caught by using seines, gill-nets, cast-nets, and traps. It has been sold fresh and is sometimes dried and salted.

Besides this special species, another special one which is the most eye-catching mammals in the Mekong (known as Mekong Dolphin) and, at the same time, one of the most threatened. Its ecology is deeply depending on the existence of deep pools areas. The distribution of dolphin in the Mekong is restricted to the area from Kratie in the south to Stung Treng in the north and the Cambodia-Lao border. It also includes the lower stretch of the Sesan sub-catchments, which is also important in term deep pools fish habitats. This is not a coincidence since dolphins are known to spend most of their time in deep pools, for they frequently undertake “hunting” migrations following groups of migratory fishes, which constitute their prey (Poulsen and Jorgensen 2001).

I have thus far commented on the seasonal ecological niche and the links of the Mekong and its three tributaries in the province and how this becomes a vital habitat for the abundant fish species found here. The confluence of the Mekong with its tributaries has created ecological zones according to the physical characteristics. In essence, the life cycle of Mekong fish depends on the season flows of the river, its

[7] Mr. Chan Samorn is the acting director of Provincial Office of Fisheries. This account is based on my personal interview with him on 2 April 2003.

rapids, deep pools and forests of the Mekong and its tributaries that sustain migrations and provide habitats and conditions in which fishes can feed and reproduce.

However, since a large number of users have access to the river and its tributaries, and streams for a variety of purposes, it is necessary to look closely at the relationships and practices of the stakeholders employ or carry out as they make use of fish and other wetland resources for their livelihoods. I therefore intend to first explain the settlement and livelihood of fishers along the rivers and tributaries and then move on to describe the nature of relationships around these ecological terrains, in particular the community where I carried out my fieldwork.

3.3 Ecological Adaptation Among Fishers in Stung Treng Province

King and Wilder (2003) have defined the human ecology as the study on the intimate and the complex interrelationships between human communities and the environment. Importantly a focus on ecosystem has emphasized how the interaction with the use of environment resources are mediated through culture, how environments are classified and ordered in cultural terms, and the ways in which communities organize themselves to exploit particular ecological niches.

The incorporation of communities into wider economic and political systems have had dramatic consequences for human-environment relations so that human ecologist have increasingly turned to examining the environmental processes affected by population growth, technological innovation, the expansion of markets and political changes (King and Wilder 2003:261). In this part, I would like to contextualize into two parts: the main fishing ecology in the province, and the fisher's adaptations.

3.3.1 The Main Fishing Grounds and Ecology in Stung Treng

The movements of fishers in Stung Treng reflect the human settlement, adaptation, and the livelihood of fishers. Their pattern is strongly determined by the cycle of fish movement and the availability of other aquatic products in the areas. However, the most famous example is the seasonal fish spawning and migrations in the Mekong and its tributaries or streams. Local communities along these rivers and tributaries traditionally depended upon the pattern of fish migrations, and often identify themselves as seasonal and non-fixed fishers.

Many people today also have their own boats (known as *Touk Ev*) for fishing, fish trading and transportation. Before the UNTAC period (1991-1993), commercial fishing was constrained by security problems, a lack of transport on and around the rivers and tributaries and also because of the market system is not yet well-organized. In the past, people tended to rely on their neighbors and kinships for extra labor in fishing activities, but now this type of labor sharing has been almost gradually replaced by the use of hired labor or individual. In addition, agricultural activities in the Mekong's wetland zone in Stung Treng province are also expanding rapidly. Environmental problems associated with increased agriculture include not only changing land use and the loss of wetland habitats, but also the impacts from increasing use of pesticides on agricultural land (DoP 2000).

According to the report by Provincial Department of Planning (2000) shows that Stung Treng covers areas of 11,092 km^2 where the total territory has been divided into five categories of land use pattern. The forest land cover an area of 928,000 ha (83.66 %), the residential land cover an area of 103,217ha (9.31 %), while the water surface and infrastructure cover an area of 45,783 ha (4.13 %) and the agriculture land is 19,000 ha (1.71 %), while 13,200 ha (1.19 %) considered as unused land respectively.

Table 3-2: Land Use Pattern in Stung Treng Province

Category	Area (ha)	Percentage
Forestry	928,000	83.66
Residents	103,217	9.31
Agricultural land	19,000	1.71
Unused land	13,200	1.19
Water surface, infrastructure, ...	45,783	4.13
Total	1,109,200	100.00

Source: NIS (1998)

The studies conducted by the National Institute of Statistics (1998) show that Stung Treng province is divided into five districts comprising of 34 communes and 128 villages with 14,126 households comprising 81,074 inhabitants, which gives an average household size of 5.6 and 50.5 % of the population is female. There are 17 different minority groups in the province. The population of the province constitutes

less than 1 percent of Cambodia's total population. Density of population in the province is 7 per square kilometer, which is much less than the national density of 64.

Table 3-3: Territory, family size and proportion of population in Stung Treng

Indicators	**Stung Treng Province**
Total area	11,092 km^2
Number of families	14,126
Average family size	5.6
Total population	81,074
Sex ratio	98
Density of population	7

Source: DoP (2000)

As the population is low and the province is endowed with natural resources, the in-migration rate is very high. As showed in population census of 1998, 19.4% of the province's population has migrated from outside.

However, the province has been characterized as marginal in terms of geography, ecology, socially and economically. The livelihood of the local population is not only vulnerable to the affected of overexploitation of the natural resource, but is also compounded by the limited availability of basic services, such as education and health. Most education facilities are in a bad condition and are poorly supported by the government.

The recently study by the National Institute of Statistic of the Ministry of Planning (1998) shows that the illiteracy rate is very high in the province where there are only 48.4% of the total people age from seven up who can read and write. An analysis of the educational level of literate population as a whole has revealed that about 66.2 % of them had not completed the primary school level. There is only 0.3 percent who have completed beyond secondary level of education.

The report by UNDP and GEP (2000) suggest that despite the northeast Cambodia having large forest areas and has low population density; both legal and illegal logging is resulting in deforestation and forest fragmentation. Although, the

environmental rangers[8] have recruited recently to prevent some kinds of illegal activities, forest clearing and land encroachment for shifting cultivation and vegetation farms are yet to be prevented or even educate the people to understand the importance of the forest.

The report also mentions that further habitat loss and fragmentation is almost inevitable with the increasing land claims in the absence of an integrated development programs from the government. Current signs indicate that these people will convert the forest into settlement areas and field crops (UNDP and GEF 2000).

In term of fishing activities, people who are depending on fish are also moving to this pattern of fish migration in the province. In this section, I would like to highlight some main fishing sites where people come to fish seasonally. There are at least 11 main fishing grounds.

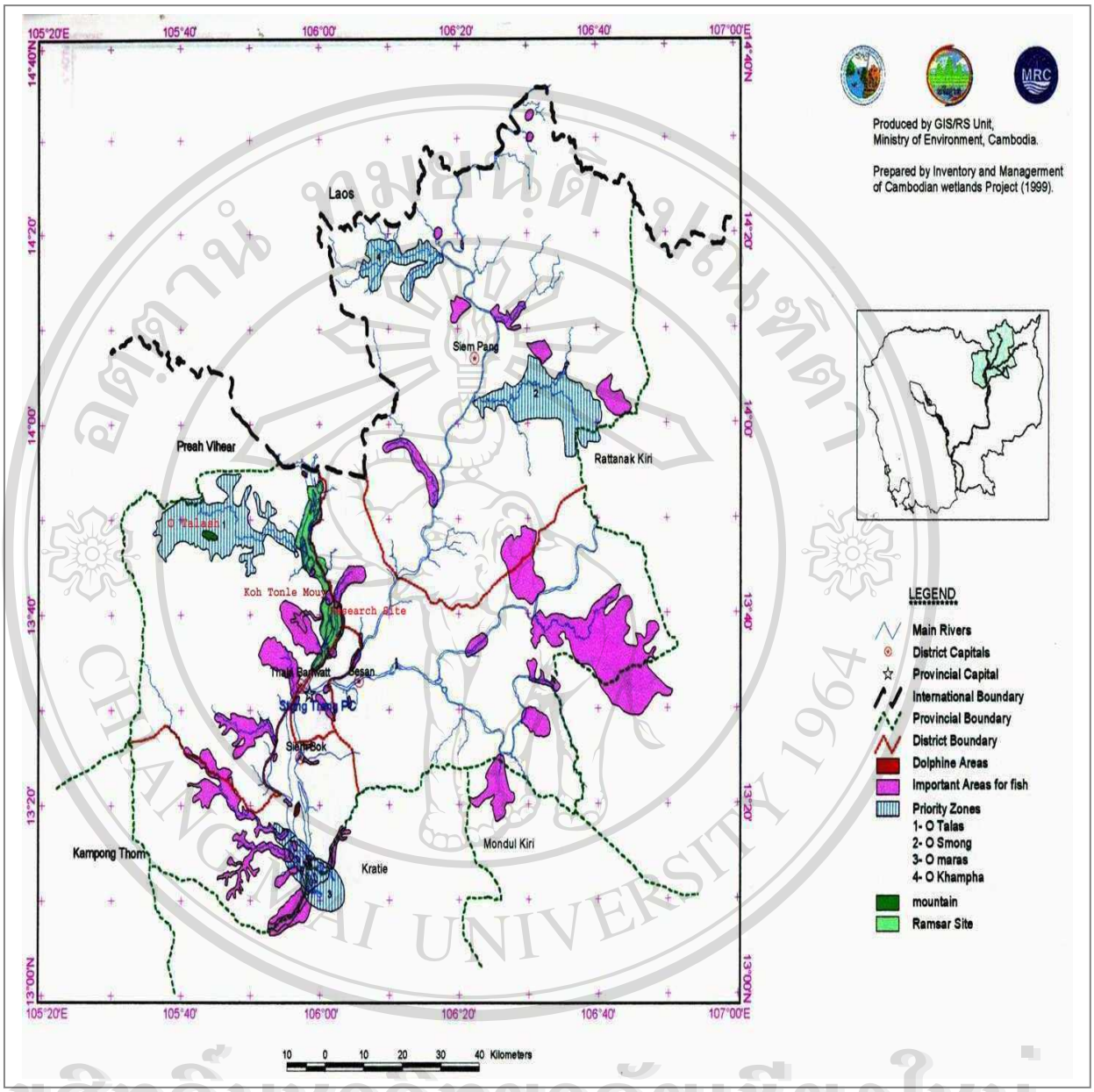
In Se San district, the fishing ground near Srepok bridge and Srepok River, is known as one of the most productive where there is no permanent settlement. Every dry season, people from other places come to fish and settle which often started from January to June. The other seasonal fishing ground is called *Veun Chan* along the Sesan River in Sesan District. This place has no permanent people living as well, but during the dry season when the most of the nearby streams along the rivers have receded, fish have to migrate out to the river and living in the deep pools and under the flooded forest there. Normally, people come to fish there from October to December.

In Srekor commune along the Se San River, a part from supporting their family, local people in this area go fishing and sell to people from Ratanakiri province. This practice is taking place from January until June. In this area, fish selling has to be selected based on the size, species, and the demand of the market. However, not all fish have to sell to local people in Ratanakiri.

For the big and valuable species, they have to be brought to Stung Treng town where there are *Moys* (fish buyers) waiting there in the provincial markets. These

[8] The environmental ranger is the government agent whose role is to protect and prevent the environmental destruct in his or her own area, in particular the Ramsar Site. These agents have to report every issues and activity regarding to the environment problem to the Provincial Department of Environment.

Moys are the fish buying companies who receives the license from the government for the exclusive right.



Map 3-3: The Main Fishing Sites and Spawning Grounds in Stung Treng
Source: The Cambodian Wetland Team (1999)

In Stung Treng district, the confluence point between the Sekong and Mekong River near the provincial town has been one of the most fishing grounds where hundred boats of fishers[9] who are using the drifting gillnets in the rivers. The confluence of Mekong with Sekong has become the only one route for all fish migration from other tributaries, Sesan and Srepok. The main fishing activities

[9] The majority of fishers are Vietnamese ethnic groups who have settled down their house in the river.

normally start from November (the peak) to January in which during this time, fishers could catch fish with thousand kilograms in some days. Most of the fishers are mixed ethnic identities such as Chams, Laos, Khmers and Vietnamese.

During this period, the condition of the water is clearly separated. The water in Sekong looks blue clear, and the water in the Mekong looks dull and brown clear. This color shows us that the water level in Sekong is shallower, while in the Mekong it is deeper. Fish and fisher are ready to move to other areas, up and downstream.

Downstream, fishers could move as far as to Siem Bok district next to Kraties province where there are several deep pools in the river. These deep pools have served as the habitats for all fish species and some are the spawning sites for *Probarbus jullieni or Seven-line barbs* (Trey Traw Sork in Khmer), *Giant barbs* (Trey Kol Reang in Khmer), *Pangasianodon hupophthalmus* (Trey Pra in Khmer) and *Small-scale croaker* (Trey Proma in Khmer). Other pools are the spawning places for mixed types of fish species.

The main fishing sites in this district are: (1) Koh Sampeay commune where people start fishing from January to June. (2) Koh Preash commune where people start to fish from January to June and (3) in O'Mras commune which is one of the biggest fishing grounds in the district where people use gillnets and fishing hooks to catch fish and then sell to the middlemen, normally fishing start from January to June as well.

Upstream, most fishers have moved along the Mekong River, in particular in Thalaboriwat district which covers the whole areas of Mekong up to Lao border. Within this river system, there are 40 islands characterized by complex ecology along the rivers such as deep pools, flooded forest and streams along the river known as Ramsar Site. With these complex ecological setting, people can fish everywhere, but the most common place is called *Koh Tonle Mouy* in Koh Sneng commune where I carried out my fieldwork.

Every year from January to May, fishers from different places and ethnicities come to fish here, in particular when the fishing grounds along the Sekong River are not profitable or the water level become shallow which trigger fish to migrate up and down the stream. During the peak time, there are around 50 fishing boats come to fish here by using drifting nets. The areas has also created good sandbar on the west side

of the riverbank which is one of the nest place for using the seine nets. That is why the Provincial Department of Agriculture, Fisheries and Forestry decided to lease these fishing grounds for seine net operation since 1995 in order to catch Trey Riels.

This year the seine nets has started since November until the end of May. From September to December, most people come to fish in O'talash close to Lao PDR border where there are mixed ethnic group, particular the Laos people who accompany their relatives who are living nearby. However, this stream is considered the most productive fish in the district where people can catch fish through their traditional practices and access.

Table 3-4: The main seasonal fishing grounds in Stung Treng province

Name of district	Name of fishing site	Seasonal fishing
Sesan	Near Srepok bridge and Srepok River	People fish form January to June
	Voeun Chan in Sesan River	October to December
	Srekor commune in Sesan River	January to June
Stung Treng	The confluence between Sekong and Mekong River	November until January
Siem Bok	Koh Sampeay commune	January to June
	Koh Preah commune	January to June
	O'Mras in O'Mras commune	January to June
Thalaboriwat	Koh Tonle Mouy in Koh Sneng	January to June
	O'Talash in Koh Sneng and Preah Romkel communes (open access)	August to January
	Vield Kscach in Kang Memai commune	January until June

The other place for fishing is called *Vield Ksach* in Thalaboriwat commune. This area is also under the process of privatization like *Koh Tonle Mouy*. In principle, they use seines nets to catch small fish, but in practice the seine nets can catch all types of fish who come across this area. Usually, fishing started from January to early of June in this area that is the open season.

Seasonal migration of fishers is a traditional practice since very long time for both fishers from inside and outside the province. The seasonal fishing can draw a large kinship together in certain places. For instance, in O'Talash, the tributary from Mekong mainstream, fisher comes to settle down there in temporary huts fishing from September to January which drawn large groups form *Laos, Chams* and *Vietnamese* in the province. This pattern of fisher livelihood is strongly linked to the general ecological characteristics of the Mekong system and other tributaries in the province. However, their fishing activities at the moment are also strongly influenced by the force of the market in which I now focus on the upstream Mekong of the province where I carried out fieldwork from early November 2002 to early April 2003.

3.3.2 The Social Network of Fishers with the Outside Market

Koh Sneng is situated along the Mekong about 25 km north of provincial town and 20 km from the district office (Thalaboriwat). This commune is about 25 km length and 20 km wide. In Koh Seng, there are four administrative villages, Koh Sneng, Koh Sror Lao, Koh Key, and Chorm Thom. These communities are all located in the wetland area (known as Ramsar Site) and on the body of the Mekong River. The total population in the commune is 2003 with 355 families. About 97.5% of people are farmers and 2% are the government officials, and 0.5% is a trader in the commune.

The social networks, in particular in Koh Sneng to the outside immediate community are critical for development of market channels. The features of fishing economy in this commune are small-scale which also require them to enter into some form of market exchange. Most of the people who live in this commune are farmers, fishermen, and few are small traders. In the small-scale and face-to-face communities, it also requires individual, neighbors and friends to interact one with another not merely in economic terms as producers, consumers, owners and coordinators of production, but also embedded in social networks, they had a more ‘ personal’ and ‘ social’ content and in a peasant economy.

In Koh Sneng, in particular during the open season, there are fishers from other places come to settle down along the riverbank, the channels, and the corridor of the island in the commune. These fishers are from outside which can be categorized with two types based on legal status, the licensed fishers and non-licensed fishers.

The non-licensed fishers are those from inside village who depend on agriculture and fishing and the seasonal fishers who settle their hut along the riverbanks, or the channels of the river and island. These fishers occupied with smaller boat used to collect fish from their traps and gill nets around evening or early in the morning at the edge of the inundated forest or along the deep pools. Most often they have their *Moys* (fish buyers or dealers) come to buy fish in the place. However, these fishers bring their fish to the market only if they have to go there for additional purposes. Seasonal fishers tend to divide labor by gender. Men went out fishing along the river channels, island corridors, and deep pools, while women stayed at huts, rears children, and undertake activities like making foodstuffs, clothes and nets, gutting fish, or operating as small-scale vendors of cigarette, wine, or beers.

The second type refers to the licensed fishers include the target and the mobile seine net fishers, the drifting gillnet fishers and the nomadic Cham fishers. This group of fishers could catch more fish with their advanced fishing nets and equipment and the labor forces. For instance, the seine nets (*ourn*) need approximately ten people to pull, and most often practiced at nighttime. They prefer this time because there are no boats and it is quieter. So large fish that stay in deep pools and flooded forest comes out to feed and migrate.

Fish at the market are categorized according to their type and size and sold at differing prices according to these categories (grade 1,2 and 3). The fish market in provincial town begins at around sunrise and continues until 8 or 10 in the morning. However, most of the fishermen now have to sell to the *'moys'* whose fish station are in the provincial town and in every district office, in particular for the big fish and valuable. These people are running fish buying companies who receive the exclusive right from the provincial office and the Ministry of Agriculture, Forestry and Fisheries at Phnom Penh. Most of the time, these companies create conflict with the local fishermen whose fish has often been devalued compared to the market price in *Vuen Kham* in Lao PDR.

However, all fish sold to the markets are not only done by a single ethnic group of fishers. In Stung Treng, there are diverse ethnic groups who are involving in fishing. The major ethnic groups are: the Khmer-Lao (Cambodian fishers), the Vietnamese and Chams (*Khmer Islam*). The Khmer-Lao people live mainly in the agricultural zone and participating in economic activity. Their households own land

rice, garden land with various forms of activities either agriculture, laboring or handicraft production. They also undertake fish processing and/or trading activities when the agricultural tasks are completed. In this regard, they sometimes buy fresh fish from fishermen in return for trade goods including rice, fruit and vegetables, bamboo, and other forest products, many of which they produce themselves or collect in the forests.

In general, the Cambodian people in Stung Treng often refer to themselves as *Nek Srok Leu* (literally uplanders) which refer to people who inhabit the agricultural zone and who grow rice and cash crops for either their own consumption or for sale. The other interesting point is that the Mekong River in Stung Treng is known in Cambodian as the Upper Mekong that is why almost of *Nek Srok Leu* 'uplanders' are also involved in fishing activities. *Nek Srok Krom* (literally 'lowland people), on the other hand, refers to people who engage in fishing or other water related activities, including navigation, transporting people and other water related livelihoods or new settlers. In terms of political and economic relations, *Nek srok Krom* are politically and economically more powerful or often known as the central people, while *Nek srok lue* is often known as less developed, less civilized, less powerful which often refer to the people who live in the periphery or marginalized regions.

Both *Nek srok leu* and *Nek srok Krom* are also markers of identity which indicate whether one belongs or is an outsider. In term of speech and voice, *Nek Srok lue* tends to speak in the right word with precise spelling of the written script, while *Nek Srok Krom* tends to speak faster and with informal intonation. In Stung Treng, however, *Nek srok leu* is regarded as insider, while *Nek srok krom* are the outsiders who come from lowland where the Mekong traverses. *Nek srok Lue* are generally small and medium-scale fishermen and to catch fish they tend to use fish traps, fences, gillnets, and Long Line Hooks which they either make themselves or purchase from other people.

The other ethnic group is called Chams (*Khmer Islam*). They are mostly full-time fishers. They also live in the provincial town consisting of less than 50 households. They have been almost totally dependent on fishing for many generations and as such have developed a range of skills and knowledge better than the Cambodian fishers for catching fish. They normally live separately from the Khmers

either in a land-based communities or on boats, but for the most part they have no land for agriculture.

The Cham people are not all from Stung Treng. They are from Kompong Cham and Phnom Penh. Most often these groups come to fish in Stung Treng from June to December which is the closed season. Some of them when the fishing season is closed they go back home and some stay fishing in Koh Key which happen around 2-3 years so far. Some come from Chroy Changva of Phnom Penh which the fishing also start from May and November. During this period, there are more Cham fishers arrive in Stung Treng province. These Cham fishers can be classified as nomadic in the sense that they are living on for fishing and travel great distance from place to place year-round to do this.

During my fieldwork in Koh Sneng, I have met the Cham people who come from as far as in Chroy Changva in Phnom Penh traveling all the way along the Mekong mainstream up Koh Sneng commune to fish. However, the Cham fishers are found everywhere in Cambodia fishing grounds along the lake, rivers, and tributaries. And they are very knowledgeable regarding to fish species and its ecology.

In Stung Treng, this ethnic group is often reported for the catching of the big and endangered fish species such as, Trey Reach (*Giant-catfish*), Trey Koul Raing (*Giant-barbs*), Trey Trawsak (*Probabus jullieni*), and Trey Pra (*Iridescent shark-catfish*). Vietnamese fishermen in the province are also blamed for catching these endangered species and small fingerlings. These fish species were reportedly caught in large number during the anarchic period (1992-98) when the law and its implementation were ineffective.

The final ethnic group who are involved with fishing in the province are the Vietnamese. They are relative newcomers having mostly arrived after the Vietnamese intervention in Cambodia in 1979. The ethnic Vietnamese[10] mostly live along the riverbank where confluence of Sekong and Mekong meet together next to the landing port. By early 2003, the community consisted of 175 households and 45 families are involved in farming snakehead fish and Trey Kes (*Glass catfish*) in the river at the confluence of Sekong and Mekong River. The confluence creates good place for fish

[10] These families are not entitled to land ownership under the Cambodian law because of their citizenship status.

and is also visually attractive. Chan Samorn (the Acting Director of Fishery Office) explains that according to the law fish cultures must be asked for permission if their size is bigger than 15 m^2, but what they have usually is 12 m^2. Each fish culture can raise fish ranging from 300kg to 1,000kgs. During the closing season, the Provincial Fishery Office invites these fishers to apply for the permission and instruction, but only 19 families have applied for the permission. Some families can have three fish raising cultures.

Besides fish farming, many of these households also raise pigs in cages under their houses and run small shops. Their livelihoods are solely on fishing and cage fish farming for their livelihoods. They are fishing the whole season that is they are moving from one place to other place irregular that is sometimes to Koh Key, Koh Hep, and O'talash. Besides these fishing areas, they go out fishing in Se San, Sre Pok and Sekong rivers. If they cannot catch fish much in Sekong River they go to *Vueng Chan*, the other place of the Mekong mainstream up to Lao PDR. Most of them move from place to place fishing along the river and tributaries. They also live on house-boats (boat-family fishers) or on the banks of rivers and tributaries, and streams while they are fishing in remote places in the province.

Their economics and livelihoods are so dynamic, and the people are knowledgeable about patterns of fish migration and places. For instance, they also buy fish from small-scale fishers and pack them in ice for transportation in which the big fish have to sell to the *Moys* waiting in the market, while the small fish are used in farms. Local fishers claim that the Vietnamese are also involved in illegal fishing activities, and, in particular, the catching of undersized fish (fingerlings–*Trey pra*), catching fish in preservation areas or zones, using destructive equipment and for introducing the practice of electrocuting fish into Cambodia.

Since the province become more integrated with the regional economy, fish tenure had become source of market demand and exclusive ownership. Later on, some fishing grounds along the Mekong River have been formed and managed by the local people in order to protect and use for their communities like the case in *Koh Tonle Moy* in Koh Sneng commune where I carried out my fieldwork.

In 2000, the local fishers organized themselves into a fishery community to control and manage the fishing ground in their commune. However, this initiative has

attracted little attention from the local authorities and resulted in the exclusion and inclusion based on the power of each group of fishers. For instance, the long distance seasonal fishers who often have access to this fishing ground has been rejected by the local community who claim they have sole collective rights to the areas. According to one Cham family who came from Phnom Penh explained that:

> We are the Cham fishers from Chrang Chomres in Phnom Penh. During the close season, we fish at *Kontuy Kor* (the cow's tail) next to the confluence of Sekong and Mekong. During open season, we move upstream fishing along the streams, tributaries and the river, in particular we often fish in *Koh Tonle Mouy*. This year our access to fishing ground in the commune has been restricted by the local people because they have their own regulation. We are the outsiders who are not their members are prohibited to fish. Therefore, we have to move to other places where there are fish available and not overlap with local fishing territory.
>
> Miss. Srey Neang, January 30, 2003
> Koh Key, Stung Treng

The case I present above show that there are multiple factors that have led to current situation, changing government policy, and restrict access to natural resources, in particular from open access to common property and private exclusive right and the overlaps of right and entitlement over fishing ground in the areas.

Some of the places that the Cham fishers mention have no people living such as in Koh Touy Kor. So that they can fish not like in Koh Sneng where there are more people living next to the fishing grounds. However, I want to show that life as fishers who come from different ethnic and places are also linked with the seasonal fish migration and the available of fish and the link with the natural environment. The relations of fishers with fish migrations are an important feature of river ecology in most major tropical rivers. Often, fish migrate several hundred kilometers in order to reach spawning sites or fertile feeding grounds, in particular cases such migrations can cover distances of several thousand kilometers and so do the seasonal fishers which I call the human environment relationships or human ecology of the Mekong in Stung Treng province.

Thus, I assume that the pattern of fish and fishers migration is strongly influenced by the dynamism and the seasonal flow of the water in the Mekong River, which is the main trigger of fish migrations. The changes in water levels (includes the rainfall, turbidity and the color of water) have also affected the pattern of fish migration. Consequently, the main periods for migratory activities occur when the

water level begins to rise at the onset of the flood season, and again when the water level begins to recede at the onset of the dry season respectively. For instance, during the peak spawning period for most species coincides with the start of rising water levels at the beginning of the flood season. In other words, the life cycles of these fish are adapted to the hydrological conditions determined by the conspicuous annual flood pulse of the Mekong River.

According to current draft fisheries law, however, both the *Cham* and the Vietnamese fishers are considered as medium-scale and are more likely to buy licenses to fish in protected areas than are the Cambodians these two groups fear and respect the law more than the latter group.

In brief, I have described fishers from different ethnic groups (Khmer-Lao, Vietnam and Chams) who live in the province and their relations with fishing communities. It is also their relations and adaptation to the surrounding environment and ecology including their everyday life used to construct and maintain a livelihood centered on the fisheries. Their subsistence and cash needs are therefore met by the river and its tributaries' resources. This is evident in the development of infrastructure such as ice production plants, the increase of fish buying companies, fish freezing and the development of aquaculture. These developments have the potential to increase, rather than decrease, conflict surround fishing in the river and its tributaries.

3.4 Summary

The confluence of the Mekong River with its tributaries Sekong, Se San and Srepok in the provincial town has contributed the complex ecology for fish spawning and migration which link the diversity of fish species around 1, 200 species in the whole Mekong Region.

Because of this unique ecology, most of the fishing grounds in Stung Treng are considered as the protected area, which allowed only the middle scale and family scale. These areas have served as special habitat for fish spawning and migration during the dry season and rainy season. However, people can fish in different types of water bodies along these rivers such as in the Mekong River, tributaries, streams, Creeks, and rice field. Fish themselves are not confined to fixed boundaries as it is

considered as fugitive resources. Fishing activities also are not fixed according to the territory. Instead, they depend on ecological conditions in the areas.

By reflecting the diversity of ecological terrain in Stung Treng, the fisheries resource is characterized with high complexity in term of different fishing practices and competition over the use of water and of other resources associated with the floodplains, lakes, rivers, streams, and creeks.

The inter-connectivity and inter-dependency of resources and habitats render them vulnerable to different interest by different resources users at the same time or at different times, in the same areas or in different areas. As a consequence, the allocation of use rights of fisheries and other resources appears to be permament sources of conflict. For instance, the fishing grounds in *Koh Tonle Mouy* and other areas has been leased by the local and provincial authorities to the commercial exploitation where local fishermen have controlled the areas for generations. As a consequence, the legitimate claim over access has been competed with stakeholders. The detail of ecological setting and diversity used by different fishers as well as their social relations to production in the study sited will be discussed and examined and discuss in the next chapter.