



(Photo by Chan Sokheng.)

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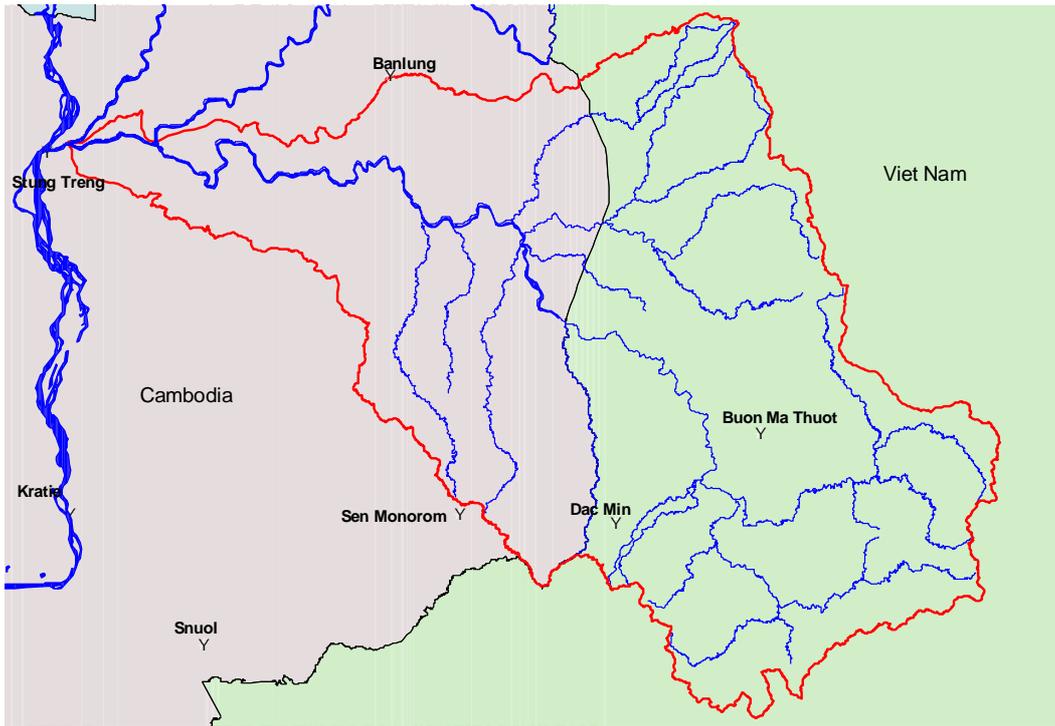
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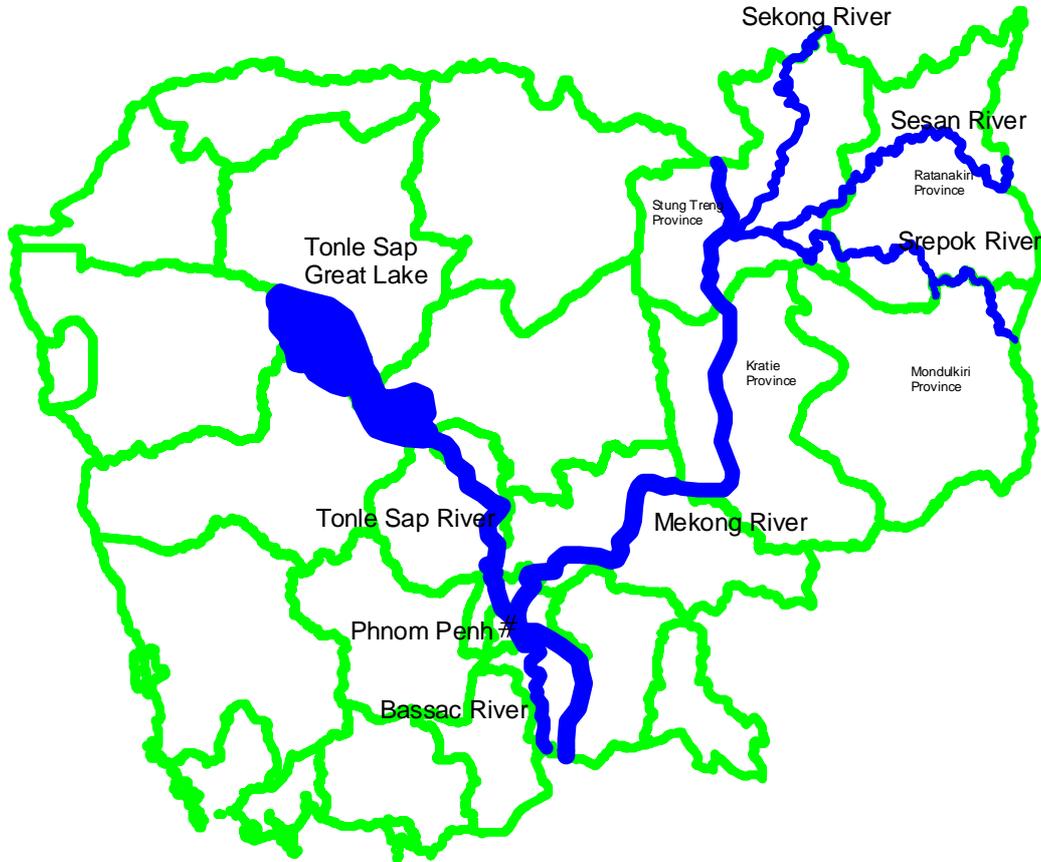
Exchange rate is approximately 4,000 Riel/US dollar  
Cover photo by Chan Sokheng

## Map of the Srepok River Basin



Adapted from Oxfam (2005).

## Map of the Major Rivers of Cambodia



## **Executive Summary**

The Srepok River is one of the major rivers of Cambodia. It originates in the Central Highlands of Viet Nam and in Cambodia flows through Monduliri and Ratanakiri provinces and finally Stung Treng, where it joins the Sesan River. The Sesan River, in turn, joins the Sekong River, just above where the Sekong empties into the Mekong River. The Srepok River basin is undergoing rapid change, with both positive and negative impacts on the livelihoods of the people who live within it. In planning for the basin's future, it is important for development actors to understand the livelihood strategies of the people living within the basin and consider how they will be affected by different kinds of changes. It was in anticipation of future development activities in the basin, including the construction of large hydropower dams, that this baseline survey of livelihoods in the Cambodian part of the Srepok River basin was commissioned.

### **The Srepok and its tributaries**

For most of its length the Srepok is very rocky, and there are numerous deep-water pools which provide important dry-season refuges for fish brood stock, contributing to the productivity of the river. There are numerous tributaries, the largest being O Leav, O Tang and O Chbar.

### **Protected areas**

The basin includes all or part of four national protected areas: Lumphat, Phnom Prich, and Phnom Nam Lyr Wildlife Sanctuaries (established by Royal Decree in 1993, and under the jurisdiction of the Ministry of Environment), and Monduliri Protected Forest (under the jurisdiction of the Forestry Administration).

### **Settlement and ethnicity**

Most villages within the Srepok River basin are inhabited by indigenous minorities, including Punong, Tampuan, Jarai, Brao/Kreung, Thmon and Kraol. Along the Srepok River itself there is a significant Lao cultural influence and ethnic Lao population. In the early 1960s, the Cambodian government under Sihanouk promoted a policy to relocate ethnic Khmer people from other provinces into Ratanakiri and Monduliri, including areas within the Srepok River basin. Beginning in the early 1970s, the Khmer Rouge relocated people in order to expand lowland rice production. After the overthrow of the Pol Pot Regime in 1979 some people began slowly to return to their original villages. Others stayed in the new settlements that had been created, often in areas that had previously been part of another village. In-migration of Khmer and, more and more, Cham families has increased considerably in the last few years.

### **Land and the concept of village**

In most of the indigenous villages we visited, people had an understanding of a territory belonging to the village, or village boundaries, and a concept of membership in the community which brings with it the right to use land within the community. In general, someone living in one village could not cross the boundary to another village and farm there, at least not without permission. The relationship of a group of people to a piece of land in indigenous communities is often closely linked to spirits associated with particular places within that area, to which people must pay close attention.

In each of the indigenous villages, there are village elders who comprise the traditional authorities. In all cases, the leadership appears to be informal in the sense that there is no ceremony or other event to appoint the village elders – they have authority because of the respect people give them. There is evidence of a breakdown in indigenous communities in many of the villages visited, owing in large part to external forces pulling the communities apart.

In recent years, land alienation has become an increasingly significant problem in communities throughout much of the Srepok River basin, despite increased awareness of the role of communities and commune councils in managing land.

### **Water regime**

Many of the villages along the Srepok River experience flooding almost every year, both in the village and in lowland rice fields. Ordinarily, this flooding does not cause damage to property or crops, and a certain amount of flooding can lead to increased crop yields by improving soil fertility. In the 2004 rainy

season, water in the Srepok River was extremely low – lower than any year since 1979 and probably long before then – and in the 2005 dry season, it was lower than anyone could remember it ever being. The low water levels have apparently led to reduced fish stocks (ordinarily high water levels during the rainy season allow for maximum fish reproduction) and have also made it easier to overfish using certain gears (including electrofishing gears).

The water regime can be expected to change in the future with the construction of hydropower dams in Viet Nam and possibly within Cambodia. Various tributaries of the Srepok have already been dammed in Viet Nam for irrigation, two hydropower dams have been built on the Srepok in Viet Nam, another is under construction on the Srepok, and one is under construction on a tributary. Impacts of dams in Viet Nam can be expected to result from both too little water (during dam construction) and too much water in the dry season (during dam operation).

## **Transport**

Transport by car and truck is becoming increasingly important, but remains difficult in much of the basin. Boat transport remains critical for fishing, collection of wildlife and forest products, going to fields, and visiting other villages, particularly for people living in villages along the Srepok River. People in these villages travel long distances along the Srepok as well as up some of the larger tributaries – sometimes as much as 100km in one trip. Villagers also travel long distances overland by oxcart or by foot – again, to fish, collect wildlife and forest products, go to their fields, or visit other villages. Elephants continue to be used for transport in some villages, and they are considered the ideal mode of transport in many cases because of their ability to travel over any kind of terrain, cross rivers, and move quickly.

## **Livelihoods**

Dependence on natural resources is one of the key features of livelihood strategies throughout the Srepok River basin. Fishing, swidden agriculture, wildlife collection, collection of non-timber forest products (NTFPs) and cattle and buffalo raising (allowing them to graze freely) are important livelihood activities in most areas, and these are closely interconnected. Alongside these livelihood strategies is lowland (wet) rice farming, practiced to varying degrees in many of the villages in the basin. Variations in ethnic composition, geographical location, local history (particularly during the 1970s under Pol Pot and the Khmer Rouge), and governance with regards to natural resources have all contributed to variations in livelihood strategies.

- 1. Lowland rice farming:** In some cases (particularly along the Srepok River itself) lowland rice cultivation has been established for as long as anyone in the village can remember, but in many villages the Khmer Rouge introduced it in the early 1970s or during the Pol Pot regime. In many indigenous villages, only a small percentage of the total rice production is in lowland fields. The effort by the Khmer Rouge to introduce lowland rice cultivation included the construction of irrigation dikes, but most of these have fallen into disrepair. Throughout the basin, rice production during the 2004 rainy season suffered heavily from drought.
- 2. Other cultivation of crops:** Swidden cultivation (in which forest or fallows are cleared and planted for several years, then abandoned and left to regrow and later recleared for planting again) was until very recently practiced throughout almost the entire Srepok River basin, with the exception of some of the villages along the Srepok River itself. Apparently, in almost all villages in the Srepok River basin in Ratanakiri, this system of cultivation has changed radically with the incorporation of the cultivation of cashews. In this new system, after cultivating other crops, people plant cashews on their fields and the fields are never fallowed so that they can regenerate as forest again. This will cause profound changes in the livelihoods of people over time, as forests are replaced by cashew plantations. There are numerous beliefs associated with swidden and swidden-like systems of cultivation, and various ceremonies are held during the course of the planting season. Along the Srepok River, dry-season vegetable gardens are planted right along the banks of the river itself, in areas underwater during the rainy season. Fruit trees are grown in almost all the survey villages, mostly around people's homes.
- 3. Animal raising:** In all the villages, people raise cattle, buffalo, pigs and chickens, and in many they raise ducks. Although in the past indigenous people may have raised animals primarily for use in sacrifices, currently in most or all villages at least some animals are sold. In several villages we heard about extensive trade in cattle across the basin and across the border to Viet Nam, both

historically and currently. In many villages there have been large numbers of deaths of cattle and buffalo owing to illness, in some cases more than 100 in one village in just one year, representing a considerable loss for villagers.

- 4. Fishing:** The Srepok River and its tributaries provide an important habitat for the reproduction of fish stocks, supporting fisheries both within the basin and throughout the country. Deep pools (some more than 30m deep), a rocky bottom over much of the river, and a low human population density all contribute to the high productivity of Srepok fisheries. Fish migrate between the Srepok and much of the upland areas within the basin via its tributaries. Villagers along the Srepok reported that migrations of fish up into the tributaries are extremely sensitive to water levels.

There were no survey villages where people do not fish. People in communities along the main Srepok River use a wide variety of gears to catch fish, depending on the season and other factors. There is no part of the Srepok that they do not get to, except for a stretch of the upper Srepok where they are no longer allowed to fish, and the range they cover in fishing by boat may span as much as 100km along the Srepok. In the dry season, they also travel long distances overland to fish in streams and ponds. These trips often combine fishing, wildlife collection, and collection of NTFPs.

People in communities within the basin but off the Srepok River (most of whom are indigenous) are also involved in a wide variety of fishing activities. In the past, indigenous people in villages throughout the basin, including those far away from the mainstream Srepok River, used two main means to catch fish: poisoning with natural poisons and blocking streams with traditional barrages made of wood and bamboo. These gears continue to be used, and people also use gillnets, castnets, fishhooks and other more recently introduced gears.

In all of the villages, people said that fish populations had decreased significantly over the past few years, and in 2005 they were less than they had ever been before. People attribute the overall low populations to electrofishing, the use of explosives and bagnets (with the protection of local authorities and government officers), and low flood levels in the 2003 and 2004 rainy seasons (the lowest in years).

All along the Srepok there are traders who are based in villages, come to villages or landing sites on motorcycle or by jeep to buy fish, or buy fish from boats. Most of the fish in the markets in Ratanakiri and Monduliri provincial towns come from the Srepok River. In every village visited for the survey, fish is an important food, and along the Srepok River itself fishing provides an important source of income. As wildlife populations decrease, or conservation efforts prevent people from consuming as much wildlife as they might otherwise, fish is becoming increasingly important.

- 5. Wildlife collection:** In villages along the Srepok River, people reported that wildlife collection and trade has been an important part of local livelihoods for generations. Probably most important was the trapping of elephants. The wildlife trade expanded in the 1990s as more and more species became targeted and trading networks became better established. In the past several years, however, management of protected areas within the Srepok River basin has become more active and efforts have been made to crack down on the collection and sale of wildlife. Despite these efforts, wildlife collection and trade remain an important part of local livelihood strategies in most villages in the basin – often combined with fishing, collection of forest products, or other livelihood activities.
- 6. Collection of forest products:** Throughout the Srepok River basin, people are heavily dependent on forest products, including wood and other materials for construction of houses and community buildings; medicinal plants; wild fruits, tubers, vegetables and mushrooms; materials used for making baskets and other crafts; honey; and resin for sealing boats and making torches. Villagers also collect forest products to sell; in some villages this contributes a major part of family income. Cutting of timber continues, both to supply external markets and for local use.
- 7. Mining:** In the past, gem and gold mining was practiced by villagers in some areas within the basin. Now, however, fewer local villagers are involved in mining, more people from outside the

area have moved in to mine, and companies are getting contracts for commercial mining operations.

- 8. Tourism:** Tourism is a growing business in both Ratanakiri and Mondulakiri provinces. A variety of tourist sites are being promoted in both provinces, including waterfalls, lakes and hills. Many of these lie within the Srepok River basin. In Ratanakiri, three of these sites have been placed under some kind of commune or community management, with income from entrance fees going to the communes or communities. Eco-tourism facilities are being developed in the Mondulakiri Protected Forest, and eco-tourism may play an important role in the local economy in the future.
- 9. Labor:** Throughout most of the Srepok River basin, selling of labor is a relatively minor element of livelihood strategies of local villagers. Historically, and now, major opportunities for employment have been more likely to benefit people from outside the local area or outside the province than local villagers.
- 10. Water supply:** In all the villages along the Srepok River, people use river water for drinking and other uses, although in some of them there are also wells. In villages off of the Srepok, people use water from wells, streams or springs. Many of the wells do not work (in some cases because they were drilled during the rainy season when the water table is high) or are inadequate. In several cases, stream water has become contaminated because of mining or concession activities.
- 11. Health:** The survey did not study health in any detail. However, in all the villages visited along the Srepok data were collected on deaths of children under 10 over the previous one-year period.

### **Implications for development practitioners**

The above description of the current situation in the Srepok River basin and analysis of changes that have occurred over time have implications for development practitioners involved in planning for the development of the basin. These include, among others:

1. People throughout the basin are extremely dependent on natural resources. At the same time, the ecosystem is fragile, governance with regards to natural resources is very weak, and any kind of development is likely to impact on natural resources.
2. Because of the interrelatedness of the different elements of livelihood strategies, any changes in one part will impact on others.
3. Without clear tenure for local communities over land and other natural resources and reinforcement of traditional mechanisms for their management, any kind of development is likely to increase land alienation among local indigenous communities and loss of their access to natural resources.
4. One of the major obstacles to development in the basin is the inadequacy of infrastructure, most notably roads. However, already, significant negative impacts of road construction have been experienced.
5. Any increased economic opportunities within the basin are likely to attract people from outside the area, increasing pressure on resources on which local people depend. Non-indigenous people are often better able to take advantages of opportunities that arise.
6. Major social changes are likely to come with any kind of development. Traditional community structures have been unable to adapt to new developments, and instead have been replaced with new ones that are often dysfunctional.
7. Villagers will become increasingly vulnerable to major trans-boundary forces and policy drivers.

## 1. Introduction

The Srepok River, called "Se Pok" in Lao (which is spoken along much of its length), is one of the major rivers of Cambodia. It originates in the Central Highlands of Viet Nam; in Cambodia, it flows through Monduliri and Ratanakiri provinces, and finally into Stung Treng, where it joins the Sesan River. The Sesan River, in turn, joins the Sekong River, just above where the Sekong empties into the Mekong River.

The total area of the Srepok River basin is about 29,450 km<sup>2</sup>, 11,250 km<sup>2</sup> of which are inside Cambodia (Mekong Secretariat, 1971). Approximately 144 villages lie within the Cambodian section of the basin, which stretches from the Ratanakiri provincial town of Banlung to the Monduliri provincial town of Sen Monorom.<sup>1</sup> The river basin in this area, on which villagers depend, is undergoing rapid change, with both positive and negative impacts on livelihoods and other aspects of their lives. In planning for the basin's future, it is important for development actors to understand the livelihood strategies of the people living within the area, and to consider how they will be affected by different kinds of development interventions.

It was in anticipation of future development activities in the basin, including the construction of large hydropower dams, that this baseline survey of livelihoods in the Cambodian section of the Srepok River basin was commissioned. The survey was designed to help the various development actors understand how people in this area make a living, and in particular how they use and manage natural resources.

The survey included a combination of fieldwork and interviews, in addition to a review of the existing literature. Fieldwork was carried out from 12 to 29 March and 16 to 25 June 2005; systematic surveys were carried out in a total of 23 villages in Ratanakiri, Monduliri and Stung Treng provinces, in northeastern Cambodia. The methodology is described in Section 1.1.

This report presents the findings of the survey. Findings on livelihoods comprise the bulk of the report; they are preceded by other findings that help to put livelihoods into context. Secondary sources are cited as relevant. References are made to two sets of case studies in particular, as the data they provide complement the current survey directly (So et al., 2001b and McAndrew et al., 2003). The case studies cover villages in five communes within the Srepok River basin in Monduliri: Pu Ropet Village, (Krang Teh Commune, Pech Roda District); Bu Sra Village (Bu Sra Commune, Pech Roda District); Sre Thom Village (Sok San Commune, Koh Nhek District); Rayo Village (one of the survey villages, in Rayo Commune, Koh Nhek District); and Dak Dam Commune (O Rang District). This report does not include recommendations regarding future development in the basin, but highlights the relevance of key findings for development planning.

### 1.1 Methodology

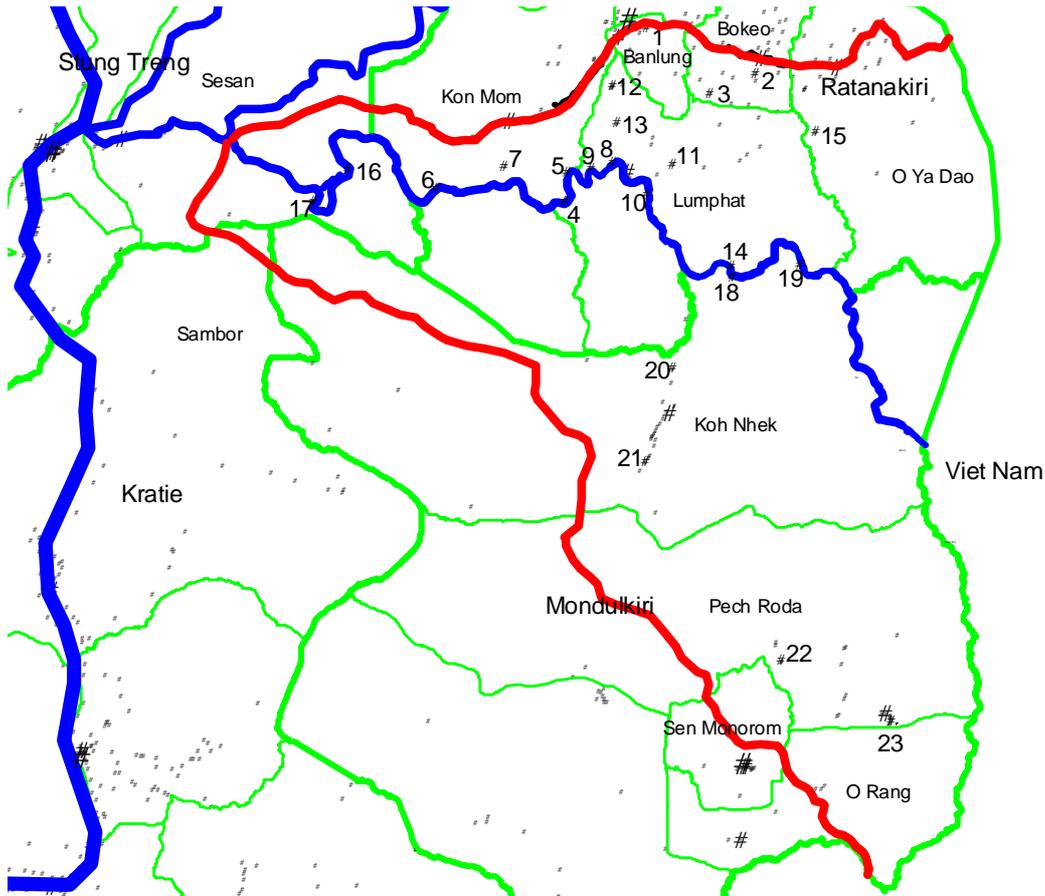
The approach used in this study included village surveys, the collection of additional qualitative and quantitative information, and a literature review. The 23 villages surveyed are listed in Annex 1, along with population and ethnic groups according to statistics of the provincial Planning departments. These villages are shown on a map of the Srepok River basin in Figure 1 below.<sup>2</sup> 12 villages are located along the Srepok River itself, and the others are located on or near tributaries or sub-tributaries (by definition, all other villages within the basin lie on or near tributaries or sub-tributaries, whether seasonal or year-round).

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<sup>1</sup> The basin in Cambodia covers all or parts 11 districts, including 41 communes: Kon Mum (6 communes), Lumphat (6), Banlung (3), Bokeo (4), O Ya Dao (5) in Ratanakiri; Koh Nhek (5 communes), Pech Roda (4), Sen Monorom (2), O Rang (1) in Monduliri; Sesan (4 communes) in Stung Treng; and Sambor (1 commune) in Kratie. It was not possible, either prior to or following fieldwork, to determine exactly how many villages lie within the basin, because the boundary of the basin could not be well defined and village locations were not accurate. However, an approximate calculation can be made of the basin boundary using topographical maps and village locations from available GIS data. These data did not include all of the same village names as did updated lists from provincial government departments, further complicating the calculation.

<sup>2</sup> Many of the villages have names in Lao or indigenous languages, but in general, Khmer names have been used throughout this report. Ka Tieng is *Kantrieng* in Brao.

**Figure 1: Map of the Srepok basin in Cambodia and target villages<sup>3</sup>**



Key: 1. Lon; 2. Nhoel; 3. Pa Ar; 4. Srepok Thom; 5. Neang Dei; 6. Phum Pir; 7. Kompong Sangkum; 8. O Kan; 9. Sam Kha; 10. Thmey; 11. Ka Laeng; 12. Kan Tieng; 13. Pruok; 14. Kaeng San; 15. Ta Kok Jarai; 16. Kbal Romeas; 17. Sre Sranok; 18. Nong Bua; 19. Koh Meayoei Loe; 20. Rayor; 21. Chi Klap; 22. Pu Chry Chang; 23. Phum Ti 6 (Pu Cha).

A total of 13 people participated in the fieldwork, but not all participated throughout;<sup>4</sup> four people visited each village to conduct the surveys. Twelve of the 21 villages along the Srepok itself were selected to represent all communes along the river.<sup>5</sup> Srepok Toch was replaced with Srepok Thom because the former was directly adjacent to another village selected (Neang Dei).

<sup>3</sup> The boundary of the basin shown here has been drawn based on topographical maps produced by the US military in the 1960s, and is not precise.

<sup>4</sup> Vuth Sarom assisted with fieldwork in Kaeng San and villages in Mondul Kiri. Sae Sophy assisted with fieldwork in O Kan, and Sem Sam-Ol and Meung Vutthy assisted with fieldwork in the villages in Stung Treng. Man Ream assisted with fieldwork in villages in Mondul Kiri. Peter Swift was the overall team leader; during the village surveys, Peter Swift and Chan Sokheng led two fieldwork teams.

<sup>5</sup> The 21 villages are, from upriver to downriver: Koh Meayoei Loe, Koh Meayoei Kraom, Peam Chimeat, Nong Bua, Kaeng San, Thmey, Dei Lo, Lumphat, O Kan, Sre Chhouk, Sam Kha, Neang Dei, Srepok Thom, Kompong Sangkum, Phum 1, Phum 2, Phum 3, Krabei Chrum, Kbal Romeas, and Sre Sranok. For the purposes of this survey, Kompong Sangkum has been considered as on the Srepok River, though houses are a considerable distance from it. During the dry season, many residents move to the river to make it easier to fish. Other villages have territories reaching to the Srepok River but do not have settlements there, and for the purposes of this survey they are not considered to be on the Srepok River. There is a settlement on the Srepok River in Kbal Romeas (Stung Treng) named "Srepok" that consists primarily of military and police and their families; it was not surveyed.

Of the estimated 123 other administrative (official) villages in the basin, 11 were selected in order to represent a range of different communes, all the major ethnic groups, and diversity in terms of proximity to major tributaries. Villages were selected to represent most major tributaries on which there are settlements (O Ka Teung, O Kan, O Chaloy, O Chip, O Tang, O Chbar, O Lve and O Phlay). They also included most of the major indigenous ethnic groups (Punong, Brao/Kreung, Jarai, and Tampuon), as well as ethnic Lao, Khmer, and Cham. Prior to fieldwork, it was not possible to know the proximity of villages to major tributaries. A best guess was made, and in the end villages on the entire range from major tributaries to the furthest reaches of some of the smallest tributaries were represented. In addition, the team visited four other villages to collect additional (primarily qualitative) information, but these villages were not surveyed systematically.<sup>6</sup>

In each of the 23 survey villages, the teams conducted interviews with the village chief, facilitated focus group discussions on fisheries, and conducted one or two individual family case studies. Between three and 31 people participated in each of the focus group discussions. Additional primarily qualitative information was collected through semi-structured interviews. For the 12 villages along the Srepok River, additional quantitative information was collected through general group discussions and women's focus groups. Guidelines or forms for each tool are given in Annex 2. These survey tools were tested in two villages, then revised for use in the remaining 21 villages. A total of five days were spent training the fieldwork teams, including two days in the field.

**Principal survey tools used in 23 villages**

- |  |   |
|--|---|
| 1. Interviews with village chiefs (all villages) | 4. Semi-structured interviews (all villages)          |
| 2. Fisheries focus groups (all villages)         | 5. General group discussions (villages on the Srepok) |
| 3. Individual family case studies (all villages) | 6. Women's focus groups (villages on the Srepok)      |

During the second period of fieldwork, additional qualitative information was collected through semi-structured interviews and mapping exercises in 11 of the survey villages, plus the four additional villages. In addition to these activities, the teams collected secondary data, visited markets, talked to fish traders and miners, visited the Lumphat Health Center, interviewed staff of the Lumphat Wildlife Sanctuary and rangers from the Srepok Wilderness Area Project in the Mondulkiri Protected Forest, and interviewed individual fishers who were particularly knowledgeable about the upper Srepok River.

A validation workshop was held on 10 November 2005 to review a near-final draft of this report and make final corrections. Participants included members of the fieldwork team, representatives of relevant government institutions, and staff of NGOs.

## **1.2 Scope and limitations**

This study attempted both to document the current situation so as to establish a baseline against which the situation in the future could be compared, and to generate an understanding of dynamics and trends so that the impacts of different development activities could, at least to some extent, be predicted. It attempted to cover the entire Srepok River basin, looking at a wide range of topics related to livelihoods, in a very short period of time. Ultimately, it was not possible to achieve all of these aims completely, and additional, more focused, research would be extremely valuable.

Only one woman participated in the fieldwork team throughout, and this must be acknowledged as a limitation of this study. In addition, the team did not include any indigenous people, which constitutes another major limitation, given that indigenous people comprise a majority of the population of the basin. However, four of the team members could speak Lao, one could speak the Punong language, and one could speak the Brao and Tampuon languages.

<sup>6</sup> The villages are: Ka Tieng (La Bang Pir Commune) and Samut Kraom (Seda Commune), in Lumphat District, Ratanakiri; Pa Yang (Lung Khung Commune), in Bokeo District, Ratanakiri; and Sre Chrey (Nang Khi Loek Commune), in Koh Nhek District, Mondulkiri.

## 2. The Srepok River and Tributaries

For most of its length the Srepok is very rocky, unlike the lower Sesan and Sekong Rivers which join together and drain much of northeastern Cambodia and southern Laos and part of the Central Highlands of Viet Nam. In the upper part of the river in Cambodia there are numerous islands, some of them large and forested. There are some sandbanks along the river, but these are less frequent than on the Sesan. Rapids make transport difficult, particularly in the upper stretches.

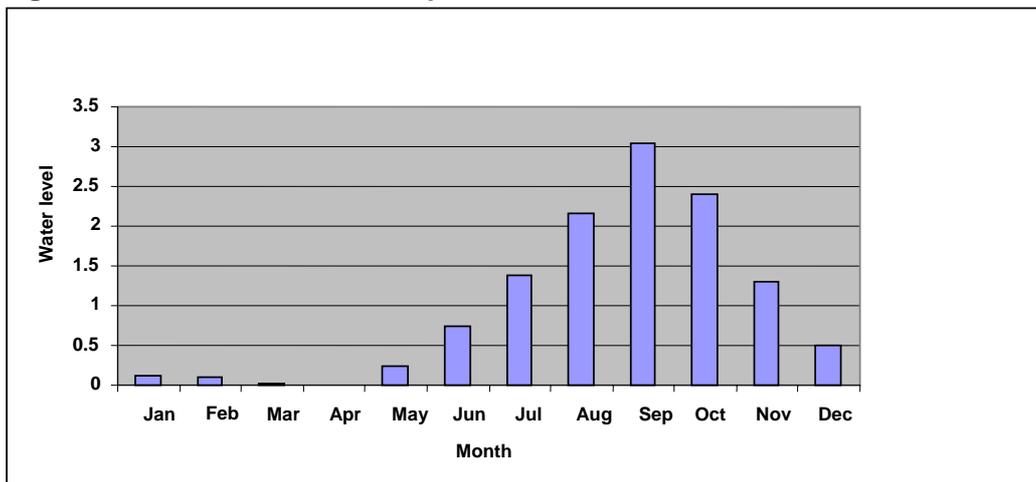
**Figure 2: Rapids on the upper Srepok**



(Photo by Rena Sugita.)

The fisheries focus groups in each of the 12 villages along the Srepok made seasonality diagrams of water levels in the river in an average year, using seeds to indicate the amount of water in each month. For each village, the baseline has been subtracted (where it was not already zero) and results normalized so that the average fluctuation above the baseline is 1 in each case. These results have then been combined to create the graph in Figure 3, where the baseline 0 represents the minimum water level.

**Figure 3: Water levels in the Srepok River**



There are numerous deep-water pools along the Srepok. These provide important dry-season refuges for fish brood stock, contributing to the productivity of the river. Those deep-water pools identified by villagers and other informants are listed in Table 1 below; their approximate positions are shown in the map in Figure 4. The deepest pool along the entire river is reportedly Anlong Phtel, in Sre Angkrong Commune (Kon Mum District).

**Table 1: Deep-water pools on the Srepok River**

No.	Name of pool	Notes
1	Anlong Tabut	Estimated dry-season depth 12m, length 1km long, said to have crocodiles and dolphins
2	Anlong Srepok	Estimated dry-season depth 25m
3	Anlong Prabanh	Estimated dry-season depth 12m
4	Anlong Koh Andet	Estimated dry-season depth 15m, said to have crocodiles and a spirit
5	Anlong Peam O So	Estimated dry-season depth 10m
6	Anlong Kut Bu	Estimated dry-season depth 15m
7	Anlong Kbal Romeas	Estimated dry-season depth 13m; also called Anlong Daoem Kdol
8	Anlong Reung	Estimated dry-season depth 12m
9	Anlong Koki	Estimated dry-season depth 34m, length 3km; deepest part is Bung Thmar Dar
10	Anlong Phtel	Estimated dry-season depth 45m, length 500m. A conservation pool under the management authority of the Sre Angkrong community fisheries.
11	Anlong Bak Roteh	Estimates of dry-season depth given variably as 14m and 34m, length 500m; also called Anlong Bung Thmar. A conservation pool under the management authority of the Sre Angkrong community fisheries.
12	Anlong Koh Sampouv	Estimated dry-season depth 11m
13	Anlong Ok	Also called Anlong Pum Rae
14	Anlong A Rong	
15	Anlong Koh Chalong	A conservation pool under the management authority of the Chey Oddam community fisheries.
16	Anlong Nha Bak	
17	Anlong Chbar	
18	Anlong Kaeng San	
19	Anlong Koh Meayoel	
20	Anlong Kalem	
21	Anlong O Leav	
22	Anlong Lve	
23	Anlong Kaeng Sang	
24	Anlong Ten	
25	Anlong Koh Lak	
26	Anlong Voen Khuy	
27	Anlong Asah	
28	Anlong Mroech	
29	Anlong Lmit	

Note: Only the deepest pools are listed. Information was provided by local community members and particularly knowledgeable fishers. For a number of the pools, the only information collected was the name. Pool names, locations and other information presented here should be considered provisional.

Figure 4 also shows the main tributaries of the Srepok. Solid lines indicate year-round flow, and dashed lines indicate those streams that stop flowing in the dry season or dry up completely. The largest tributaries are O Leav, O Tang and O Chbar. In general, on the Ratanakiri side of the river, there are many more streams that flow year round; this may help explain why there are more settlements on this side. Many of the tributaries have deep-water pools, reportedly up to three to five meters deep in the dry season.

There are numerous natural ponds or other wetlands throughout the basin. Many are connected by water to streams or the Srepok during the rainy season, and a number of them have water in the dry season.

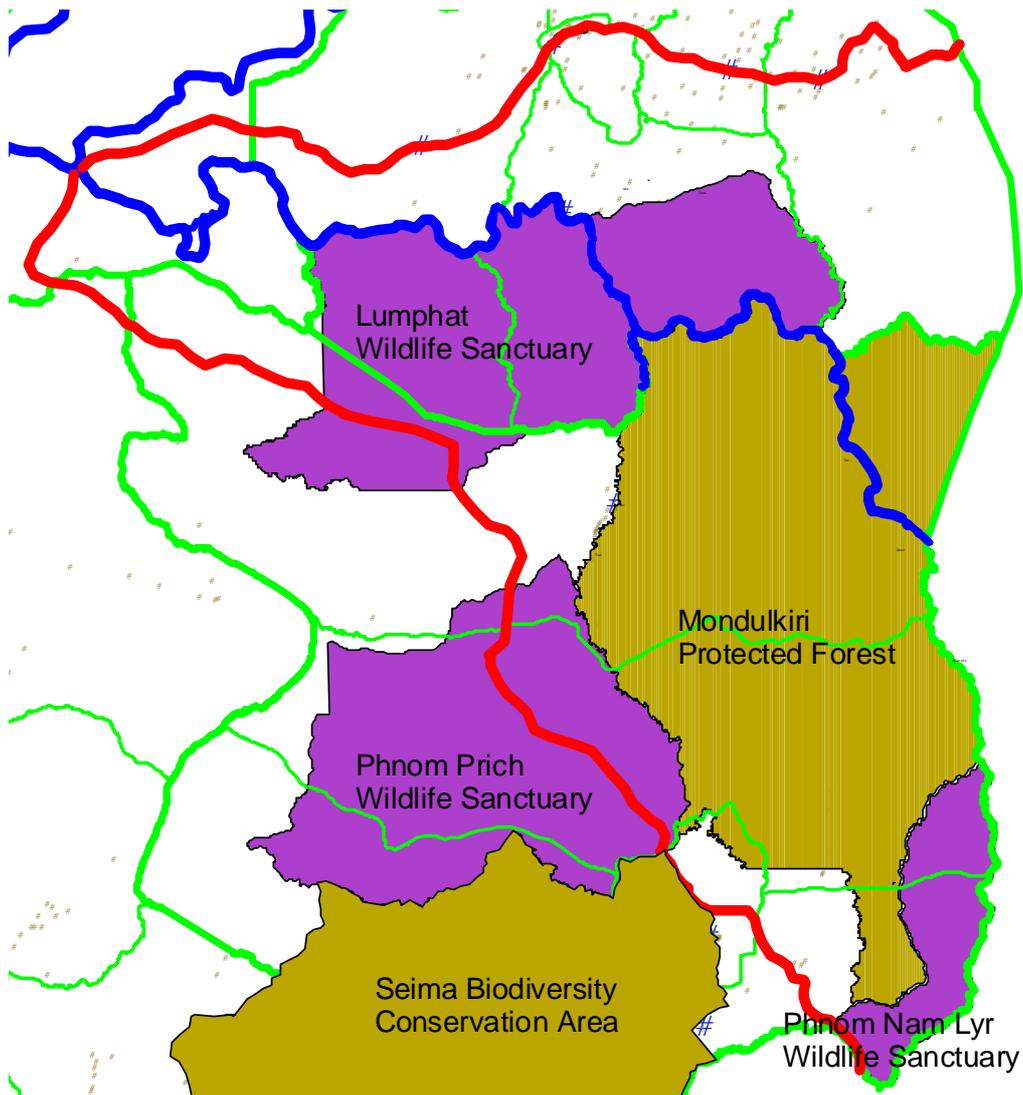
Figure 4: The Srepok River, main tributaries, and deep-water pools on the Srepok



### 3. Protected Areas

The basin includes all or parts of four protected areas. These are shown in Figure 5 below. Lumphat, Phnom Prich and Phnom Nam Lyr Wildlife Sanctuaries were all established by Royal Decree in 1993, and are under the jurisdiction of the Ministry of Environment. Mondulkiri Protected Forest is under the jurisdiction of the Forestry Administration. WWF is providing support for management of Phnom Prich Wildlife Sanctuary and Mondulkiri Protected Forest, and WildAid and Bird Life International are providing support for management of Lumphat Wildlife Sanctuary. In addition to these national protected areas, in the Ratanakiri part of the basin some provincial protected areas have been established.

**Figure 5: Protected areas in the Srepok River basin**



## 4. Settlement and Ethnicity

Ratanakiri Province was carved out of Stung Treng in 1959, and Mondulakiri out of Kratie in 1962 (Meyer, 1979). Stung Treng Province was under Lao and later Lao/Siamese control for about two centuries; only in 1904 was it given back to Cambodia (Guerin, 2001; Ironside and Baird, 2003). It is, therefore, not surprising that there is a significant Lao cultural influence, and ethnic Lao population, along the Srepok River. Lumphat, which was the capital of Ratanakiri Province prior to the Pol Pot regime, has historically been a center of the ethnic Lao population. Along the Srepok River, in Phum Pi, Neang Dei, Kaeng San, Peam Chimeat, Nong Bua and Thmey villages, people told of ethnic Lao settlements existing at least several generations ago. Some older villagers had been born in Laos, and others had parents or grandparents who were born in areas that are currently part of Laos. A similar situation was also found in Samut Loe and Samut Kraom villages (Seda Commune, Lumphat District, Ratanakiri), several kilometers from the river. The Lao settlers had reportedly heard stories of great plenty along the Srepok River. In Peam Chimeat, Nong Bua, Samut Loe and Samut Kraom, indigenous people moved into the Lao settlements, or Lao men married indigenous women; today, a majority of the population in all four villages consider themselves indigenous. Tampung settlers from Samut Loe and Samut Kraom reportedly established Kaeng San later. Kraol and Punong (called Phnong in Khmer) settlers from present-day Kratie reportedly also moved into Sre Angkrong early on, giving rise to what are now referred to as *Khmer Daoem* (original Khmer).

Koh Meayoel Loe and Koh Meayoel Kraom, the two uppermost villages on the Srepok River, were reportedly first settled by Punong people from Ban Don, a relatively large settlement on the Srepok River in what is now Viet Nam. On the lower Srepok, Sre Sranok village was established by ethnic Brao people who moved in from nearby Chrap village (roughly 10 km from the river); Punong people settled Kbal Romeas but we did not learn its early history.<sup>7</sup> Throughout most of the rest of the Srepok River basin, off the Srepok River, villagers reported that, until recently, only indigenous minority groups inhabited their local areas. In Koh Meayoel Loe, Nong Bua, and Kaeng San, Lao is still widely spoken in public. At home, however, people use the languages of their own ethnic groups.

In the early 1960s, the Cambodian government under Sihanouk promoted a policy to relocate ethnic Khmer people from other provinces into the area between Lumphat, Kon Mum and Banlung, as well as in Siem Pang District (Stung Treng Province) and along the Sesan in Ratanakiri (Ian G. Baird, personal communication). During this time, the government began to establish rubber plantations in Ratanakiri, which was an important factor in facilitating the movement of Khmers from other provinces. A number of villages were created to house rubber plantation workers. Kompong Sangkum (one of the survey villages) and Trapeang Chreh, both in Kon Mum district, were established by the Cambodian government during the 1960s, with people brought in from other provinces. At roughly the same time, a similar process of "Khmerization" was carried out in Mondulakiri Province with the development of the provincial town of Sen Monorom, and Khmers began to move into Koh Nhek District in Mondulakiri Province.

The establishment of the rubber plantations began a period of social dislocation in Ratanakiri that has continued to the present. Villages have been split, moved and combined (while often maintaining at least some of their original identity), often multiple times. With the establishment of the rubber plantations, a number of indigenous communities lost their land. According to villagers in La Bang Muoy and La Bang Pir communes (Lumphat District), the Khmer Rouge (who had a significant presence in Ratanakiri) took advantage of their discontent and began to mobilize them as well as people in other villages. During the late 1960s, many villages emptied as people joined the Khmer Rouge (supported by the Viet Cong) in the forest.

In 1970, the Cambodian government withdrew and lost control of all of Ratanakiri Province, and in Mondulakiri the Khmer Rouge and Viet Cong gained control of many areas. The US started to bomb large parts of Cambodia, including much of the Srepok River basin. This aerial bombardment, often called the "Secret War in Cambodia" continued until 1973.

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<sup>7</sup> According to a report by Partners for Development (1999) on participatory rural appraisal (PRA) exercises carried out in Kbal Romeas, the village was first founded by people from Angkrong (presumably Sre Angkrong) and Srepok Thom villages. They deserted the village and it was later reestablished by people from another village (Veal Rumpé). We were told that Kbal Romeas was formed of two villages, Rumpé and O So, joined together.

Beginning in the early 1970s, the Khmer Rouge relocated people in order to expand lowland rice production. Other than along the Srepok River itself and in a few other villages, throughout the basin lowland rice had not been cultivated before this time. Villages along the Srepok River in Mondulkiri, where people had already been cultivating lowland rice, were relocated to Koh Nhek District in 1970 to expand lowland rice production along O Chbar, one of the largest tributaries. Eventually, almost all of Mondulkiri Province was relocated to this area, possibly the only area in the province aside from the Srepok River itself where people had cultivated lowland rice in the past. In some villages of Bu Sra Commune (Pech Roda District, Mondulkiri) and Dak Dam Commune (O Rang District), people fled to Viet Nam, where they spent the Pol Pot years. In Ratanakiri, villagers were taught to farm lowland rice for the first time, in at least some cases preparing their fields by hand until their work groups could purchase buffalo. People in Ratanakiri were moved from areas suitable for upland (swidden) rice cultivation to areas more suitable for lowland rice cultivation.

After the overthrow of the Pol Pot regime in 1979, people began slowly to return to their original villages. Others stayed in the new settlements (often in areas that had previously been part of another village). In some cases, the presence of Khmer Rouge prevented people from returning to their home areas. In Mondulkiri, this led to the creation of larger villages consisting of previously isolated villages joined together for security. Over time, however, many people have moved back to their original settlements. This has created a situation whereby some villages in Ratanakiri consist of two or three separate settlements.<sup>8</sup> Many of the people from the communes of Bu Sra and Dak Dam (in the districts of Pech Roda and Sen Monorom, respectively, in Mondulkiri) who had spent the Pol Pot years in Viet Nam have now returned to their home areas. Some villages from the 1960s disappeared permanently; in Mondulkiri, there is an enormous area south of the Srepok River where there are no villages, whereas previously villages existed there. In Kaeng San, one of the survey villages along the Srepok River, only three families originally came from this village. Others are primarily from Samut Loe and Samut Kraom, about 20km away. Throughout the 1980s and most of the 1990s, the Srepok River basin remained one of the strongholds of the Khmer Rouge in northeastern Cambodia.

In-migration of Khmer and, more and more, Cham families has increased considerably in the last few years. There are also individual Vietnamese families in some villages, and larger Vietnamese populations in the provincial centers. In-migration has been associated with the growth of provincial and district centers, mining operations, plantations and land acquisition for small-scale farming. McAndrew et al. (2003) describe how in-migration began in Dak Dam Commune (O Rang District, Mondulkiri):

The first Khmer family settled in Dak Dam in 1993. The husband had built relationships with the Phnong villagers as a trader formerly based in Sen Monorom. The family was given a house and allowed to open up a *chamkar* [swidden]. Nevertheless, the household remained principally involved in trade ... Relatives of this Khmer family gradually came from Svay Rieng and settled in Dak Dam. They too engaged in small business and trading activities ... By early 2003 around 10 to 12 Khmer families lived in Dak Dam, as well as a similar number of households with Khmer husbands and Phnong wives.

Of all the areas visited, in-migration was most pronounced in Pu Chry Commune (Pech Roda District, Mondulkiri) and Ka Laeng Commune (Lumphat District, Ratanakiri). Chams have moved into Pu Chry Commune in large numbers, all of them since 2001, and there are now reportedly 300 Cham families in the commune. This in-migration has been facilitated by the provision of infrastructure, in some cases by NGOs. There is a Cham school and one commune council member is Cham. In Ka Laeng, large-scale in-migration has been associated with the gem mine at Chumrum Bei Srok, where the population was nearly 500 families as of February 2005 – almost all of them in-migrants.

In 1998, with the final defeat of the Khmer Rouge and government control of the last Khmer Rouge stronghold at Anlong Veng, UNHCR (United Nations High Commission for Refugees) helped former Khmer Rouge soldiers and their families return to their home provinces. In Mondulkiri, two new villages were established in Koh Nhek District to accommodate reintegrated Khmer Rouge: Sre Chrey and Kdei Sangkheum.<sup>9</sup>

In addition to all the permanent settlements and villages, there are also many seasonal settlements, for fishing (particularly along the Srepok River), resin tapping, swidden agriculture and other activities.

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<sup>8</sup> Among survey villages, Pruok, Ka Laeng and Ka Tieng each consist of multiple settlements.

<sup>9</sup> Many of the people resettled in Sre Chrey are originally from the villages along the Srepok in Mondulkiri Province.

Currently, in some villages in the Srepok basin, there are large numbers of people of different ethnic groups (usually because there has been a lot of in-migration in recent generations). In others, everyone is of the same ethnic group. Where in-migration happened several generations ago, or where there has been a lot of intermarriage across ethnic groups, villages often do not have a clear ethnic identity. This is the situation in many of the villages along the Srepok River itself. Where in-migration or intermarriage has happened more recently, there is often a clear dominant ethnic group, or clearly defined sub-groups within the village.

Figure 6 below shows the distribution of ethnic groups within the Srepok River basin in Cambodia, based on reports by villagers and local authorities and, in a few instances, on provincial government statistics. Ethnic groups are: Khmer, Lao, Tampuan, Jarai, Brao, Punong, Kreung, Kraol, Thmon, and Cham. Each has a distinct language, though the Brao and Kreung are closely related groups and their languages are mutually intelligible. In general, the dominant ethnic group is indicated or, in cases where there has been a great deal of recent in-migration, the dominant group prior to in-migration. For example, Sre Sranok is considered a Brao village, as the original settlers were all Brao, even though there are now many Khmer in-migrants or descendants of Khmer in-migrants living there. In some cases, there are distinct settlements of different ethnic groups within the same administrative village, and these are indicated with distinct dots where information was available.

In this map, there is almost no overlap between the ethnic groups. There are apparently no Punong villages on the northern side of the Srepok, except for Kbal Romeas in Stung Treng,<sup>10</sup> and no Jarai, Tampuan or Brao villages on the southern side of the Srepok, with the exception of the ethnically mixed Peam Chimeat, Nong Bua, and Sre Sranok. (Ethnic groups in Nong Bua and Peam Chimeat, in order of numbers, are reportedly: Tampuan, Punong, Jarai, Lao and Khmer.) The division between the Jarai villages, Tampuan villages and Brao villages is just as distinct. Along the southern bank of the Srepok River there are two villages that are essentially Punong (Koh Meayoe Kraom and Koh Meayoe Loe), and on the northern bank there is one (Kaeng San) that is essentially Tampuan. Downstream of Kaeng San, villages along the Srepok are all either Lao or Khmer (and there is a significant amount of mixing), except for Kbal Romeas and Sre Sranok in Stung Treng and the villages in Sre Angkrong Commune, Kon Mum District. Off the Srepok, we did not find any Lao villages, although Samut Loe and Samut Kraom in Lumphat District, Ratanakiri, have a strong Lao influence and many early inhabitants were immigrants from what is present-day Laos. In Koh Nhek District, Mondulakiri, there are a total of four Kraol villages/settlements and a single Thmon village. Across the border in Kratie, there are other Kraol and Thmon, as well as Punong, villages. The Kraol people in all of these villages supposedly originate from Sre Chih commune in Sambor District, Kratie.

For most of the people living in the basin, Khmer is a second or third language.<sup>11</sup> In many of the villages, language comprehension was a significant issue for fieldwork. It is also a significant issue for education. Of the villages we visited, children receive formal education in their maternal (indigenous) language only in Pa Ar (thanks to a project supported by CARE International). In the other villages, instruction is all in Khmer. In Thmey, a Khmer teacher expressed his utmost frustration at being unable to communicate with his students, who are all Lao speakers.

In general, indigenous people are Animist; the Lao and Khmers are both Buddhist and Animist; and the Chams are Muslim. However, the Punong in Kbal Romeas and at least parts of Bu Sra, and the Tampuan in Samut Loe and Samut Kraom also follow Buddhism. In some areas, Christianity has begun to take hold.<sup>12</sup>

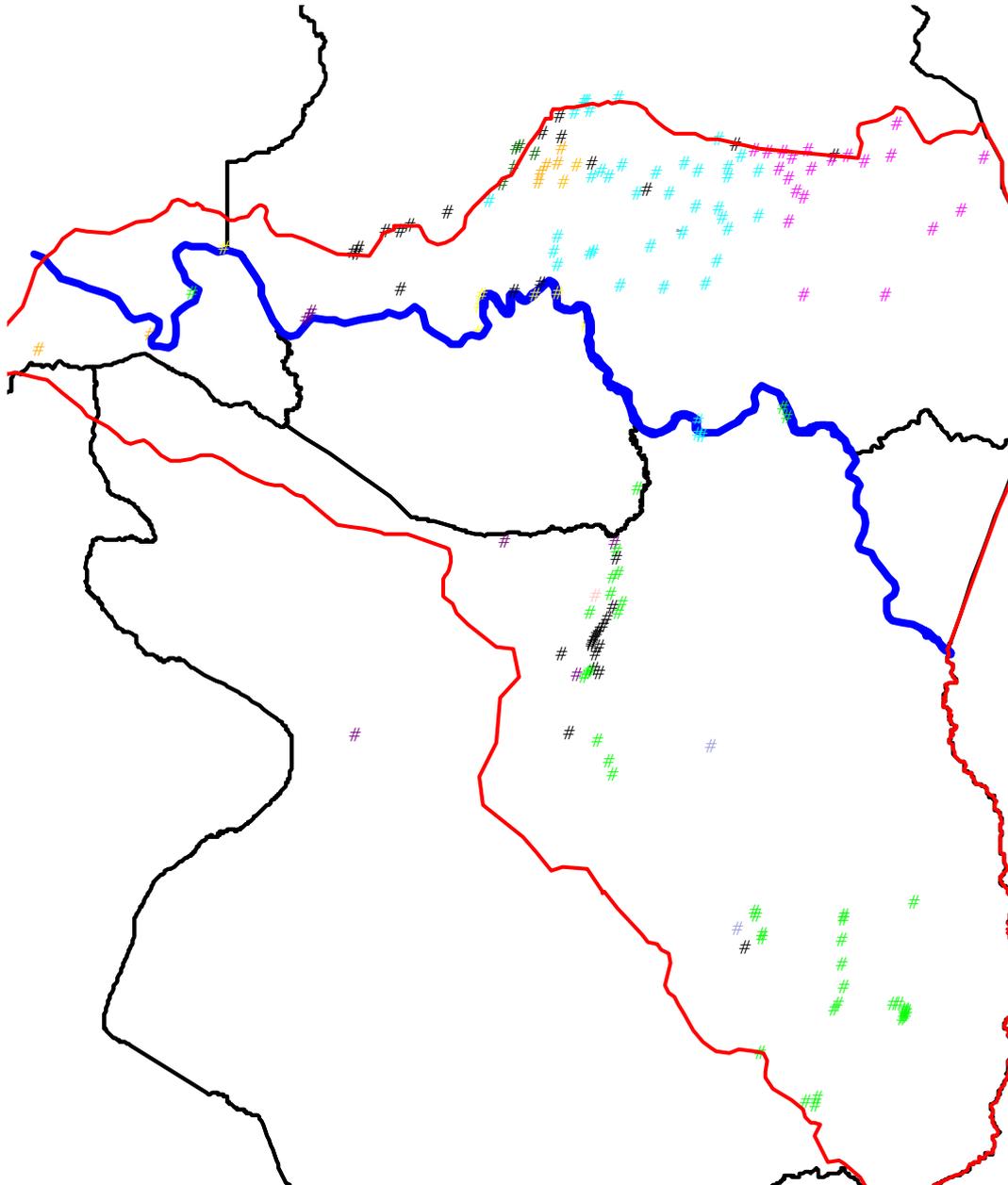
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<sup>10</sup> Government statistics indicate a majority Punong population in Ta Kok Punong, a village in O Ya Dao District, Ratanakiri. People in villages we visited almost universally reported that the population there is in fact majority Jarai, though there are strong Punong cultural and language influences. We did not visit the village.

<sup>11</sup> Khmer is now the *lingua franca* throughout most of the basin, except for those villages with large ethnic Lao populations or particularly strong Lao cultural influences, where Lao is spoken widely. However, in many of the other villages in Ratanakiri, the older generations speak better Lao than Khmer because Lao was much more widely used in the past.

<sup>12</sup> The greatest Christian influence was found in Bu Sra Commune, in Mondulakiri, where there are several churches. Christian groups there have provided funds for road construction and dry season rice cultivation. There are also Christian influences in Krang Teh Commune (Pech Roda) and Dak Dam Commune (O Rang). The village chief in Ka Tieng Village in La Bang Muoy Commune (Lumphat District, Ratanakiri) said there were about five Christian families in his village. According to Ian Baird (personal communication), some younger people have also converted to Christianity in Ka Tieng village in La Bang Pir Commune, Lumphat District.

Figure 6: Ethnic groups in the Srepok River basin in Cambodia



● Khmer	● Lao	● Cham	● Tampuan
● Kreung	● Brao	● Kraol	● Punong
● Thmon	● Jarai		

## 5. Land and the Concept of Village

In most of the indigenous villages visited, people had an understanding of a territory belonging to the village, or village boundaries. There is also a concept of membership in the community, which brings with it the right to use land within the village territory. In general, people said that someone living in one village could not cross the boundary to another village and farm there, at least not without permission. In at least some ethnic Lao villages, there is also a strong identification of boundaries. In the Khmer villages there was not (people were often waiting for boundaries to be defined by the authorities) and there was not a sense of membership in a community conferring certain rights.

The relationship of a group of people to a piece of land in indigenous communities is often closely linked to spirits associated with particular places within that area, to which people must pay attention. In some cases, there is a direct link between a particular spirit and a group of people. This appears to be the case in all the Punong villages visited, where each village has a village spirit (*neak ta* in Khmer), for which there is a village-wide ceremony once or twice each year. (Those villages where ceremonies were held twice a year – Kbal Romeas, Nong Bua and Koh Meayoei Loe – had had greater contact with Lao cultural influences.) In most of the Tampuon villages visited, there are no village-wide ceremonies for any spirits on an annual basis, and there is no single spirit associated with each village. The only exceptions were Kaeng San and Samut Kraom, where there are strong Lao cultural influences; people there identified the existence of a single village *neak ta* to be a Lao influence.

The concept of village territory manifests itself differently in different villages. In Ta Kok Jarai (a Jarai village), people said that one could plant rice in a village other than one's own but could not plant permanent crops, such as cashews. This is presumably a new phenomenon, as there were unlikely to have been permanent crops in the past. In Phum Ti 6 (Bu Sra Commune, Pech Roda District, Mondulkiri) people said that in the past one could not cross village boundaries to farm but, as of the past year, they now can. This is because they have started holding commune-wide spirit ceremonies in addition to the village-wide spirit ceremonies. In Neang Dei (an ethnic Lao village), there is a strong taboo against outsiders carrying anything into the village – if they did this, someone in the village would get sick, and the outsiders would have to be fined.

**Figure 7: Annual spirit ceremony in Chi Klap**



(Photo by Heang Sarim.)

In most cases, the territory of each indigenous village borders that of neighboring villages, with no space in between. Streams, hills and other geographical features are used to demarcate boundaries. In many cases, village boundaries that had existed prior to 1970 continue to be recognized by local communities, even though there may now be people from other villages living within them.<sup>13</sup>

In each of the indigenous villages, there are village elders who comprise the traditional authorities. In all cases, the leadership appears to be informal in the sense that there is no ceremony or other event to appoint the village elders; they have authority because of the respect people give them, in part because of their age. Decision making in most cases appears to be, and has been, more by the entire community with these elders serving facilitating roles than by the elders acting on their own. In most villages, the elders continue to play important roles in resolving conflicts, including land conflicts in some villages.

There is evidence of breakdown in indigenous communities in many of the villages visited, owing in large part to external forces pulling the communities apart. In particular, in many villages, community leaders have become involved in selling land belonging to the community, against the wishes of the community.

Participatory land-use planning (PLUP) has been carried out in many of the communes in Ratanakiri, in conjunction with the government Seila program (which supports commune councils and provincial government departments). These activities began a number of years ago and many villages now have land-use plans endorsed by the Provincial Governor. Apparently as a result of these initiatives, in several villages, community members and commune council members expressed certainty that the land within the village or commune boundaries belonged to their village or commune, and that community members and the commune council would be right to protect that land from outsiders.<sup>14</sup> In general, there is not the same level of awareness in Mondulakiri. PLUP has just recently begun in one commune (Pu Chry, in Pech Roda District) within the Srepok River basin in Mondulakiri.

In recent years, land alienation has become an increasingly significant problem in communities throughout much of the Srepok River basin, despite increased awareness (in Ratanakiri) of the role of communities and commune councils in managing land. Some of the problems in Ratanakiri have been documented by two reports by NGO Forum (2004, 2005). Areas of red soil in Ratanakiri and Mondulakiri, in particular, have been the stage of many of the recent land conflicts, as they have been in the past.<sup>15</sup> Land has been lost through the granting of concessions, land sales and land grabbing. In Ka Laeng Village (Lumphat District, Ratanakiri), land alienation has resulted from in-migration associated with the gem mine at Chumrum Bei Srok that lies within the territory of the village. In Pu Chry (Pech Roda District, Mondulakiri), outsiders have either been given land or have bought or rented it from villagers. In Ratanakiri, land grabbing and selling is leading to intense conflict between some villages, as communities make claims on ancestral land so that they can sell it. Many villagers expressed frustration with the land sales and saw that they were destroying their communities.

In June 2005, a huge conflict erupted in Dak Dam Commune (O Rang District), as well as in a neighboring commune outside of the Srepok basin. A Chinese company, Wuzhishan, had been granted a concession to plant pine trees on land that local villagers claimed as their own. At the time of fieldwork, conflict was also erupting over a 20,000 Ha concession which had been granted in O Ya Dao district for an oil palm plantation and which was being revived as a rubber plantation.

This survey did not investigate problems related to land mines and UXO.

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<sup>13</sup> Ironside (1999) describes how village borders continue to be important even as communities are forced to resettle.

<sup>14</sup> In Kaeng San, a man had recently been given permission to move into the village, and we asked villagers whether he might cause problems for the community, or try to sell land he acquired there. One woman replied, "No, our community is strong. The land here belongs to our community and we will make sure he follows our rules." In another case, we observed a land conflict between the villages of Ka Laeng and Pa Yang. Village leaders in Pa Yang pulled out the PLUP document signed by the Provincial Governor and explained how Ka Laeng villagers were violating the agreements that had been reached.

<sup>15</sup> In the 1960s, the government began to convert areas of red soil to rubber plantations in Ratanakiri. Of the survey villages, people in Lon and Ka Tieng reported that their villages had lost land to the rubber plantations.

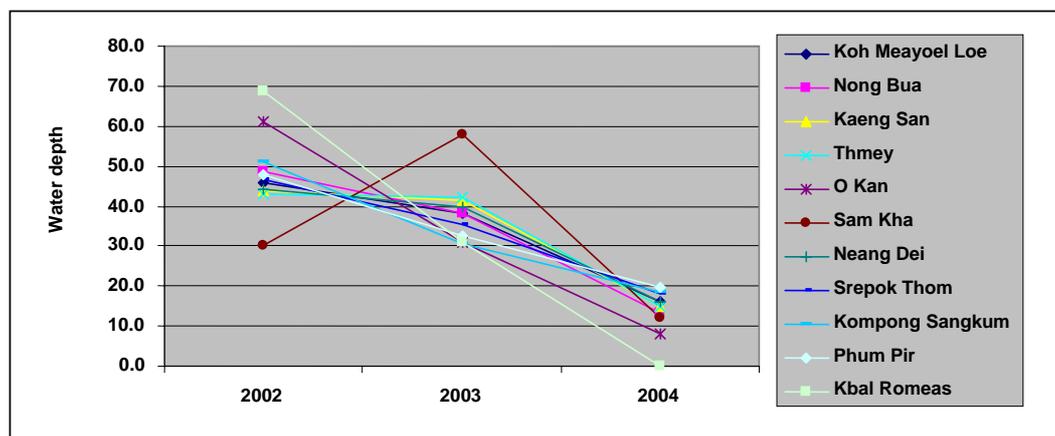
## 6. Water Regime

Many of the villages along the Srepok River experience flooding almost every year, both in the village and in lowland rice fields. Ordinarily, this flooding does not cause damage to property or crops, and a certain amount of flooding can lead to increased crop yields by improving soil fertility. Different villages, and their rice fields, are at different heights; they thus experience annual flooding differently. Waters of the Srepok River apparently do not ever flood any villages not directly on the Srepok River, although villages may experience flooding from some of the tributaries.

In each village along the Srepok River, villagers identified years in which flooding caused damage to crops (in particular, lowland rice fields). There were no cases of houses being damaged by flooding, but in several villages people reported that chickens and pigs were washed away. In most villages, people reported no major floods lasting more than a few days since 1979. Years in which flooding was greatest were not consistent between villages, though villagers could generally pin flood years down fairly precisely owing to association with other events. This inconsistency between villages is apparently because damage to rice crops by flooding depends on the depth of the water, length of the period of flooding, and stage of maturity of the rice. These conditions have differed between villages. Rice that is just ripening is particularly vulnerable to flooding, and just three days of submersion can destroy the crop. Earlier in its life cycle, rice could survive much longer periods of submersion, and flooding can actually lead to better harvests. Long-lasting floods are very damaging to crops.

In the women's focus groups in villages along the Srepok, flood levels were compared for the past three years. The results are shown in Figure 8 below:

**Figure 8: Trends in flood levels**

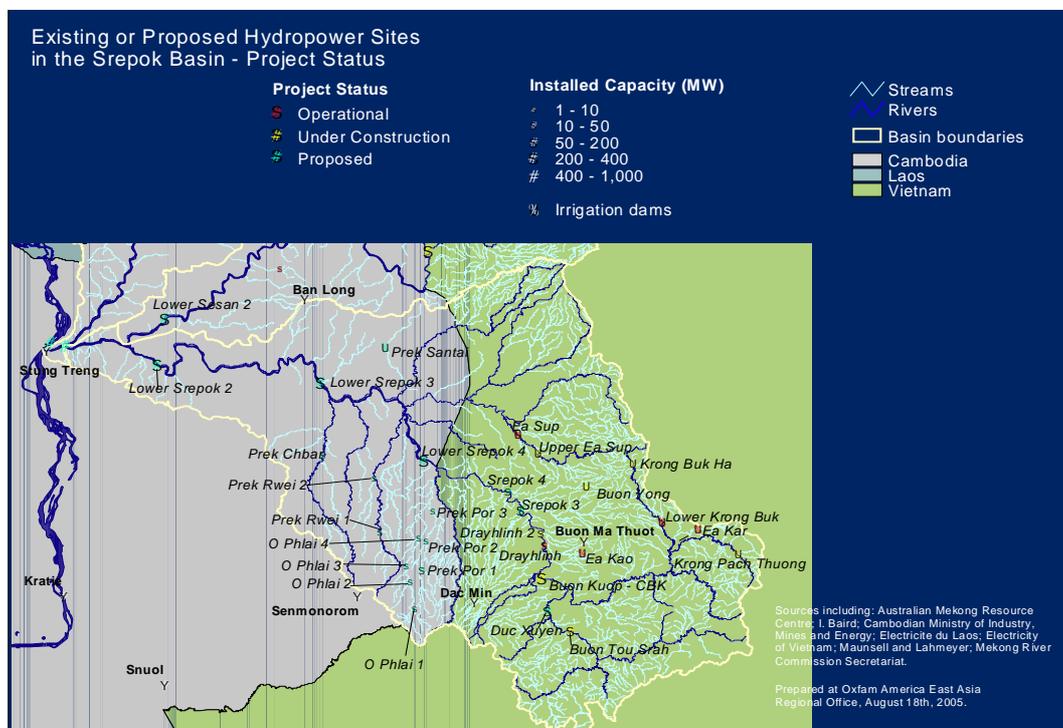


In the 2004 rainy season, water in the Srepok River was extremely low – lower than any year since 1979 and probably long before then. Flood levels during the 2003 rainy season were also lower than usual. In the 2005 dry season, water levels were lower than anyone could remember them ever being. The low water levels have apparently led to reduced fish stocks (ordinarily high water levels during the rainy season allow for maximum fish reproduction) and have also made it easier to overfish using certain methods (including electrofishing gears). Low water levels have impacted on crop cultivation along the river's banks, have made boat travel difficult, have led to damage to boats, and have made it difficult to collect water to use. During the 2005 dry season, increased growth of algae was noted in all villages along the river, and people said that this made it difficult to use gillnets for fishing. In some villages, people said that they noticed a white coating on rocks this year they had not seen in previous years, though in one village people said they had seen such a coating in other years. In many of the villages along the river, people said that in the 2005 dry season they noticed for the first time a film on top of the water and sediment when they boiled river water. And in one village (Kaeng San) they said that there was more foam on the surface of the water this year than there ordinarily is during the dry season.

The Srepok River and various tributaries have been dammed and additional dams are under construction inside Viet Nam, but the current study was unable to isolate the impacts of these dams. In the future, the water regime of the Srepok can be expected to change considerably with the construction of the additional dams, as well as others that may be built in Viet Nam and Cambodia. Figure 9 below gives a map of existing and proposed hydropower and irrigation dam sites within the Srepok River basin taken from Oxfam (2005). Two hydropower dams (Dray Hlinh and Buon Kuop) have been built on the Srepok in Viet Nam; the first is no longer operational and the second (shown as "under construction" in this map) just became operational in 2003. One other (Dray Hlinh 2) is under construction on the Srepok and the Buon Tou Srah dam is under construction on the Krong No River, a main tributary of the Srepok. Various tributaries of the Srepok have been dammed in Viet Nam for irrigation, including O Leav and other tributaries that enter the Srepok inside Viet Nam. In early 2005, a group of Vietnamese and Cambodian officials and technicians visited villages along the Srepok River in Cambodia, reportedly taking measurements that could be used to model the river and area immediately around it. Most village chiefs and villagers had not been informed of the purpose of the visits or of upriver dam construction.

Halcrow (1999) studied the potential for dams on the Srepok within Cambodia, and concluded that none of the projects considered was commercially viable, and that each would cause serious social and environmental impacts. However, a map produced by the Cambodian Ministry of Industry, Mines, and Energy shows potential sites for construction of hydropower dams in Cambodia on the Srepok and various tributaries.

**Figure 9: Existing and proposed hydropower dam sites within the basin**



Source: Oxfam (2005).

The Sesan River, into which the Srepok flows, has already been dammed upriver in Viet Nam at the Yali Falls, and impacts of the dam have been studied in some depth. These studies give an indication of what kinds of impacts can be expected from upstream dams on the Srepok or tributaries. In conjunction with NTFP (an NGO working in Ratanakiri), the Ratanakiri Fisheries Office (2000) found that:

...rainy season flooding believed to have been caused by water releases from the dam has damaged agricultural crops and flooded villages along the Se San River in Ratanakiri every year ... Massive surges of water over 2 metres high have caused serious damage downstream, including large amounts of riverbank erosion. Dry season gardens have been flooded, and a number of other dry season activities, including gold panning and foraging for food and fishing have been severely disrupted. At least 32 people have been drowned because of rainy and dry season flooding caused by the dam, and large numbers of livestock have drowned ... The river has become turbid and smells bad ... Local people report that serious human health problems have resulted from changes in water quality in the Se San River, which local people bathe in and drink.... Irregular fluctuations in the Se San River have seriously affected riverine vegetation, birds, reptiles and various aquatic life forms whose lifecycles are dependent on the natural rhythm of the Se San River .... Native fish, fish habitat and riverine fisheries have been severely impacted by changes in the hydrological regime and water quality. Fish catches have reportedly declined drastically, which has badly affected villagers, who are highly dependent on fishing for food and income. Although all fish species have apparently been impacted, large fishes may have apparently been affected more. Fish diseases have also increased. The rapidly rising waters, which occur without warning, have washed away large numbers of fishing gears and boats.

In quantifying losses in Cambodia due to the Yali Falls dam, McKenney (2001) found that:

On average, livelihood income per household decreased from about \$109 per month to \$46 per month – a drop of 57 percent ... This study estimates that local people experienced more than \$800,000 in other tangible losses from 1996 to 1999, including lost fishing equipment, boats, livestock, housing, and rice stocks ... Non-quantified impacts include deaths and illnesses, other livelihood impacts (not addressed above), livestock losses due to suspected water quality problems, and natural resource impacts ... In the future they will continue to face the prospect of significant losses. With few alternatives to pre-dam livelihood activities, it is unclear how long villagers can withstand the high level of losses and remain living along the Se San River.

Baird et al. (2002) found that flooding caused by the dam caused water in the Srepok to back up as far as Kbal Romeas (one of the survey villages in Stung Treng). Claasen (2004) documented impacts by downstream hydrological changes in the Sesan River related to the Yali falls dam on birds such as river lapwings, river terns, black-bellied terns and other species.

Similar impacts could be expected from dams on the Srepok River. It is important to recognize that impacts of dams in Viet Nam can be expected to result from both too little water (during dam construction) and too much water in the dry season (during dam operation). Dams can also be expected to impact on water quality because water is stored in reservoirs (where deeper water has low or no oxygen content) rather than allowed to flow freely (where oxygen content is high). This can result in anaerobic or rotten water being released downstream. This is true of both new and old reservoirs but is especially problematic for new ones. Changes in downriver water flow are also a serious problem that can impact on fish migrations and the whole aquatic ecosystem in general. Dams on any of the tributaries of the Srepok could potentially have similar impacts.

## 7. Transport

Until recently, villagers moved around in the Srepok River basin by five main modes of transport: boat and raft along the river, elephant, oxcart and foot. People in Thmey Village (Lumphat District) on the Srepok said that in the past they rowed boats up as far as O Leav to fish, taking two days to get there. People in Koh Meayoel Loe said that in the 1960s they took pigs, rice and other goods by bamboo raft downriver during the rainy season to Lumphat, where they sold the bamboo; they walked for five nights back to their village. People traveled to Ban Don, in Viet Nam, by elephant.

Today, transport by car and truck is becoming increasingly important, but remains difficult in much of the basin. Many roads are in bad condition or unusable by cars or all but the most rugged trucks; even when they are in good condition, there is often no regular passenger service. Cars and trucks provide regular service between Ratanakiri and Stung Treng, and between Ratanakiri and O Ya Dao district center. Buses, pick-ups and cars provide regular passenger service between Mondulkiri provincial town and Phnom Penh. Between Mondulkiri provincial town and Koh Nhek district town, a regular service is provided by Russian military jeep and truck. Transport from Mondulkiri provincial town to Mroech (on the Srepok River, upriver of Koh Meayoel Loe) is possible by Russian military jeeps used to buy fish, but they do not travel every day. Trucks used to buy fish also carry passengers from Sre Angkrong (one of the survey communes, on the Srepok River) to Banlung, the provincial town of Ratanakiri. There is also irregular service between Koh Nhek and Kratie provincial town, and between Banlung and Koh Meayoel Loe (on the Srepok River) and the gem mine at Chumrum Bei Srok. Otherwise, there is no regular passenger service by land and villagers ordinarily can only travel overland by motorcycle. Motorcycles are becoming increasingly common.

**Figure 10: Road construction in Pu Chry Commune (Pech Roda District, Mondulkiri)**



(Photo by Heang Sarim.)

Roads that have been improved include: many of the secondary and tertiary roads in Ratanakiri, the road from Mondulakiri provincial town to Bu Sra Commune, part of the road from Mondulakiri to Lumphat, and the road from Mondulakiri through O Rang district (on the route to Phnom Penh). The improvement of roads does not come without costs. The most striking evidence of this is the case of Pu Chry Commune (Pech Roda District), which lies along the road that is being improved between Mondulakiri provincial town and Lumphat district town. Massive in-migration to Pu Chry resulting in loss of land by local communities, mentioned already above, has been directly linked to construction of this road; it began as road construction began. Elsewhere (outside the basin), the construction of roads has been linked to the spread of HIV/AIDS but it was beyond the scope of this survey to investigate any such impacts.

Boat transport remains critical for fishing, collection of wildlife and forest products, going to fields, and visiting other villages, particularly for people living in villages along the Srepok River. They travel long distances along the Srepok as well as up some of the larger tributaries, sometimes as much as 100 km in one trip. Boats are used by traders to transport fish, resin and other products from villages and camps along the Srepok to Lumphat and Stung Treng. These boats also take passengers, and fish traders bring goods to fishers as needed. Rice and household goods are also transported by boats from Stung Treng to Lumphat in the rainy season, stopping along the way to sell goods in each village.<sup>16</sup> People in Kbal Romeas and Sre Sranok said they traveled to Stung Treng by boat in the rainy season rather than going overland. In Thmey, Neang Dei and Srepok Thom, people said they transported sick people to the Lumphat Health Center by boat, and people in Thmey, Neang Dei, Srepok Thom, Kompong Sangkum and Phum Pir said they used boats to go to ceremonies. Along the river, villagers also use their own boats for gathering firewood and fodder for cattle and buffalos, and crossing the river. Boat transport is also important along O Chbar stream during the rainy season, for access to and from villages in Koh Nhek District.

Villagers also travel long distances overland by oxcart or by foot – again, to fish, collect wildlife and forest products, go to their fields, or visit other villages. These activities will be described in more detail in later sections. Elephants continue to be used for transport in some villages,<sup>17</sup> and they are considered the ideal mode of transport in many cases because of their ability to travel over any kind of terrain, to cross rivers, and to move quickly. They continue to be used by indigenous people who operate barrages (*thnuos*) across streams to catch fish and by others who use them to transport resin; two are rented for use by rangers in managing a protected area (the Mondulakiri Protected Forest). In Bu Sra Commune (Pech Roda District), where there is a sizeable tourist industry, they are also used to carry tourists. In the past, many more were raised. In most cases, they were lost during the Pol Pot regime, although some died later. We did not hear of any cases of elephants in villages that had been captured from the wild since the Pol Pot regime.

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<sup>16</sup> People in O Kan estimated that there were 10 or more such boatloads a year.

<sup>17</sup> Of communes surveyed, there are three elephants in Pu Chry (Pech Roda District), one in Sok San (Koh Nhek District), three in Bu Sra (Pech Roda District), and six in La Bang Muoy (Lumphat District).

## 8. Livelihoods

Dependence on natural resources is one of the key features of livelihood strategies throughout the Srepok River basin. Fishing, swidden agriculture, wildlife collection, collection of non-timber forest products (NTFPs) and cattle and buffalo raising (allowing them to graze freely) are important livelihood activities in most areas, and they are closely interconnected. For example, on the same oxcart trip into the forest, a family may collect monitor lizards, fish in dry season ponds, and collect various NTFPs. In different areas, different activities are emphasized, and activities change over time as markets, natural conditions and villagers' demands for cash change. In many cases, the distances people travel to access these resources are significant, and there are essentially no areas that are not somehow used to support local livelihoods. These livelihood strategies are in many cases linked closely to trading networks, sometimes to overseas markets.

Alongside the livelihood strategies just mentioned is lowland (wet) rice farming, practiced to varying degrees in many of the villages in the basin. In some cases (particularly along the Srepok River itself) this has been established for as long as anyone in the village can remember, but in many villages the Khmer Rouge introduced it in the early 1970s or during the Pol Pot regime. Lowland rice fields are sometimes far from villages, and in some cases people go to live at their fields for a large part of the year. In recent years, cashew farming has become widespread, particularly in Ratanakiri, in many cases replacing the traditional swiddens. In Pu Chry commune (Pech Roda District, Mondulkiri), soybean cultivation has become similarly dominant.

Variations in ethnic composition, geographical location, local history (particularly during the 1970s under Pol Pot and the Khmer Rouge), and governance with regards to natural resources have all contributed to variations in livelihood strategies. Along the Srepok River itself, where all villages have either predominantly Lao or Khmer populations, or strong Lao and Khmer cultural influences, lowland rice farming is practiced by the vast majority.

### 8.1 Lowland (wet) rice cultivation

Throughout the Srepok River basin, most households cultivate rice – either in lowland rice fields or swiddens and swidden-like fields. The first system involves preparing fields that hold water, and plowing them. The second involves clearing forest or regrown fallows and burning the vegetation; the fields are not plowed. The soil and water requirements differ between the two systems, so ordinarily they are carried out in different locations. For example, nowhere did we find people planting lowland (wet) rice on red soils, though red soils are preferred for swiddens. According to Jeremy Ironside (personal communication), red soils are not used for lowland rice because they are too porous, but in Ratanakiri there are some black soils at the bottom of the red plateau areas that are very fertile and can be used for lowland rice. Swidden rice cultivation and variations on it will be described in the next section.

Lowland rice is cultivated in many of the villages in the basin, and of the survey villages visited, only in Pu Chry Chang (Pech Roda District, Mondulkiri) and Lon (Banlung District, Ratanakiri) is there no lowland rice cultivation. However, in many indigenous villages, only a small percentage of the total rice production is in lowland fields. Except for villages along the Srepok River itself, along O Chbar (in Koh Nhek District, Mondulkiri), and in the villages of Samut Loe and Samut Kraom (Lumphat District, Ratanakiri), it appears that indigenous people who farm lowland rice generally also farm rice in swidden or swidden-like systems as well.

Of the survey villages, people in all of the villages along the Srepok River itself, plus Rayo<sup>18</sup> along O Chbar, farmed rainfed rice prior to Khmer Rouge control of these areas – in fact, as long as anyone could remember. The same is true of Samut Loe and Samut Kraom, located about 20km from the river. So et al. (2001b) report that lowland rice cultivation began in Bu Sra Commune (Pech Roda District, Mondulkiri) in 1962. In the other areas, lowland rice production was introduced by the Khmer Rouge, and often this involved relocating to areas suitable for it, as described above. Following the fall

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<sup>18</sup> Villagers in Rayo reported that they had been farming lowland rice for as long as they could remember. However, a survey by WWF (So et al., 2001) reports that before 1975 villagers only cultivated swidden rice.

of the Pol Pot regime, people in some areas abandoned lowland rice cultivation and returned to their home villages; others continued to cultivate lowland rice. In Pu Chry Commune (Pech Roda District), villagers said that they plan to start cultivating lowland rice in the near future.

Table 2 below shows the number of families involved in lowland rice production and the average size of holdings, as reported during general group discussions and interviews with village chiefs.<sup>19</sup>

**Table 2: Lowland rice cultivation**

No.	Village	Number of families cultivating lowland rice <sup>20</sup>	Average holdings per family <sup>21</sup>
1	Srepok Thom	137/148 families	1-3 Ha
2	Neang Dei	29/31 families	1.5-2 Ha
3	Phum Pir	92/101 families	1.5-5 Ha
4	Kompong Sangkum	47/53 families	up to 5 Ha
5	O Kan	68/70 families	2-10 Ha
6	Thmey	140/152 families	up to 1.5 Ha
7	Kaeng San	75/77 families	1.5-3 Ha
8	Kbal Romeas	no data	0.7-1 Ha
9	Sre Sranok	no data	0.9-2 Ha
10	Nong Bua	no data	1.5-3 Ha
11	Koh Meayoel Loe	45/54 families	1-5 Ha

Unlike swidden, lowland rice production requires plowing, and thus the use of draught animals. Though the use of trowels (rather than draught animals) has been reported for cultivating small areas of lowland paddy in ethnic Brao villages in northern Ratanakiri Province (Ian G. Baird, personal communication), we did not encounter this. In villages along the Srepok, people said that those who had land suitable for lowland rice cultivation but lacked draught animals generally rented or borrowed (in a reciprocal arrangement) cattle or buffalo to prepare their fields. In Sam Kha, people said a pair could be rented for one season for 960kg of rice.

In some villages, people go to live at their fields for several months during the rice season. In the case of Kompong Sangkum, the entire village relocated from the Srepok River (where the village was established by the government during the 1960s) to the area where rice fields are located. Rice paddies belonging to different families are generally clustered together, though there may be up to four or five different areas of rice paddy in a given village.

The effort by the Khmer Rouge to introduce rainfed rice cultivation included, as elsewhere in the country, the construction of irrigation dikes. Figure 11 below shows the dikes built under Khmer Rouge control that we were able to identify. We heard of only one dike built prior to this time, on a pond (Trapeang Chreh) in what is now Kon Mum District (Ratanakiri); this dike was rebuilt under the Khmer Rouge but we could not identify the location on a map. Most of the dikes built under the Khmer Rouge have fallen into disrepair.

We found few examples of people pumping water from rivers, streams or ponds onto their fields; in most of the survey villages along the Srepok, the general discussion groups cited cost (inability to pay for pumps and fuel) as the main obstacle. Only in Kompong Sangkum (Kon Mum District) was lack of available water sources cited as a reason for not pumping. In Phum Pir (Kon Mum District), pumps are used to pump water onto seedbeds. Only in Bu Sra Commune in Mondulkiri did we encounter dry season rice cultivation,<sup>22</sup> although we did hear of it (but did not verify it) in a village near Lumphat that was not included in the survey, using water from O Chaloy.

<sup>19</sup> McAndrew et al. (2003) found that in Dak Dam Commune (O Rang District, Mondulkiri), only three of 65 sample households cultivated lowland rice in the previous crop season (2002 rainy season). The average area was 0.67 Ha and average yield was 330-490kg per Ha.

<sup>20</sup> Figures are the number of families cultivating lowland rice out of the total number of families in the village. Data come from village chiefs; in some cases these are only estimates.

<sup>21</sup> Data from general group discussions.

<sup>22</sup> A Christian group has provided support to dry season rice cultivation.

Figure 11: Dikes on tributaries of the Srepok<sup>23</sup>

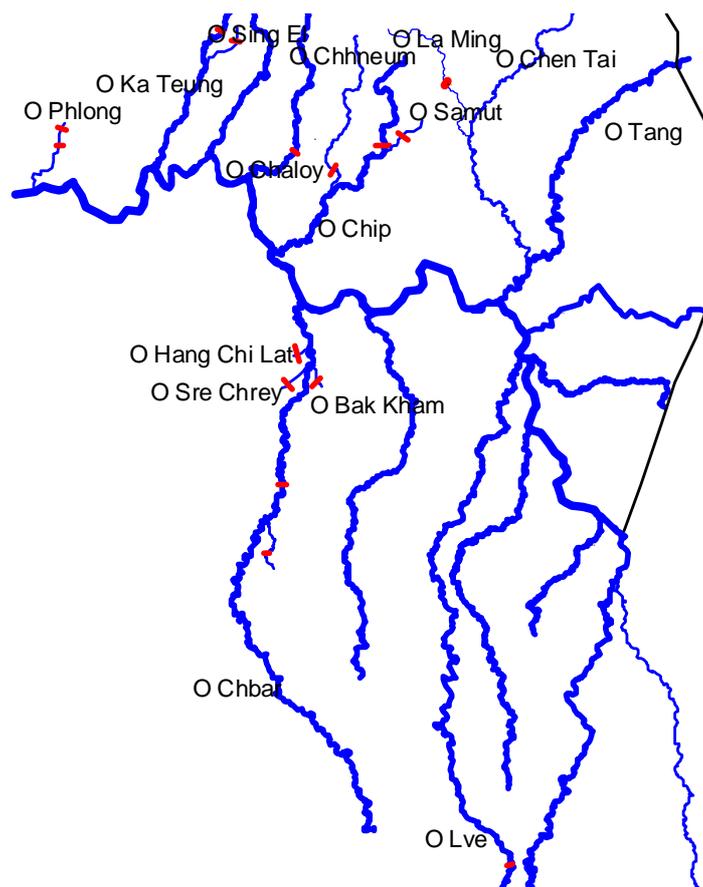


Table 3 below shows reported rice yields from lowland rice farming. They range from 700 to 3,300kg per hectare for a typical year. The yields reported are representative only and actual measurements would be necessary to produce accurate numbers. In some villages (including many of the villages along the Srepok itself, and Rayo on the O Chbar), people reported that in most years they sold large quantities of lowland rice. Estimated yields for the 2004-2005 rice season are also shown.

Table 3: Reported lowland rice yields<sup>24</sup>

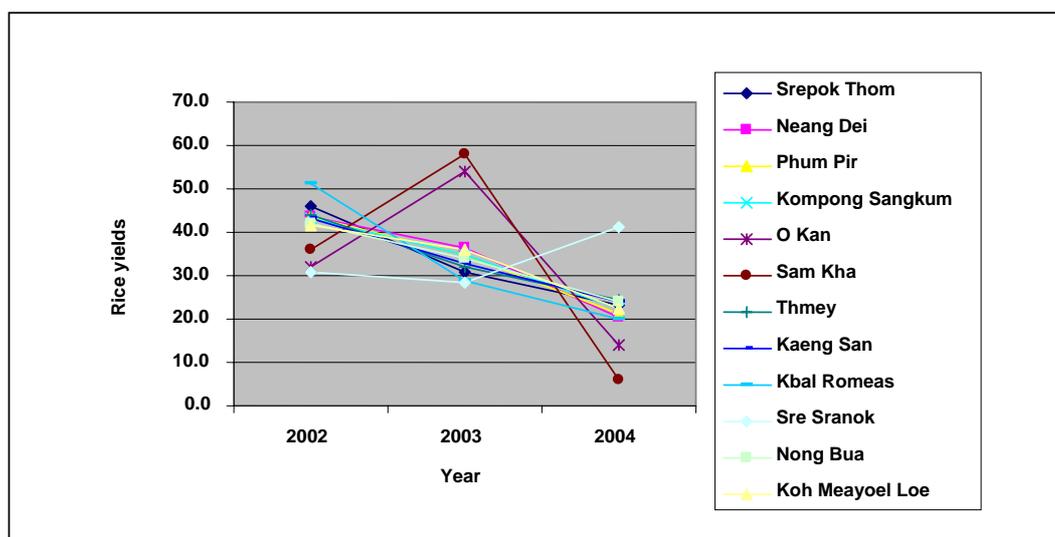
No.	Village	Typical yields	2004-2005 yields
1	Srepok Thom	2,000kg/Ha	200-300kg/Ha
2	Neang Dei	1,500-2,000kg/Ha	200kg/Ha
3	Phum Pir	1,500kg/Ha	50kg/Ha
4	Kompong Sangkum	2,000kg/Ha	1,000kg/Ha
5	O Kan	2,200-3,300kg/Ha	
6	Thmey	1,500-2,000kg/Ha	50-100kg/Ha
7	Kaeng San	1,500kg/Ha	max 100kg/Ha
8	Kbal Romeas	2,000kg/Ha	
9	Sre Sranok	1,800kg/Ha	
10	Nong Bua	7,00kg/Ha	max 150kg/Ha
11	Koh Meayoel Loe	2,000kg/Ha	max 100kg/Ha

<sup>23</sup> The map is based on reports by local community members and local authorities. The fieldwork teams did not visit any of the sites and information could not be cross-checked in all cases, so this map should be considered provisional only.

<sup>24</sup> Data is from general group discussions.

Figure 12 below shows trends in lowland rice yields over the past three years. Throughout the basin, rice production during the 2004 rainy season suffered heavily from drought. At the time of fieldwork, in March 2005, in some villages (including Chi Klap and Ka Laeng) people were eating wild potatoes (*kduech*) alongside rice. In Ka Laeng this was because they did not have any rice (a very severe situation given that the harvest had just been completed), and in Chi Klap it was to make their rice last longer. Along the Srepok River, lowland rice crops have in some years been damaged by flood. As mentioned above, there was inconsistency in the years of flood damage between villages, apparently because damage depends on the length and depth of flooding, as well as on the stage of maturity of the rice. The height of lowland rice fields varies between villages, with O Kan, Sam Kha, Sre Sranok, Sre Ankrong and Krabei Chrum having some of the highest fields, and Srepok Thom, Lumphat and Kaeng San having some of the lowest.

Figure 12. Trends in lowland rice yields<sup>25</sup>



## 8.2 Other cultivation of crops

Swidden cultivation (in which forest or fallows are cleared and planted for several years, then abandoned and left to regrow, and later re-cleared for planting again) was until very recently practiced by indigenous people throughout almost the entire Srepok River basin, with the exception of some of the villages along the Srepok River itself. In Ratanakiri at least – apparently in almost all villages in the basin there – this system of cultivation has changed radically, with the incorporation of the cultivation of cashew trees. In this new system, after cultivating other crops, people plant cashews on their fields and the fields are never fallowed so that they can regenerate as forest again. This will cause profound changes in the livelihoods of people over time, as forests are replaced by cashew plantations.

Whether people practice swidden or this new system, in which cashews are ultimately planted, the main crop planted (initially, in the latter case) is generally rice. In either system, forest or fallows are cleared and burned, but the fields are not plowed. A good burn is necessary to ensure a good crop. People ordinarily avoid clearing areas of large trees because of the spirits associated with them; it also requires a lot of labor and can be dangerous. Regrown fallows are often the most suitable areas for clearing. Crops are planted using a dibble stick, or two dibble sticks per person (one in each hand), and fields are weeded but not watered. Seeds of different crops may be mixed in with rice seed before it is sown, and other crops can be planted among the rice plants or in parts of the fields. Crops planted include, among many others, sesame, squash, gourds, cucumbers, chili, corn and sugarcane. After a few years (the number depending on the fertility of the soil) rice can no longer be planted because

<sup>25</sup> Data is from ranking exercises conducted by women's focus groups, and has been normalized so that the total for each village over three years is 100. Yields cannot be compared between villages for a given year.

weeds grow too profusely; for poor quality soils, rice can only be planted one year. The best quality soils are generally red, and rice can be planted for several years in succession. These lands have also been the target of numerous disputes as mentioned above. In a traditional swidden system, when rice can no longer be planted, farmers move on to a new area, and plant other crops on the old fields and eventually allow them to regrow into forest that years later someone (it might or might not be the original cultivators) could clear to plant a new crop. In the new system, farmers plant cashews at this point.

Baird (1995), Baird et al. (1996), and Ironside and Baird (2003) give more thorough descriptions of traditional swidden systems in the Sesan River basin in Ratanakiri, and ICC (2003) describes swidden cultivation in four districts of Mondulakiri. Within the Srepok River basin, McAndrew et al. (2003) describe swidden cultivation in Dak Dam Commune:

In Dak Dam, 64 of the 65 sample households cultivated swidden plots. Of these, 63 harvested rice in the last crop season. The average swidden plot size of the rice cultivators was 1.3 hectares. The average rice yield of 0.67 tons or 0.52 tons per hectare was low ... Other than rice, swidden farmers in the Dak Dam sample cultivated more than 40 kinds of vegetables and fruits. The swidden crops harvested by most Dak Dam households in the last crop season were ginger, corn, chilli, eggplant, and bottle gourd.

So et al. (2001b) described swidden cultivation in Pu Ropet Village (Krang Teh Commune, Pech Roda District):

The villagers have practiced swidden or shifting cultivation for centuries. The people grow rice, corn, beans, pumpkins, eggplant, etc. Depending on the rain, they are able to harvest only one crop per year. At present the people say they do not plan to shift to other new areas, but continue to cultivate their crops in the same plots near their village, as there is increasing pressure to not cut new cultivation sites. Each family has 2-3 plots for farming. Each plot is one ha. Normally they can cultivate one plot for 5-9 years, depending on the fertility of the soil. The Village Chief reported that there are only 10 families practicing shifting cultivation while the others do permanent paddy rice cultivation since they feel that shifting cultivation is time consuming, difficult and has a low yield. Rice produced on the swidden sites is for consumption only, not for sale.

And in Bu Sra Commune (Pech Roda District):

The highland rice field is developed in forested areas on the plateau and along the stream banks containing hard wood trees and dense tree species (Sokram, Pchek, Beng, Koki). These areas are rich in natural fertilizers and close to water sources and provide high yields for rice cultivation. Each shifting cultivation field lasts for 3-4 years. After they have used up the existing fertilizer on the surface they move to a new area. At present, off-village shifting rice fields provide low yields, but are still the main practice for villagers.

There are numerous beliefs associated with this kind of cultivation, and various ceremonies are held during the course of the planting season. Fields are often far from home, and during much of the year many people go to live at their fields. ICC (2003) found that "all of the Bunong [Punong] have a dual abode. They have one home in the village and another home in the *mir* [swidden] and their time is divided between these two locations."

In these systems, fields are often near streams (but on relatively high ground that does not flood or become soggy), because that is where soils are most fertile and because people need a source of water for drinking and use while they tend their fields. In Sre Sranok Village (Stung Treng) people said that they plant swiddens near streams because that is where the bamboo forests are, and these are preferred because they produce fertile fields.

Rice planted this way ordinarily ripens before lowland rice. We did not try to determine yields, which would have been even more difficult than in the case of lowland rice because of uncertainties in the areas of fields. Rice yields are ordinarily slightly lower than yields from lowland rice, but it is important to remember that a wide variety of other crops are planted together with the rice.<sup>26</sup> There may also be

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<sup>26</sup> Guerin (2001) presents historical evidence from Siem Pang District in Stung Treng that "the yields of the swidden fields are generally superior to that of the wet rice fields in this region ... On the other hand, on top of the rice, the harvests of the swiddens are significant and provide most of the corn the region needs in July-August. The swiddens also supply commercial products such as Chinese nettle and chilli sold to the Lao. Therefore we can affirm that the swiddens show better results than the wet rice cultivation in the region of Stung Treng, at the beginning of the 20th century."

less risk than in planting lowland rice, in which requirements for intense rainfall at certain times of the year are stricter; most upland farmers manage to get some kind of crop most years, but this is not necessarily the case with lowland rice cultivation (Jeremy Ironside, personal communication). In many cases, people depend entirely on these rice crops because they do not plant lowland rice. Like lowland rice, upland rice crops suffered heavily from drought in the 2004 rainy season but, ordinarily, they are not susceptible to flooding because they are planted on higher ground.

These systems are not practiced in most of the villages along the Srepok River itself, nor in other villages where lowland rice is particularly dominant (such as Rayo, in Koh Nhek District, and Samut Kraom and Samut Loe, in Lumphat District). In these villages, rice is grown almost entirely in lowland rice paddies – although in Sre Sranok (Stung Treng), rice is grown using techniques similar to swidden with the intention of converting fields to lowland rice cultivation in the future. However, in most of the villages along the Srepok people plant various upland crops and vegetables in permanent fields. In some of these villages (such as Peam Chimeat, Nong Bua, Koh Meayoel Loe and Thmey) these fields are along the river or adjacent to lowland rice fields; in others (such as O Kan), they are in areas distinct from rice paddies and away from the river. Sizes of these fields were reported to be from 30-50 ares (in Sre Sranok) to 1-2 Ha (O Kan and Neang Dei) and 1-5 Ha (Phum Pir in Sre Angkrong Commune). In villages along the Srepok River, corn, cassava, sugarcane, pumpkins and squash are also planted around homes in the rainy season.

In some villages where lowland rice is dominant, people have also begun to clear additional fields in the past few years to plant cashews,<sup>27</sup> though in others<sup>28</sup> they said the soil was not suitable for growing cashews. More and more, also, in villages where people have traditionally cultivated swidden, they are clearing the forest and planting cashews without first planting rice or other crops. In these villages, most trees have been planted within the last three or four years. According to the Ratanakiri Provincial Department of Agriculture, cashew cultivation in Ratanakiri started in 1997 or 1998; in 2000, people started to plant cashews on a large scale. In 1998-1989, CAREERE provided seedlings through the Ratanakiri Department of Agriculture. In Mondulkiri, cashew cultivation reportedly started in 1996. Cashews used to be exported to Viet Nam, but in 2005 cashews from Ratanakiri at least were going instead to Memot District, Kompong Cham Province, where they were processed in a factory. In 2005, cashews brought a price of 2,000-4,000 Riel per kg in Ratanakiri, which amounts to about 1-2 million Riel per hectare per year when trees are mature<sup>29</sup> - they begin to bear fruit after two to three years. Cashews are easy to plant and require little care. Villagers are more and more becoming dependent on this single crop, for which the price is currently high, but the future is uncertain, given increased production in Viet Nam and other countries. This makes people very vulnerable to shifts in international markets over which they have no control.

In Bu Sra Commune (Pech Roda District, Mondulkiri), people planted coffee on a fairly large scale several years ago. The price of coffee on the international market dropped and people stopped tending their coffee trees, as it became too expensive to fertilize and water them. People have recently begun to plant pepper instead. In Pu Chry, soy beans are planted on a large scale.

Along the Srepok River, most dry-season vegetable gardens are located right along the banks of the river itself, in areas underwater during the rainy season. In these areas, the soil is relatively moist and watering is relatively easy. People ordinarily plant crops along the river directly in front of their houses so they can watch over them. There is little cultivation of vegetables in other areas during the dry season (apparently there is more in the rainy season) and people seem to rely on wild vegetables. (In ranking exercises carried out by the women's focus groups in villages along the Srepok River, consumption of wild vegetables was consistently ranked higher than domestic vegetables in both dry and rainy seasons.) People reported planting crops along the river banks from November or December to March or April. They plant the crops when the river water recedes; occasionally, the water level has risen again and the crops are destroyed.<sup>30</sup> People in Sre Sranok said that if the water rose, they were often able to salvage some of the vegetables by digging up the crops and planting them on higher land. Crops planted include: various green herbs, tobacco, lemongrass, scallions, cabbage, "morning glory" (*trakuen*), chili and other vegetables. In the 2005 dry season, fewer people planted vegetables

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<sup>27</sup> For example, in Sre Angkrong, people have planted cashews for two years now, and in Sam Kha and Koh Meayoel Loe people started planting cashews in 2005.

<sup>28</sup> For example, Thmey and Kaeng San.

<sup>29</sup> Yields are estimated to be 500kg/Ha (Jeremy Ironside, personal communication).

<sup>30</sup> This happened in O Kan in 1991 and Kbal Romeas in 1998.

along the Srepok than in other years because the rains ended very early and the soil dried out. In Sam Kha, people said also that this year they were busy clearing fields for upland crops, including cashews. In addition to gardens along the Srepok, we also saw vegetable gardens along the O Chhbar stream in Koh Nhek District (Mondulkiri).

**Figure 13: Vegetable garden on the bank of the Srepok River in Sre Angkrong**



(Photo by Chan Sokheng)

Fruit trees are grown in almost all the survey villages, mostly around people's homes. Fruit is most abundant in the long established villages along the Srepok River. Some of the villages on the upper Srepok, and many of the others, have only been recently established; most indigenous groups do not have a long tradition of planting fruit trees. Along the Srepok, the predominant trees are mangoes, coconuts, jackfruit, lemons, guava and milkfruit. Bananas, papayas and pineapples are also common throughout the basin.

### **8.3 Animal raising**

In all villages, people raise cattle, buffalo, pigs and chickens, and in many they raise ducks. Other writers have noted that in the past, indigenous people raised animals primarily for use in sacrifices (Matras-Troubetzkoy, 1983; Ironside and Baird 2003). Currently, however, it appears that, in most or all villages, at least some animals are sold. In many, cattle and buffalo are used as draught animals. People in Koh Meayoel Loe (Mondulkiri) recalled floating pigs downriver by raft to sell in Lumphat during the 1960s, and said that years ago people in the village traveled to Ban Don (in present-day Viet Nam) by elephant to sell chickens and pigs and visit relatives.

In several villages we heard about extensive trade in cattle across the basin and across the border to Viet Nam, both historically and recently. In Koh Meayoel Loe, people said that early Lao settlers in this village came to buy buffalo to sell in Ban Don and Pleiku in Viet Nam. In Neang Dei, people said that, up until two years ago, people from Ban Don came to buy cattle and buffalo in the village; in Sam Kha

they said they did so up until six or seven years ago. Up until four years ago, people in Samut Kraom bought cattle in villages near Lumphat, to sell in Viet Nam, and someone from Kaeng San had taken buffalo to Ban Don to sell as recently as 2004. In recent years, export of cattle and buffalo to Viet Nam has become increasingly restricted. People also bought cattle and buffalo in Kaeng San and Peam Chimeat to sell in villages in Kratie up to five years ago, and people in Srepok Thom said that they had been to villages in Kratie to buy cattle. A Ratanakiri provincial Animal Health and Production officer reported that Oknha Mong Retthy, a Cambodian investor, bought cattle in Kon Mum and Lumphat Districts (as well as Veun Sai along the Sesan River) in 2003 and 2004 to export to Malaysia, but has now stopped buying them.

Table 4 below gives statistics provided by village chiefs on the number of people with cattle and buffalo in the survey villages. Cattle and buffalo are used as draught animals in farming lowland rice and pulling oxcarts, and they are also used in ceremonies in indigenous communities (as are pigs and chickens). Cattle and buffalo are also investments and can be sold when a large sum of money is needed. Almost all families raise chickens, and many raise pigs, but no numbers were collected for either. Both pigs and chickens are important sources of income.

**Table 4: Number of families with cattle and buffalo**

No.	Village	Total number of families in village	Number of families with cattle and buffalo
1	Nhoel	50	6
2	Pa Ar	99	14
3	Srepok Thom	148	75
4	Neang Dei	31	31
5	Phum Pi	101	95
6	Kompong Sangkum	53	46
7	O Kan	70	35
8	Thmey	152	147
9	Pruok	121	15
10	Kaeng San	77	68
11	Ta Kok Jarai	58	14
12	Kbal Romeas	99	96
13	Koh Meayoe Loe	54	46

In almost all villages, cattle and buffalo are released to wander on their own during the dry season when they are not needed, often in degraded forest where it is relatively cool, near the village and near ponds and other water bodies. When it is time to farm again, people go to bring them back. Cattle or buffalo that are used for work are kept tied or are driven back to their pens every evening. In some of the villages along the Srepok River, people said that a function of annual village spirit ceremonies is to ask the spirits to take care of the cattle when they are left to roam freely, and to ensure that the cattle can be found again when needed.

In virtually every village, many buffalo and cattle die each year of disease. Villagers along the Srepok described four main sets of symptoms, three of which probably correspond to Hemorrhagic Septicemia, Foot and Mouth, and mineral deficiencies (Ashish John, personal communication). The fourth, with the main symptom being bloody diarrhea, could be a number of different conditions. In most villages, the condition interpreted to be mineral deficiencies (with symptoms including limp hips and legs making the animal unable to walk) was said to have occurred during the 2005 dry season for the first time.

In some cases more than 100 cattle or buffalo have died in one village in just one year, representing a considerable loss for villagers. Table 5 below shows the number of cattle and buffalo reported to have died in villages along the Srepok River in 2004.

**Table 5: Deaths of cattle and buffalo in 2004<sup>31</sup>**

No.	Village	Deaths in 2004
1	Srepok Thom	25 cattle and 12 buffalo
2	Neang Dei	4 cattle and buffalo
3	Phum Pir	150 cattle and buffalo
4	Kompong Sangkum	15 cattle and buffalo
5	O Kan	10 cattle and 10 buffalo
6	Sam Kha	20 cattle and buffalo
7	Thmey	30 cattle and 20 buffalo
8	Kaeng San	15 cattle and buffalo
9	Kbal Romeas	20-30 cattle and 60 buffalo
10	Sre Sranok	30 cattle, and 110 buffalo
11	Nong Bua	100 cattle and buffalo
12	Koh Meayoel Loe	10 cattle and buffalo

In most villages along the Srepok, people said that deaths of cattle and buffalo were higher during the past year than in previous years.

The importance of elephants as a mode of transportation has already been mentioned. In several villages along the Srepok River, people told us that trapping elephants was one of the major livelihood activities in the past. People in Koh Meayoel Loe also said that, in addition to trapping their own elephants, people in this village bought them in Ban Don in exchange for buffalo. Raising elephants involves various rituals. In Samut Kraom, people said that elephant owners sacrifice chickens once every two months and pigs twice a year to a spirit associated with the elephant, and in Koh Meayoel Loe, they said that elephant owners must sacrifice a pig once a year.

## 8.4 Fishing

The Srepok River and its tributaries provide an important habitat for the reproduction of fish stocks, supporting fisheries both within the basin and throughout the country. Deep pools (some more than 30m deep), a rocky bottom over much of the river, and a low human population density (particularly along the upper part of the Srepok River and tributaries such as O Leav, O Lve, O Lve-te' and others) all contribute to the high productivity of Srepok fisheries. Fish migrate between the Srepok and much of the upland area within the basin via its tributaries, although waterfalls serve as natural barriers to migration for many species at the upper ends of some of the tributaries.

Baird (1995) writes that, in general, more fish from the Mekong River migrate up the Srepok and Sekong Rivers than up the Sesan River. This was the case even before the construction of the dam on the Sesan. One reason is that the Sekong and Srepok are generally deeper than the Sesan, and another is that there are large wetlands in the upper reaches of the Srepok that are believed to be important spawning and feeding grounds for some species of fish. The Sekong and Srepok also have a rockier habitat than the Sesan, which is important for many species of fish. The importance of the Srepok River to fisheries outside of the basin is considerable, but beyond the scope of this survey to investigate. However, Baird and Flaherty (2004) have described how medium-sized cyprinids migrate between the Sesan, Sekong and Srepok Rivers and the Mekong River in southern Laos, Baird et al. (2003) have described how small cyprinids migrate between the Tonle Sap River and Great Lake and the Mekong, Sekong, Sesan and Srepok Rivers in northeast Cambodia and southern Laos, and Baird et al. (2004) have described large migrations of catfish between Cambodia and Laos at the beginning of each dry season.

So et al. (2001a; 2001b) and McAndrew et al. (2003) found that fishing is an important livelihood activity in villages off the Srepok River in Monduliri.<sup>32</sup> In every village visited for the current survey,

<sup>31</sup> Data are from general discussion groups. Data for O Kan, Kbal Romeas and Sre Sranok are for the one-year period between April 2004 and March 2005. Otherwise data are for the period from January to December 2004.

<sup>32</sup> So et al. (2001a) found in Pu Ropet that "Most people in Pourapet Village fish for family consumption. They use fishing gears such as nets, throw nets (sam nagn), handle pick-out (ang rut), fishhooks (san touch), handle-scooping-basket (cheang dai), small cylindrical drum-oblong-trap (tru) as well as the traditional method of poisoning the water with the bark of Reang Tuk trees (*Barringtonia acutangula*). They fish in ditches, streams, canals and natural ponds. The quantity of fish is only sufficient for family consumption and perhaps limited sale to

fish is an important food, and along the Srepok River itself fishing provides an important source of income. There were no survey villages where people do not fish. In the villages along the Srepok, as well as other villages where significant amounts of fish can be caught, people make fish paste (*prahok*) and in some cases salted fish (*trey pralak*).<sup>33</sup> In many villages, people travel long distances to fish, by boat, elephant, oxcart, foot or motorcycle, and fishing is often coordinated with other livelihood strategies, including collection of NTFPs (non-timber forest products) and wildlife, and rice cultivation. In every village visited (and probably every village within the basin), at least some of the fish caught and consumed is directly connected to the Srepok River ecologically, through migrating populations.

**Figure 14: Dry season fish catch with gillnets in the Srepok River in O Kan**



(Photo by Heang Sarim.)

### **Fish migrations**

There are no significant natural barriers anywhere along the Srepok in Cambodia and fish theoretically can migrate back and forth between the Mekong River or Tonle Sap Lake, or further downriver, up the Srepok into Viet Nam, and into the tributaries in Cambodia. However, along some of the tributaries

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neighbors to support their livelihoods. 76% of the families fish and each family gains an average net income of 97,413 Riel per year." So et al. (2001b) found in Sre Thom that "Sre Thom villagers traditionally fish for family consumption. It is an important part of their daily diet. They harvest fish using traditional equipment such as fishing nets, hooks and bamboo baskets. Unfortunately, local villagers are under pressure to use illegal methods introduced by outsiders, namely electric shock. Fishing is practiced year round. The community fishes in areas near their settlements in rainy season but in streams and ponds during the dry time." In Rayo, "The people can fish the whole year in O Chbar River and in Boeung Lumkok. The villagers use traditional equipment such as nets like sam nagn, mong, chhneang, san touch. Most fish are for household consumption and some limited selling in the village." McAndrew et al. (2003) found that "in Dak Dam 60 of the 65 sample households fished in the past year. Twenty-six of these households caught fish at least once a week and another 2 households caught fish at least once a month."

<sup>33</sup> Ian G. Baird (personal communication) reports that indigenous people in many areas dry fish in the sun and pack it into bamboo tubes for later use, instead of making *prahok*.

there are waterfalls that serve as natural biogeographical barriers to fish migrations (as was mentioned above), although some species of fish are able to get past some of them. Shallow water also serves as a barrier for some fish species that otherwise might migrate up into the tributaries.<sup>34</sup> Of the survey villages, three (Phum Ti 6, Nhoel and Lon) are located above waterfalls that appear to be insurmountable barriers to migration of most fish species.

In all 12 of the survey villages along the mainstream Srepok River, fisheries focus groups were asked to identify from photographs those fish species found locally. A total of 156 species out of 176 shown were identified in five or more of those villages.<sup>35</sup> Similar exercises were conducted in some of the villages off of the Srepok, and 120 species were identified from O Kan,<sup>36</sup> 126 from upper O Chbar,<sup>37</sup> 113 from upper O Lve,<sup>38</sup> and 106 from upper O Phlay.<sup>39</sup> In addition to the fish identified, river prawns were reported in the Srepok River in small numbers by fishers in Sre Sranok Village (Stung Treng). Maximum sizes of selected fish species caught in the past two years (reported by fisheries focus groups) are shown in Annex 3.

**Figure 15: Natural barrier to fish migration at Bu Sra Waterfall**



(Photo by Heang Sarim.)

<sup>34</sup> Large fish can migrate up the O Phlay as far as the road from Sen Monorom to Bu Sra (near the villages in Bu Sra Commune), and up the O Por (a tributary of the O Phlay) as far as Bu Sra Waterfall just below the road from Sen Monorom to Bu Sra. Fish can migrate all the way up O Lve, but as water gets shallower fewer fish get through. There are no major obstacles to fish migrations along O Tang. The same is true for O Chip, although large fish do not generally go past the villages in Seda Commune because the water is shallow. Fish can go up O Chaloy as far as the seven-step waterfall (near the gem mine at Chumrum Bei Srok). There are no major obstacles on O Kan. On O Ka Teung, there are two major waterfalls that fish cannot get past (Krek and Ka Koeua). There are also waterfalls on some of the smaller tributaries, some of which most fish cannot get past.

<sup>35</sup> Though this exercise was conducted carefully, there is some potential for confusion by villagers in identifying fish from photographs only.

<sup>36</sup> Fish identification conducted in Pruok Village.

<sup>37</sup> Fish identification conducted in Chi Klap Village.

<sup>38</sup> Fish identification conducted in Pu Chry Chang Village.

<sup>39</sup> Fish identification conducted in Phum Ti 6.

Fisheries focus group discussions in all of the survey villages provided information on fish migrations. The emphasis was on understanding migrations of longitudinally migratory fish; certain species (such as snakeheads and some species of catfish) have completely different migratory behavior and are much more localized. From these discussions, a general pattern of migrations could be identified. In general, at the beginning of the rainy season, fish migrate up from the Mekong River or leave deep-water pools in the Srepok or tributaries where they sought refuge during the dry season. During the rainy season, they head up the Srepok River, up streams and, in some cases, into ponds connected to these streams. Some species spawn in the streams or ponds, others quickly return to the river and spawn there. At the end of the rainy season, many of those that have not yet done so come back down the streams, into the river, and head downstream. At this time, as they swim downstream, they travel from pool to pool. Some stay in pools (either in the upland streams or in the main river). This is consistent with the description by Baird (1995) of migrations in the Sesan River, of Baird and Flaherty (2004) of migrations of medium-sized cyprinids, and of Chan (2002) of migrations of *Cirrhinus microlepis*, *Pangasius hypophthalmus*, and *Botia modesta*.

Villagers along the Srepok reported that migrations of fish up into the tributaries are extremely sensitive to water levels. For example, when the water level in the Srepok begins to rise, fish begin to move into the streams. But if the water level drops, fish will not start moving into the streams again until the water level has surpassed its earlier highest level.

### **Spirits**

Throughout the Srepok basin, untold numbers of spirits are associated with different natural features, such as deep-water pools in the river and tributaries, large trees, hilltops, large boulders in rivers, waterfalls, etc. We were able to identify some of these pools, waterfalls and other features along the Srepok and its tributaries, but the results are by no means complete. In some cases (particularly along the Srepok River itself) people can fish in these areas, but are careful about what they say; in others (particularly along tributaries), they do not dare go at all. Often people say there are crocodiles associated with spirits, but that they may only be seen under certain circumstances.<sup>40</sup>

In Koh Meayoel Loe (Mondulkiri), the spirit on Koh Meayoel Island is also the village “guardian spirit”, for which there are annual spirit ceremonies. In Kaeng San (Ratanakiri), there is no annual spirit ceremony associated with the spirit in the Kaeng San deep-water pool, but fishers ask permission from the spirit before going out fishing.

Degen et al. (2005) found in Punong communities along the O Chhlong in Mondulkiri and its tributaries that the association of spirits with particular features along streams played an important role in fisheries management.<sup>41</sup>

There are also some places that are completely off-limits for any fishing activity. The spirits inhabiting these places are considered “very strict” and any lack of respect would result in serious consequences, such as sickness to everybody in the village. Frequently, closed areas are deep pools, often associated with waterfalls. Here fish may concentrate as the waterfall forces some species to discontinue their up-stream migration ... Closed areas, thus, reduce fishing effort and facilitate stock recovery and recruitment.

### **Fishing activities of communities along the main Srepok River**

People in communities along the main Srepok River use a wide variety of gears to catch fish, depending on the season and other factors. Some of the more important ones are gillnets (both fixed and floating), fishhooks (longlines, individual hooks on lines that are tossed out and pulled in, and

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<sup>40</sup> Along the Srepok, spirits were reported at the following locations: Anlong Koh Andet, a deep-water pool in Sre Sranok Village (crocodiles are reported there); Peam Krabei Chrum, in Krabei Chrum Village; Anlong Phtil, a deep-water pool in Sre Angkrong Commune; Chuor Khmer, rapids in O Kan Village; Koh Chalong; Anlong Kaeng San, a deep-water pool in Kaeng San Village; Koh Meayoel Island (in Koh Meayoel Loe Village); Kalem; Kaeng Sang; Voen Khuy; and Anlong Mroech. People told us that boats have sunk and people drowned because of the spirit at Anlong Kaeng San, and that people have seen a beast there that takes various forms. People told us of some taboos associated with the spirit on Koh Meayoel Island, regarding cursing one’s parents, cutting trees or rattan on the island, and cursing if one does not catch any fish.

<sup>41</sup> Similar to the findings of Degen et al. (2005), in Pu Chry Chang Village (Mondulkiri) people said that there are spirits associated with a waterfall where the O Roman stream flows into the O Lve. People do not dare to fish near the waterfall using natural poisons (commonly used elsewhere) and fish are abundant there.

individual hooks that are tied out), drop-door traps (*chan*), castnets, various bamboo traps (*lop*, *tru*, *tam*, *pam*, and *leay*), bamboo fences (*thnuos*) usually used with traps, and natural poisons.<sup>42</sup>

Many people in these communities use boats to fish in the main river (year round, except for the peak of the rainy season when water currents are too strong and many fish have gone up into the tributaries) and lower stretches of some of the larger tributaries (during the rainy season only). In some villages, wildlife collection is also an important part of trips for fishing along the tributaries.<sup>43</sup> (In Nong Bua, people told us that they did not go fishing up tributaries where they might encounter rangers, because they collect wildlife when they go fishing and wildlife collection is more important to them than fishing.) There is no part of the Srepok that people in these villages do not access, except for a stretch of the upper Srepok where they are no longer allowed to fish. (In May 2005 the river was closed to most traffic, including for fishing, between O Lve and O Chronh, as part of the management regulations of the Mondulkiri Protected Forest. Police and military based along the upper Srepok have also at times closed upper parts of the river to boat traffic.) The range people in some villages cover in fishing by boat may span as much as 100 km along the Srepok.<sup>44</sup> Within this range, however, most people fish in the general area of their own village. Only people with access to motorized boats can travel far from their own villages – expenses are lower and convenience greater when fishing near home. There do not seem to be restrictions on crossing village boundaries, but there is a general sense that people should fish in their own village.

The stretch of the Srepok above the uppermost village (Koh Meayoel Loe) is open to all. In all villages from Sam Kha up, at least some villagers fish at least occasionally, ordinarily during the dry season or between rice seasons. In this area, fishing pressures are low and fish are particularly abundant. However, boat travel to get there is extremely difficult because of dangerous rapids; only the most experienced fishers go. Fishing trips in this area also require a significant investment because of the long distances traveled, and trips are likely to last as much as 10 days or more. How far people go up depends in part on how much they are willing to brave the rapids and what restrictions have been placed on access (as mentioned above).

The peak time for fishing by people in villages along the Srepok is the recession season, when fish are caught as they leave the tributaries to enter the river. During the dry season, fish can be caught where they congregate in the deep-water pools in the river. They also congregate to a lesser extent in pools in the tributaries, but boats cannot get up into tributaries at this time and people travel overland to fish there, as will be described shortly. At the beginning of the rainy season, fish can be caught as they migrate up into the tributaries. Fish movements at this time are extremely dependent on water levels, and fish can be caught easily only if the water level of the river is rising (prompting fish migrations) – and then only if it rises above previous levels that year. Otherwise, fish catches are extremely low because fish have left the deep-water pools but are not moving much. When the water level gets higher, in July and August, specialized gillnets can be floated down the river; for a few days each month, people with these nets can record their biggest daily catches of the year.<sup>45</sup> By September, water levels in the river are too high and there is too much debris floating down river for gillnets or other gears to be used. September is also the peak of the rice planting season and villagers ordinarily do not spend a lot of time fishing. Fishing at this time is primarily in the streams and rice fields.

Possession of boats is important for people fishing on the river, but those without boats are still likely to fish along the river at least at some point during the year by borrowing boats from others or accompanying them on their trips. Table 6 below shows the number of boats in some of the villages along the Srepok. In the dry season, people often camp out for two to three days to fish (if not weeks in the case that they go upriver), and traders come to the places where they are fishing. Women are

<sup>42</sup> See Baird (1995) for a description of gears used along the Sesan River.

<sup>43</sup> Tributaries that people fish by boat include: O Phlay; O Ten; O Lve; O Lve-te'; O Leav; O Tang; O A Tom; O Chimeat; O Chbar; O Chaloy (a short distance only); O Kan (a short distance only); O Ka Teung; O Steung Reang (a short distance only); O La Ha (a short distance only); O Rey; and O Koki.

<sup>44</sup> People in Koh Meayoel Loe said they fished from O Chimeat to Mroech; people in Nong Bua from O Chbar to O Phlay; people in Kaeng San from O Chbar to O Leav; and people in Thmey village from O Ka Teung to O Phlay. People in Neang Dei ordinarily fish only as far downriver as O Chat Knat (a little below O Rey). Recent restrictions on boat traffic on the upper Srepok mean that people from these villages can now only go upriver as far as O Lve.

<sup>45</sup> In Koh Meayoel Loe, people said that, using floating gillnets, they could catch 100 kg of fish per boat per day in July (when fish migrate upriver). Species reported caught at this time include primarily *Labeo dyocheilus* (*trey pa wa* in Khmer) and *Morulus chrysophekadion* (*trey k'ek* in Khmer).

unlikely to go out in boats to fish alone, although there are cases when they do. A wide variety of gears are used on fishing trips by boat. Among them, gillnets are most widely used throughout the year, and castnets are used when the water is low.

**Table 6: Number of boats in villages along the Srepok River<sup>46</sup>**

No.	Village	Number of boats with motor	Number of boats without motor
1	Neang Dei	0	31
2	Phum Pir	44	11
3	Kompong Sangkum	4	2
4	O Kan	7	7
5	Thmey	45	75
6	Kaeng San	19 (estimated)	53 (estimated)
7	Kbal Romeas	7	43
8	Sre Sranok	16	50
9	Koh Meayoe Loe	10 (estimated)	17 (estimated)

In the dry season, people living in the villages along the Srepok also travel overland to fish in streams and ponds. These trips often combine fishing, wildlife collection and collection of NTFPs. Again, people often travel considerable distances from home, and camp out for a period of time. Fish are salted or made into fish paste (*prahok* in Khmer). In four of the villages along the Srepok that were visited (Kbal Romeas, Sre Sranok, Nong Bua and Kaeng San) people use natural poisons for fishing in the tributaries, and in most other villages they had done so in the past. Nearer to home, people scoop fish, shrimp and other waterlife out of ponds (ordinarily it is women who do this), drag mosquito nets through ponds or scoop out small ponds or pools to catch the fish. Some people in these villages operate different kinds of barrages on some of the smaller tributaries or sub-tributaries. The use of natural poisons and barrages will be described below.

#### **Fishing activities of communities within the basin off the main Srepok River**

People in communities within the basin but off the Srepok River (most of whom are indigenous) are also involved in a wide variety of fishing activities. In communities on some of the larger tributaries, some people have boats. This is particularly true of villages along O Chbar in Koh Nhek District (Mondulkiri). In Ta Kok Jarai Village, which lies along a small stream (O Chen Tai) that flows into O Tang, one of the larger tributaries of the Srepok, there were four boats.

Many people from a number of villages near the district center of Koh Nhek, most of them Khmer, transport their boats by oxcart to the upper Srepok, in the area of Mroech (a police post several kilometers from the Vietnamese border). They do this in November or December, then bring the boats back home in May or June. They fish in O Phlay, which forms the border with Viet Nam, and the upper Srepok, and have to pay fees to the police stationed there. Some people who do not have boats use plastic jugs for flotation, or make rafts. A woman we interviewed who fishes in this area using a non-motorized boat reported catching 50-70kg a night in O Phlay with gillnets in October and November, and 10-20kg a night in the uppermost part of the Srepok in other months. She said that people with motorized boats could catch 40-50kg of fish a night in the latter area in these months. The number of fishers in this area has increased year by year. Fish traders come to Mroech and sometimes O Phlay, overland from Mondulkiri provincial town or Koh Nhek district town, and by boat from Viet Nam.

In general, however, in villages off the Srepok River, people do not have boats, and do not fish along the main river. Gears used by the indigenous people in these villages include gillnets, castnets, fishhooks, scooping baskets (*chunchoat* in Khmer), poisoning, barrages (*thnuos* in Khmer), and a variety of other gears. People travel by foot, oxcart, motorcycle and, in a few cases, by elephant, sometimes considerable distances. In villages in Pech Roda District (Mondulkiri), fishing is often combined with resin tapping, which will be described below. Resin trees are often far from villages and people camp out in the forest to tap their trees; while they are there, they fish. In Sok San Commune, in Koh Nhek District, people travel long distances to villages where they lived prior to the Pol Pot era to collect strychnine seeds and other forest products, and fish while they are there.

<sup>46</sup> Data are from interviews with village chiefs.

In the past, indigenous people in villages throughout the basin, including those far away from the mainstream Srepok River, used two main means to catch fish: poisoning with natural poisons and blocking streams with traditional barrages made of wood and bamboo. These two activities produced large quantities of fish that could be used to make *prahok*. People also made their own castnets using natural fibers and made their own fishhooks, and used scooping baskets (*chunchoat*). Poisoning has continued to be used in the past several years in all but two of the villages we visited off the main Srepok,<sup>47</sup> and use of barrages was reported in several villages. Gillnets are a recent introduction, although they are now widespread. In the past, people traveled far from their own villages to set up barrages and poison fish, sometimes traveling by elephant (with as many as six elephants) to set up barrages.<sup>48</sup> Now, people in villages visited in Ratanakiri say that they are no longer allowed to poison fish or fish on a large scale (using large barrages) outside their own village boundaries, as a result of various natural resource management activities that have taken place through government programs. Men, women and children all participate in poisoning and barrage operations, but men may travel even further to use gillnets or set out fishhooks.

Traditional wooden and bamboo barrages are used in many of the villages to catch fish as they leave streams to enter the Srepok during the recession season. The traditional barrages were reportedly used more in the past, and now are used on the O Ka Teung, O Kan, O Chip, O Chaloy and other streams. We were told that the authorities allow the use of these barrages. On large streams such as these, they can be used only in certain locations where the currents are not strong enough to break them. Certain individuals have the rights to these sites and, traditionally and currently, no one else can set up a barrage without permission from the owner of the site; we did not find out how they acquired these rights. Ceremonies are held for the spirits before a traditional barrage is set up. An entire village might help to operate a barrage, and all those who participate share the catch equally. Some Khmer and Lao villagers living along the Srepok also operate barrages, but mainly on smaller streams where barrages do not have to be as rugged.

Poisoning of fish using natural poisons is done in small pools in streams during the dry season or at the beginning of the rainy season. Though poisoning of fish using natural poisons is common in indigenous villages, we found no examples of ethnic Lao or Khmer people doing it. Poisoning of fish is done individually, in small groups, or as an entire village. Degen et al. (2005) found that, along the Chhlong River in Monduliri, "within the Punong culture, the use of natural poisons has been well regulated and used in a way that allows not only for high fish yields in a short period of time but also for strengthening village cohesion by sharing the fish within the community." They argue also that the use of natural poisons is not environmentally harmful, because the poisons degrade quickly, and claim that they do not affect humans. There are two main ways natural poisons are used. The first is to poison standing pools of water, cut off from the stream when the water recedes. The fish are poisoned after a rain that causes fish to swim up into the pool. The second is in flowing water, during the dry season when the water is low. In the latter, people block the river downstream, pound poisons into the water upstream, then walk downstream to catch fish as they are stunned. In the past, if people caught a large amount of fish, they would use it to make *prahok* (fish paste), but now they rarely get enough to do so. Various types of plant materials can be used to poison fish.<sup>49</sup>

In some villages furthest from the Srepok, people fish in areas above waterfalls which act as natural barriers to fish migrations.<sup>50</sup> In these areas, there are few species of fish, and people generally catch fewer fish than in other villages.

In-migration into indigenous villages is having significant impacts on fisheries there, in part because the new Khmer and Cham settlers do not share indigenous people's understanding of how to treat natural resources. In particular, they are more likely to use electrofishing and other destructive gears than are the local villagers. This is particularly a problem in Ka Laeng (Lumphat District), with in-migration to the gem mine at Chumrum Bei Srok. People from district and provincial centers, some of them along the periphery of the basin (such as Banlung, Bokeo, O Ya Dao and Kon Mum, in Ratanakiri, and Monduliri provincial town) are involved in electrofishing and use of other destructive gears, as are more and more local villagers. In addition, in Pu Chry (Pech Roda District), one man told

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<sup>47</sup> Lon and Chi Klap.

<sup>48</sup> Villages using elephants included Samut Kraom (Seda Commune, Lumphat) and Ka Tieng (La Bang Pir Commune, Lumphat).

<sup>49</sup> See Baird (1995) for a more detailed description of poisoning using natural poisons.

<sup>50</sup> Of the survey villages, this was the case in Lon, Nhoel and Phum Ti 6 (Pu Cha).

us that the Punong people in some villages no longer fish in the O Chbar because to do so they would have to cross through the new Cham settlement, and they are embarrassed when Chams ask to check how much fish they have caught (because the Chams catch a lot more than they do).

### **Fishing activities of communities outside the basin**

Some people from outside the basin fish within it, most notably people from Stung Treng. A group of people from Thalla Barivath District in Stung Treng Province fish seasonally in the uppermost reaches of the Srepok, as far as the Vietnamese border. They primarily fish upriver of Koh Meayoel Loe, where there are no villages; apparently, were they to fish further downstream they would encounter resistance from local villagers. In 2005, for the first time, their group included one person with a boat used for taking fish to sell.

Ethnic Lao people from Phluk Village, along the Sesan River in Stung Treng, also come upriver as far as Sre Angkrong Commune, and possibly higher up. Local villagers resent them because they catch much more than they do, and suspect that they use carbide to drive fish out of deep-water pools into their nets.

### **Bagnets, explosives, giant castnet, electrofishing, and mosquito net gears**

In addition to the fishing activities by local communities described above, various people are involved in large-scale fishing operations with the protection of local authorities and government officers. Large commercial bagnets (referred to locally as *uan* in Khmer) are tied across tributaries of the Srepok as well as some smaller streams, to catch fish as they try to swim down the tributaries into the Srepok during the recession season. They have been used in the area since around 1994. The catch on one stream has been reported to be as much as 15 tons per season in recent years (on O Phlay), although catches on other major tributaries are more like two to five tons. Catches are decreasing considerably. The catch on O Chbar was reportedly 20-30 tons when bagnets first started to be used, but in recent years this has reduced to about five tons. In all villages along the Srepok, people expressed their anger at the use of bagnets, which they blame in large part for the decreased fish stocks.<sup>51</sup> In recent years, villagers in Neang Dei prevented bagnets from being used on O Ka Teung, and villagers in Nong Bua and Peam Chimeat attempted (unsuccessfully) to prevent them from being used on O Chimeat. In the 2004 recession season, rangers from the Lumphat Wildlife Sanctuary confiscated bagnets and otherwise tried to prevent them from being used, but they were still used secretly on many of the tributaries. Baird and Flaherty (2004) claim that large commercial bagnet fishing operations in northeast Cambodia (all of which are illegal) have resulted in reductions in the catches of some important medium-sized cyprinid fishes that migrate from the Sekong, Sesan and Srepok Rivers in northeast Cambodia to the Mekong River in Laos, especially *Scaphognathops bandanensis*.

Explosives continue to be used in deep-water pools during the dry season at the very lowest part of the Srepok (around Kbal Romeas and Sre Sranok) and at the upper part, mostly above Koh Meayoel Loe (from O Tang to the Vietnamese border). In many of the villages in between, people say that the use of explosives has reduced significantly. People in Kompong Sangkum reported that there were still two to three explosions a year in Anlong Koh Sampouv and Anlong Bak Roteh (deep-water pools in Kon Mum District). In 2005, a dolphin was killed by explosives at Kaeng San. Villagers report that those using explosives for fishing are either military or police, or people who get explosives from them.

A group of people from Lumphat have operated a giant castnet (*chayra*) operation at the very upper end of the Srepok, sometimes even venturing into Viet Nam. Their net has a 10 m radius. The *chayra* operator reported that, fishing on the Srepok inside Viet Nam, they caught 500 kg of fish at one time, mostly *trey keh* (*Micronema* sp.), but said that within Cambodia the maximum catch for one deep-water pool was 70 kg (at Anlong Ten). In the past, another group had used *chayra* but no longer does.

Electrofishing is widespread throughout the basin, on the Srepok River, on tributaries and in ponds. As mentioned above, electrofishing is often associated with population centers such as provincial and district towns, the gem mine at Chumrum Bei Srok, and the new settlements in Pu Chry (Mondulkiri), but people living in villages elsewhere, particularly along the Srepok, are also involved. In every village people were concerned about electrofishing and saw it as one of the major threats to the fisheries. Traps made of mosquito nets (locally called *du*) are also used in many areas; they catch even the smallest fish and can have a major negative impact.

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<sup>51</sup> Baird (2003) documents complaints by community fisheries associations about the use of bagnets.

### Collection of other aquatic life

In addition to fish, people collect a variety of other waterlife to eat. How much they collect depends in part on the availability of fish: when there is a lot of fish available, people are less likely to collect these other organisms. Those identified are shrimp, crabs, snails (*kchong* and *kchao* in Khmer), bivalves (*leas*, *chumpuh tea* and *krum* in Khmer), frogs (*kangkep* and *talantan* in Khmer), toads, mycrohylids (*hing* in Khmer) and various water insects (*kantea touk* and *kanteh lang* in Khmer). There is also larger wildlife, such as turtles (including soft-shelled turtles) and monitor lizards (*ansong* in Khmer); these will be discussed below. Toads are eaten only in some villages, and they are poisonous if not properly prepared. Collection of water plants will be described in a later section.

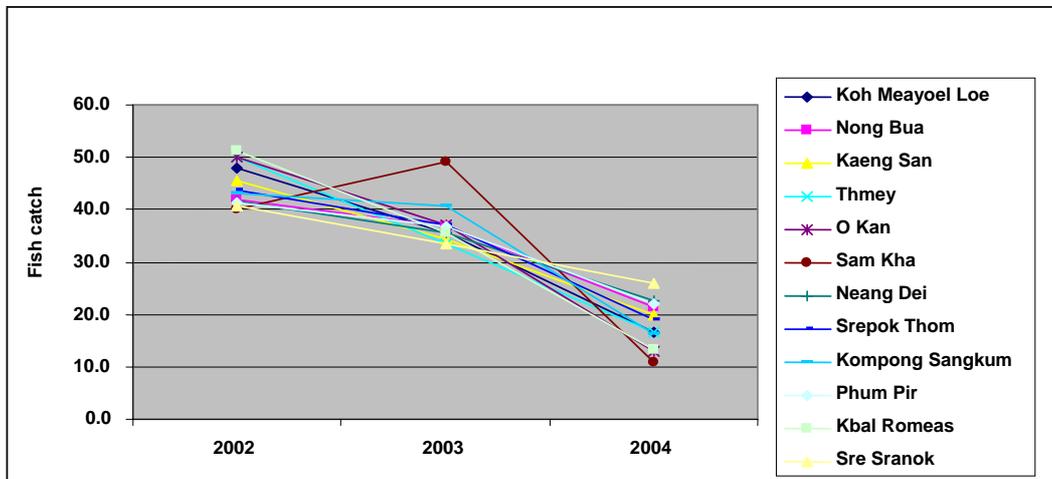
Of the bivalves, *leas* and *krum* are collected in the dry season; in the rainy season, there is too much water to collect them (and people are more likely to eat fish). Of snails, people collect *kchao* primarily in the dry season, and *kchong* in rice fields in the rainy season. *Kchao* can be found in the rainy season but no one collects them then. Shrimp are caught in all seasons.

### Fish catches and pressures on the fisheries

It was not possible to estimate the total fish catch in the Srepok, or even the total catch for an individual family over the course of a year. The most that could be done was to estimate average annual family incomes, which will be discussed below.

In all of the villages, people said that fish populations have decreased significantly over the past few years, and that in 2005 they were less than they have ever been before. Fish traders also estimated that total fish populations were decreasing. Villagers attributed the overall low populations to electrofishing, the use of explosives and bagnets, and low flood evels in the 2003 and 2004 rainy seasons (the lowest in years). In Ta Kok Jarai (O Ya Dao District), people also blamed the gold mine near Peak Village, which they said was dumping chemicals into the O Chen Tai stream. In Nhoel, people said that more people were fishing now than in the past: there used to be more forest, and people ate more wildlife, but now much of the forest has been converted to farmland. People in La Bang Pir Commune (Lumphat District) also blamed waste from the rubber factory upstream for filling in deep-water pools in O Ka Teung and negatively affecting water quality in this stream. Figure 16 below shows how women's focus groups in villages along the Srepok quantified trends in fish catches over the past three years.

Figure 16: Trends in fish catches



### **Fish trading<sup>52</sup>**

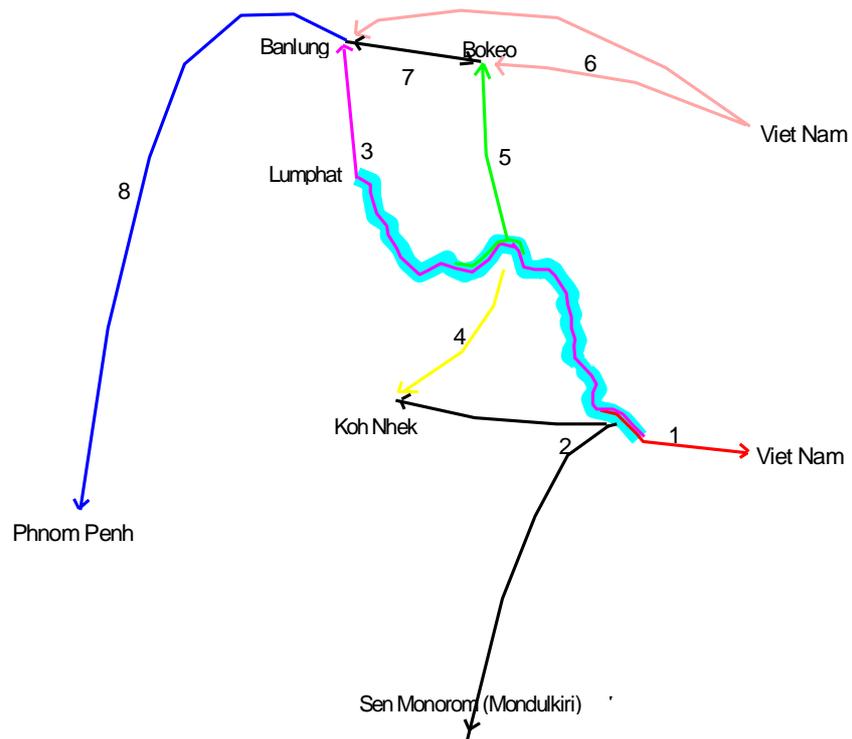
In all of the villages surveyed along the Srepok River itself, people reported (and we observed) selling of fish; fish selling makes an important contribution to family incomes. In most of the other villages, people said they never sold fish, though So et al. (2001a) found average incomes of 97,413 Riel per year from fish selling in Pu Ropet (Krang Teh Commune, Pech Roda District) and So et al. (2001b) found a small amount of fish selling in Bu Sra (Pech Roda District). Aside from the Srepok River, fish that is sold is caught mainly through large-scale or high impact operations, such as the use of bagnets or electrofishing.

All along the Srepok there are traders who are either based in villages, come to villages or landing sites on motorcycle or by jeep to buy fish, or buy fish from boats. The map in Figure 17 below shows trading routes for fish along the upper Srepok. At the very upper reaches of the Srepok (from O Lmit to the Vietnamese border), traders from Viet Nam come to buy fish by boat from people fishing along the river, to sell in Viet Nam [1]. They do this throughout the year. Two traders (who are policemen) come by jeep from Mondulkiri provincial town, and several by motorcycle from villages near Koh Nhek district town, to buy fish in this area to sell in Mondulkiri and Koh Nhek, respectively [2]. They do this from November to June. Traders from Lumphat also come by boat, buying fish as far upriver as O Phlay (on the border with Viet Nam), if they are allowed up, and downriver to near Lumphat, and sell it in Lumphat to traders from Banlung (the provincial town of Ratanakiri) [3]. They do this as long as there is enough water to get upriver. Fish from Lumphat and nearby Dei Lo also goes to Banlung. In general, traders in boats from Lumphat buy fish from people who come from villages along the Srepok, and traders from Koh Nhek and Mondulkiri buy from people from Koh Nhek who have traveled overland to get to the Srepok River or O Phlay. Traders from Lumphat, Koh Nhek and Mondulkiri all buy goods for fishers on order, as fishers in this area camp out far from any villages. Traders from Koh Nhek go to Koh Meayoel Loe and Koh Meayoel Kraom to buy fish by motorcycle during the dry season [4]. There are also two traders from the market in Bokeo district town (Ratanakiri) who bring fish by motorcycle in the dry season from Koh Meayoel to Bokeo, from October to June [5].

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<sup>52</sup> See Baird (1995) for a discussion of the development of markets for fish from the Sesan River in Ratanakiri.

Figure 17: Fish trading routes (upper Srepok)

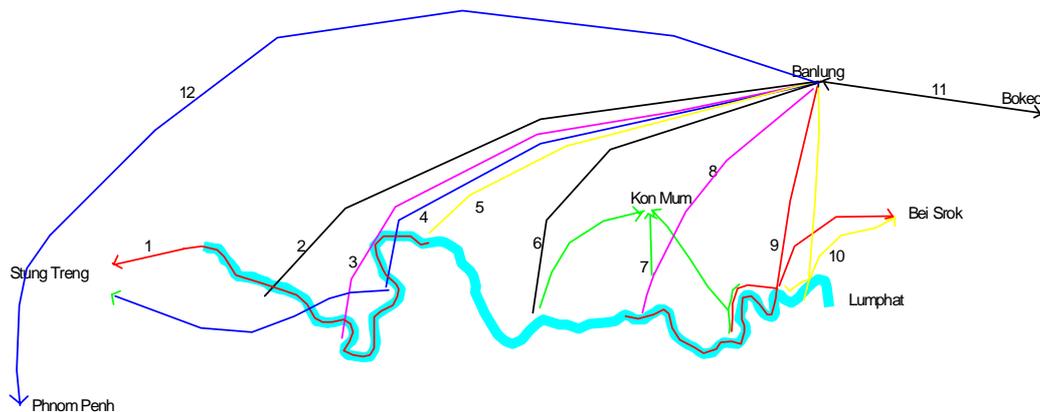


There is some import of cultured fish from Viet Nam to Bokeo and Banlung [6], but no export of fish to Viet Nam along this route. Fish from Banlung is sold in Bokeo, or vice versa, depending on relative abundance [7]. From Banlung, one trader transports certain species of fresh fish overland to Phnom Penh. These include *Barbichthys nitidus* (*trey kya*), *Micronema* sp. (*trey keh*), *Probarbus* spp. (*trey trasak*), *Mekongina erythrospila* (*pa si i*), *Bagarius yarrelli* (*trey krabei*) and *Wallago leerii* (*trey stuok*). Of these, all but *Mekongina erythrospila* are exported to Thailand, via Battambang; this one species is sold in Phnom Penh, where it brings a high price in restaurants. This trader transports an estimated 500kg on average of fish to Phnom Penh per week. Another trader in Banlung buys *Micronema* sp. to smoke, and the smoked fish are transported by airplane and overland to Phnom Penh [8].<sup>53</sup> There is reportedly no export of fish from Monduliri provincial town.

People in Koh Meayoel Loe also reported that if they caught a lot of fish, they made *prahok* which they take overland to trade for rice in the other villages in Koh Nhek District.

The map in Figure 18 below shows trading routes for fish along the lower Srepok. In the rainy season, traders buy fish by boat from villages as far upriver as Krabei Chrum and take it to sell in Stung Treng [1]. Traders take fish overland by car or motorcycle from Srepok (a settlement of police and military within Kbal Romeas Commune), Sre Sranok, Kbal Romeas and Krabei Chrum to Banlung [2, 3, 4, 5]; one of the traders in Kbal Romeas also takes fish overland to Stung Treng. Three traders from Banlung buy fish in Sre Angkrong Commune, and there is a depot in the commune [6]. Some people in the village go out by boat to buy fish along the river and sell it to these traders. Three fish traders in Kon Mum District market buy fish in Srepok Thom, Srepok Toch, Neang Dei, Kompong Sangkum and occasionally Sre Angkrong [7].<sup>54</sup> Fish traders from Banlung buy fish in Kompong Sangkum (more than do traders from Kon Mum market), but only in the dry season [8]. They buy from locations where people fish along the river. Traders buy fish by boat from Kompong Sangkum, Srepok Thom, Srepok Toch and Neang Dei, or by motorcycle in the dry season; fish then goes overland from Sam Kha to either Ban Lung or the gem mine at Bei Srok [9]. One or two traders on motorcycle buy fish in Sam Kha and O Kan (some of it originally from Sre Chhouk) and sell it in Bei Srok or Banlung [10]. In addition, there are traders who follow fishers from their own village to buy from them. Some wild fish is also reportedly taken from Stung Treng to Banlung, and cultured fish from Kratie to Banlung.

**Figure 18: Fish trading routes on the lower Srepok**



Several fish traders we met reported paying fees to commune councils for the right to buy fish in local villages. One fish trader showed us a license that allowed him to buy fish in O Kan Village, for which he says he paid 40,000 Riel to the commune chief. In Sre Sranok, a fish trader had to pay 250,000 Riel per year to the commune chief for the right to buy fish. Fish traders on motorcycle reported paying fees of 5,000 Riel each to police stationed along the river each time they buy fish on the uppermost reaches of the Srepok.

<sup>53</sup> 3.5kg of fresh *Micronema* produce 1 kg of smoked fish, which sells for US\$10 per kilogram in Phnom Penh.

<sup>54</sup> One of these traders reported buying a total of between 10 and 100 kg of fish per day in these villages.

Ordinarily, fish are classed in two types, “meat fish” (usually scale-less fish) and “scaly fish”, the first bringing a slightly higher price. Meat fish bring 2,500-6,000 Riel per kg in the survey villages along the Srepok; scaly fish bring 2,000-4,500 Riel per kg. The highest prices were reported in Thmey and Kompong Sangkum, the lowest in Kbal Romeas and Sre Sranok. Certain fish species are particularly valuable (these are among the species that are transported to Phnom Penh) but prices paid to fishers are much less than the price in, for example, Banlung. *Micronema* sp., which brings 10,000 Riel per kg in Banlung and 10,000-12,000 Riel per kg in Monduliri provincial town, brings 7,000 Riel per kg in O Kan and just 3,000 Riel per kg in Kbal Romeas (500 Riel more than other scale-less fish); in Sre Sranok it is the same price as other scale-less fish. *Mekongina erythrospila*, 8,000 Riel per kg in Banlung and 7,000 Riel per kg in Monduliri provincial town, is graded together with meat fish in most villages on the Srepok. (In Kbal Romeas and Sre Sranok, however, it brings 5,000 Riel per kg from November to December, compared with 2,500 Riel per kg for meat fish.) *Barbichthys nitidus* brings 10,000 Riel per kg in Banlung if over 3.5kg and 7,000 Riel per kg in most villages. It is reportedly not sold in Monduliri provincial town.<sup>55</sup>

**Figure 19: Fish trader with icebox on the upper Srepok**



(Photo by Rena Sugita)

Most of the fish in the markets in Ratanakiri and Monduliri provincial towns come from the Srepok River. In Ratanakiri, the Srepok has long had more fish than the Sesan, as it has a more suitable habitat, as was mentioned above.

In most villages, we could not determine incomes from fishing. However, the fisheries focus group in O Kan estimated that annual incomes from fishing are about 200,000 to 300,000 Riel per family, some much more than that. In Kbal Romeas, the fisheries focus group estimated incomes to be about 100,000 Riel per family. In Sre Sranok, people said that a family could earn millions of Riel a year from fishing, and that probably 10 families in the village do so. They said a family could earn more than one million Riel a year just catching *Mekongina erythrospila* (*pa si i*). In Sam Kha, people said that a family could earn about 200,000 Riel per year fishing if they fished on a reasonably large scale; in Sre Angkrong, people estimated a family that fishes full time could earn 200,000-300,000 Riel, or even as much as 1.5 million Riel a year; and in Neang Dei, they estimated a family could earn 100,000-200,000 Riel per year from fishing.

<sup>55</sup> Other fish transported to Phnom Penh are *Probarbus* spp. (*trey trasak*, 8,000 Riel per kg in Banlung), *Bagarius yarrelli* (*trey krabei*, 4,000 Riel per kg in Banlung) and *Wallago leerii* (*trey stuok*, 4,000 Riel per kg in Banlung).

### Importance of fish and other aquatic life to diet

Fish is an important part of people's diets throughout the Srepok River basin, but just how important it is depends on the season. For example, in villages off the Srepok fish is more abundant in the rainy season, when fish have migrated from the river up into the tributaries. As wildlife populations decrease, or conservation efforts prevent people from consuming as much wildlife as they might otherwise, fish is becoming increasingly important relative to wildlife. At the same time, as fish populations drop, overall fish consumption is decreasing. Table 7 below shows the estimated number of days a month that people eat fish in villages along the Srepok River. In almost all cases, fish is reportedly consumed more frequently during the rainy season than the dry season. This table shows that people in these villages eat fish almost every day.

**Table 7: Estimated fish consumption (days/month fish consumed)<sup>56</sup>**

No.	Village	Days/month rainy season	Days/month dry season
1	Koh Meayoel Loe	28	28
2	Nong Bua	25	20
3	Kaeng San	28	26
4	Thmey	25	20
5	O Kan	30	8-12
6	Sam Kha	28	20
7	Neang Dei	27-28	27-28
8	Srepok Thom	26	26
9	Kompong Sangkum	20	25
10	Phum Pir	29	25
11	Kbal Romeas	17-21	13
12	Sre Sranok	21	17

Table 8 below also highlights the importance of fish in the diet. It compares the importance of fish and other protein sources, in the rainy and dry seasons, for villages along the Srepok River. Data comparable to that presented in Tables 7 and 8 were not collected for villages off the Srepok. Fish consumption is significantly less in these villages, particularly in the dry season (in some villages we saw no signs of fish), and total protein consumption seems to be much less as well. However, seasonally, fish consumption is still important.

**Table 8: Comparison of protein sources (average ranking rainy/dry seasons)<sup>57</sup>**

No.	Village	Fish		Domestic meat		Wildlife		Crustaceans		Mollusks		Water insects		Other	
		Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry
1	Koh Meayoel Loe	33.98	36.81	19.42	11.11	28.16	13.19	6.80	24.31	7.77	13.19	3.88	1.39	0.00	0.00
2	Nong Bua	21.57	26.24	5.88	7.09	25.49	24.82	17.65	15.60	22.55	24.82	6.86	1.42	0.00	0.00
3	Kaeng San	40.63	36.25	17.19	16.25	12.50	8.75	4.69	21.25	17.19	16.25	7.81	1.25	0.00	0.00
4	Thmey	33.33	27.87	17.95	14.75	23.08	8.20	20.51	19.67	2.56	19.67	2.56	9.84	0.00	0.00
5	O Kan	31.46	35.96	32.58	30.34	5.62	3.37	11.24	12.36	7.87	5.62	0.00	2.25	11.24	10.11
6	Neang Dei	18.95	23.96	13.68	11.46	8.42	9.38	29.47	16.67	20.00	38.54	9.47	0.00	0.00	0.00
7	Srepok Thom	36.00	29.41	21.60	22.79	20.00	15.44	7.20	11.03	7.20	13.97	8.00	7.35	0.00	0.00
8	Kompong Sangkum	36.71	27.96	21.52	16.13	18.99	12.90	6.33	16.13	12.66	18.28	3.80	8.60	0.00	0.00
9	Phum Pir	47.86	30.37	17.09	14.81	14.53	12.59	7.69	17.78	8.55	19.26	4.27	5.19	0.00	0.00
10	Kbal Romeas	24.14	20.69	10.34	12.64	8.05	10.34	22.99	18.39	12.64	18.39	10.34	8.05	11.49	11.49
11	Sre Sranok	26.87	26.15	14.93	24.62	10.45	15.38	26.87	7.69	7.46	16.92	4.48	0.00	8.96	9.23

### Diseases in fish and other aquatic life

In all villages along the Srepok, villagers were asked if they had ever noticed fish with lesions or other signs of disease. In all but one village they said they had – all very similar symptoms and apparently the same disease, Epizootic Ulcerative Syndrome (Ian G. Baird, personal communication). Snakeheads, in particular, were found to have lesions, but other fish did also, including *Hypsibarbus*

<sup>56</sup> Data are from general discussion groups. In some cases, estimates were given as days per week, in which case they were multiplied by 4.3.

<sup>57</sup> Data are the result of ranking exercises carried out by the women's focus group discussions.

sp. (*trey chhpin*), *Clarius* sp. (catfish), walking perch and, occasionally, other species, usually in streams during the dry season but also in ponds and the river. According to Roberts and Baird (1995), the disease was probably introduced to Southeast Asia from Bangladesh with aquaculture species, and then spread on its own.

When asked if they had ever observed other waterlife dying off, most people said they did not know. However, people in O Kan said that in the rainy seasons of 2002 and 2003 frogs had died, but not in 2004. They said they had never seen crabs, shrimp or clams dying off. People in Kbal Romeas said they had never seen shellfish die naturally, but frogs died every year, generally in October, and had done so for a long time. In Sre Sranok, people said that snails (*kchong*), frogs and crabs died every year, but people did not see shrimp dying. When the water dries out locally, clams (*krum*) die.

### **Fisheries management**

In all villages along the Srepok River, people said they were not familiar with Fisheries officers; in Mondulkiri, they had not even been appointed yet. When illegal fishing gears have been seized, it has in most cases been by rangers from the Lumphat Wildlife Sanctuary, who are supported by the international NGO WildAid.

Fisheries officers have, however, organized community fisheries<sup>58</sup> in four communes in Ratanakiri along the Srepok: Sre Angkrong Commune (Kon Mum District) in 2001; Chey Oddam Commune (Lumphat District) in 2002; and Serei Mongkol and Trapeang Chres Communes (Kon Mum District) in 2004. The community fisheries associations have been given the right and responsibility to protect deep-water pools along the river and, in the case of the first two community fisheries, this has been through proclamations by the provincial governor. In Sre Angkrong Commune, villagers and local authorities could explain how the community fisheries were supposed to work, but in Chey Oddam villagers did not seem to be aware that the community fisheries existed. In all of these communes, there are currently a large number of illegal fishers. They use illegal gears to fish in the conservation pools and elsewhere, but the community fisheries do not seem to be able to do anything about it. Baird (2003) and Oul et al. (2001) provide more in-depth descriptions and analysis of these community fisheries.

Outside of these communes, participatory land use planning (PLUP) and natural resources management (NRM) planning at commune level, carried out in conjunction with the Seila program, have also led to new management structures in fisheries in Ratanakiri Province. Communes are claiming management and use rights of fisheries resources within their boundaries, and commune councils in some communes at least perceive that they have an important role to play in managing fisheries within their boundaries. Villagers in some areas in Ratanakiri perceive that there are new restrictions on crossing village and commune boundaries to fish.

### **Aquaculture**

Aquaculture is apparently not practiced on any significant scale anywhere in the Srepok River basin. In Sre Sranok Village (Stung Treng), a Vietnamese family had set up a cage in the Srepok River for raising *Barbichthys nitidus* (*trey kya*), *Osphornemus exodon* (*trey romeas*), and *Channa micropeltes* (*trey chdao*) and had apparently tried raising them once. They had started several years ago, and at the time of our visit, there were no fish being raised. In Ka Tieng Village (La Bang Muoy Commune, Lumphat District), a Vietnamese family dug two ponds in which they attempted to raise catfish, starting in late 2004, pumping water into the ponds from O Ka Teung. After four months, the fish had not grown much, and the family abandoned the effort. They blamed poor water quality in O Ka Teung, which they suspected was a result of the rubber factory upstream. We were also told that some families raised fish in ponds near Kon Mum district town, but did not verify it.

In Lon village (Banlung District), provincial Agriculture officers reportedly released grass carp fry from Viet Nam into Yeak Laom Lake several years ago (the first non-native species introduced there). The carp consumed much of the vegetation in the lake and the population plummeted after they ran out of food (Ian G. Baird, personal communication).

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<sup>58</sup> Community fisheries are local associations given management rights over certain areas of fishing grounds. The Sub-Decree on Management of Community Fisheries provides a legal framework for them.

## 8.5 Wildlife collection

Most of the Srepok basin has at least some forest cover, and in parts at least, there are important and significant wildlife populations. Elephants are found in parts of the basin in Mondulkiri, and gaur are found in parts of the basin in both Ratanakiri and Mondulkiri. Crocodiles live in some areas, and have been photographed by WWF near O Phlay.

In villages along the Srepok River, people reported that wildlife collection and trade had been an important part of local livelihoods for generations. Probably most important was the trapping of elephants. This had been one of the main occupations in Nong Bua and Koh Meayoel Loe in the past, next to rice farming. Extensive rituals and numerous taboos were associated with elephant trapping. In Sre Angkrong, we were told that, in the 1960s, people went up the Srepok as far as O Chimeat or further to trap otters and catch crocodiles. People in Nong Bua said that Lao settlers came because “there was fish, elephants, pangolins, and turtles”. In Koh Meayoel Loe, villagers said that Lao settlers came to catch crocodiles and otters, in addition to trading buffalo.<sup>59</sup>

The wildlife trade expanded in the 1990s as more and more species became targeted and trading networks became better established. In the past several years, however, management of protected areas within the Srepok River basin has become more active, and efforts have been made to crack down on the collection and sale of wildlife. Despite these efforts, wildlife collection and trade remain an important part of local livelihood strategies in most villages in the basin. As has been noted already, collection of wildlife often happens alongside fishing, collection of NTFPs, and other activities. Still, people travel further afield to collect wildlife or hunt than for any other activity. In Nong Bua, people explained their preference for wildlife collection over fishing thus: “Wildlife can be kept alive for 10 days; fish starts to rot in one day.”

McAndrew et al. (2003) write about Dak Dam Commune (O Rang District, Mondulkiri):

PRA participants from Pou Les, Pou Chob, and Pou Ontreng traced a decline in the presence of wildlife in Dak Dam from the return of villagers in the early 1980s. Several reasons were given for the decrease. Traders came more frequently to the village to buy wildlife, which stimulated villagers to hunt more often and to kill more than they could consume. At the same time local residents had, until recently, greater access to guns. Soldiers and police stationed in Sen Monorom had guns and hunted to increase their food supplies and to supplement their incomes. Illegal loggers had guns to arm themselves and hunted wildlife for their food.

The confiscation of guns from 1998 onwards greatly reduced the involvement of outsiders in hunting and consequently the accelerated rate of destruction. Some hunting with guns still took place in Dak Dam but it was not very common. Generally, soldiers and police were required to relinquish their guns when they had no mission. This also made it more difficult for local residents to borrow guns from uniformed relatives in Sen Monorom. Despite the seizure of guns hunting still thrived in Dak Dam with villagers hunting mainly with traps and dogs. Traps were used to hunt wild pigs and larger animals and dogs were used to hunt smaller game such as monitor lizards and hares. At least two Khmer shopkeepers in Dak Dam traded in wildlife and Khmer traders from Sen Monorom came to the village to buy wildlife. Given the proximity of the flourishing wildlife market in Sen Monorom and the lack of any systematic monitoring activity, hunting without guns in Dak Dam was likely to continue unabated.

So et al. (2001a) found in Pu Ropet (Krang Teh Commune, Pech Roda District):

Hunting is a traditional activity for the indigenous people of Pourapet Village. In the past they used equipment such as traps (snares), spiked bamboo, crossbows and arrows and dogs. Because of increasing demands of the wildlife market (both domestic and international) firearms are increasingly used for wildlife hunting. Nowadays, hunting is a significant occupation for villagers who believe that by spending just a little money to acquire a firearm, they can gain a considerable economic return. They can borrow or rent a rifle (AK47) from soldiers and purchase bullets from police staff or soldiers for a low price. Wildlife meats sell for a high price in the market. About 53% of the 38 families interviewed of Pourapet Village practice some form of hunting. Each family gets an average net income of 885,673 Riel per year.

Until recently, guns were widespread and hunting was common throughout much of the Srepok River basin in Cambodia. With the crackdown on possession of guns, much fewer people are involved in

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<sup>59</sup> Baird (1995) describes the history of the wildlife trade in the area of the Sesan River in detail.

hunting, but hunting with guns continues. In part, at least, people borrow guns from military and police for hunting. Use of dogs to collect wildlife such as turtles and monitor lizards is much more common; these are probably the most commonly collected wildlife. In September, monitor lizards can be picked off trees from boats on streams. Crossbows with poisoned arrows are also common, and are used to hunt mouse deer, muntjac and other small mammals. Juvenile mynahs are particularly sought after;<sup>60</sup> pangolins would be too but they have become extremely scarce.<sup>61</sup> Juvenile parrots and antlers are also commonly cited as important wildlife products for family income. Along the river and streams, soft-shelled turtles are collected: in Sre Sranok a single family may sell an estimated 100kg in one year.<sup>62</sup> In Kbal Romeas Village (Stung Treng), they are caught using drop-door traps (*chan*); elsewhere, people use sticks to probe the sand or mud for them, and dig them up. In Nong Bua people said they used to set out longlines for them.<sup>63</sup>

We did not learn much about beliefs or customs related to hunting. However, in Kaeng San, people said that they used to make sacrifices before going out hunting, and also after successful hunts.

In villages along the Srepok, people combine wildlife collection with fishing trips along the tributaries. Throughout the basin, but particularly in villages along the Srepok and in Mondulkiri, people also make extensive trips into the forest, by foot, oxcart or motorcycle, to collect wildlife. When they come to ponds, they stop to fish and make smoked fish, salted fish, or fish paste (*prahok*). In Sre Angkrong, one person explained that "on a trip into the forest, people collect everything: hard resin, *prahok*, smoked fish, turtles, porcupines, pangolins, etc. Two to three oxcarts go out together, for four to five nights; people never go out with just one oxcart. Everyone in the same oxcart shares the profits, but food is shared among all the oxcarts."

It is probable that there are wildlife traders in all the villages. In Koh Meayoel Loe, we were told that wildlife traders in Banlung provide money to their contacts in villages to buy wildlife from villagers and bring it to them. In Banlung, muntjac are on open display in the market, as is dried sambar deer meat. In many villages, wildlife may ultimately end up in either Banlung or Mondulkiri provincial town, depending on the prices traders are willing to offer. In addition to the wildlife trade, some wildlife ends up eaten by local villagers, and Table 8 above gives an indication of the importance of wildlife to diet.

We asked the general discussion groups in all the villages along the Srepok if, in the past five years, they had ever seen wild animals sick or dead in the forest. In a number of the villages people said they had seen wild pigs in the forest dead of unidentified diseases.<sup>64</sup> In others,<sup>65</sup> they said they had never seen any such cases, and people in two<sup>66</sup> said they did not know. In none of the villages had anyone seen any other wild animals sick or dead.

## 8.6 Collection of forest products

Throughout the Srepok River basin, people are heavily dependent on forest products, including: wood and other materials for construction of houses and community buildings; medicinal plants; wild fruits, tubers, vegetables and mushrooms; materials used for making baskets and other crafts; honey; and resin for sealing boats and making torches. Villagers also collect forest products to sell and in some villages this contributes a major part of family income.

In much of the basin, forest resources have been decimated in recent years, primarily through logging and land clearing. There are currently no logging concessions anywhere in the Srepok River basin,

<sup>60</sup> A pair of juvenile hill mynahs brings about 150,000 Riel in Thmey village and 180,000 in Krabei Chrum (Kbal Romeas Commune, Stung Treng). In all of the villages along the Srepok River, and a number of others, collection of juvenile mynahs was cited as a major source of income. This species has been heavily impacted by the wildlife trade in other countries in the region.

<sup>61</sup> People in Koh Meayoel Loe reported that pangolins sell for 120,000 to 150,000 Riel per kg if over 4kg.

<sup>62</sup> Soft-shelled turtles, other species of turtles, and some species of monitor lizards nest on the river banks of the Srepok, or sometimes on islands, during the dry season. People have never seen turtles' eggs damaged by flooding; in some villages, they said that turtles know when the floods will come.

<sup>63</sup> See also Baird (1995) for details of hunting methods in the area of the Sesan River.

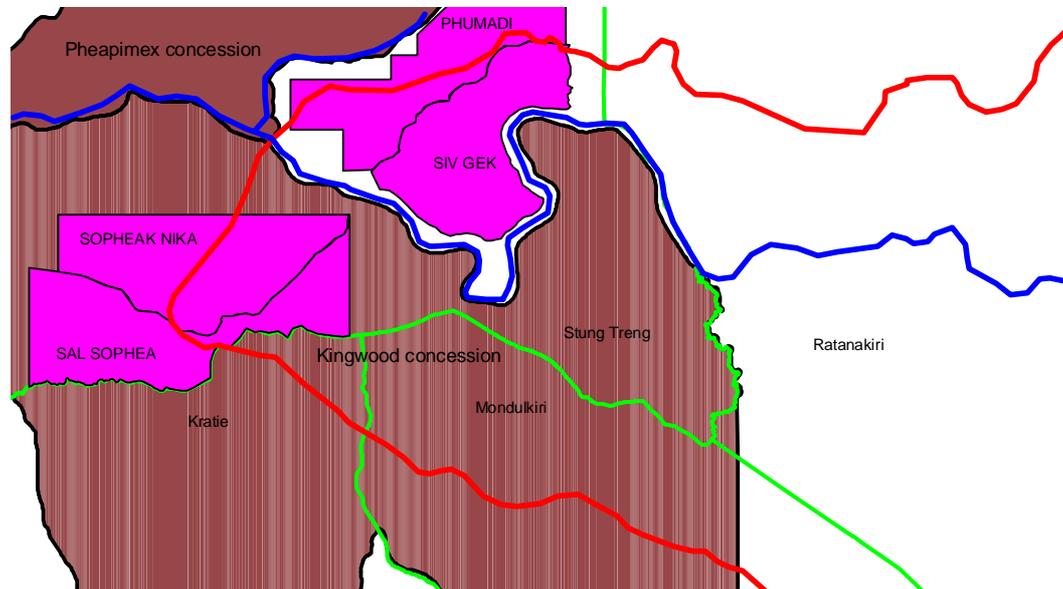
<sup>64</sup> Koh Meayoel Loe (year not specified); Kaeng San in 2002; Thmey in April 2004; O Kan every year for the past three years; Srepok Thom in 2002; and Sre Sranok in 2003 but never before.

<sup>65</sup> Nong Bua, Kompong Sangkum, Phum Pir and Kbal Romeas

<sup>66</sup> Sam Kha and Neang Dei.

although some were granted in the past. The Mondulkiri Protected Forest includes what used to be a logging concession, and the Kingwood Concession, which includes parts of Stung Treng, Kratie, Mondulkiri and Ratanakiri provinces within the Srepok River basin (as shown in the map in Figure 20 below), was cancelled in 2003. In addition, various land concessions have been granted within the basin, often on forested land; four proposed land concessions are shown in the map in Figure 20.

**Figure 20: Kingwood Concession**



McAndrew et al. (2003) write about logging in Dak Dam Commune:

In Dak Dam PRA participants from Pou Less, Pou Chob, and Pou Ontreng villages observed that forest cover had steadily declined in the commune since their return from Koh Nhek district in the 1980s, with a severe drop occurring after 1998. The predominantly Phnong assembly attributed the loss of timber resources mainly to the operations of the Khmer Sathapana company in the late 1990s, illegal logging by people with chainsaws, and the building of homes to accommodate the growing commune population.

Dak Dam villagers viewed the Khmer Sathapana company as a legal entity that had a contract with the government. Early on, company representatives convened a meeting with the villagers and told them that they could benefit from the logging operations. The officials encouraged the Phnong to cut and sell logs to the company, and several of them did just that. Village residents, both men and women, were also hired at \$10 per month to work at the company sawmill. By the time they closed their operations, the company had cut and left a large number of logs in the forest. Villagers noticed that illegal loggers later came into the commune and hauled this timber away.

Illegal logging in Dak Dam was conducted on a large scale. Villagers remembered that truck convoys used to pass through the commune bringing logs across the border into Vietnam...In recent years the once rampant illegal export of logs to Vietnam had been considerably contained. Nevertheless, some illegal logging ventures still continued. Villagers mentioned that people from Sen Monorom sometimes logged at night using trucks to transport the timber.

Cutting of timber continues today, both to supply external markets and for local use. In most or all villages there are at least several chainsaws, which are used to cut wood when people build houses and, in many cases, also to cut wood to sell. Outsiders with powerful backing also log in local forests.<sup>67</sup> Cutting poles to sell is listed as an important activity in most of the villages along the Srepok.

<sup>67</sup> In Ka Laeng, in particular, people complained about logging within the village boundaries by powerful outsiders, who cut trees of luxury species – hiring villagers to point them out to them.

Timber is increasingly needed by local communities for housing construction. So et al. (2001a) write about Pu Ropet (Krang Teh Commune, Pech Roda District):

For centuries the indigenous community has built small bamboo houses with small supporting poles and thatch roofs. However, cultural and socio-economic changes have caused the community to increasingly build houses modeled on modern Cambodian (Khmer) style. Some houses are built of wood and roofed with zinc. This has caused an increasing demand for timber from the ethnic community, although it remains relatively small, used for house construction.

In Ratanakiri, as a result of natural resource management (NRM) planning carried out in conjunction with the government's Seila program, access to timber for domestic use has become increasingly regulated. In some villages, people say that crossing village boundaries to cut trees is no longer allowed as it was in the past.

In terms of contribution to family income, some of the most important NTFPs collected are: liquid resin, hard resin, strychnine seeds, honey, and wild mushrooms. These are collected by indigenous and non-indigenous people alike. We found no cases of villagers collecting malva nuts, an extremely important economic activity in some parts of Ratanakiri and Mondulkiri, although in the past some had traveled to other areas to do this.<sup>68</sup>

**Figure 21: Preparing bags of liquid resin for filtration in Banlung**



(Photo by Rena Sugita)

Liquid resin is tapped from various wild growing Dipterocarpus trees, with *D. alatus* (*chhoe teal*) and *D. intricatus* (*trach*) being the most commonly tapped. The trees are privately owned by villagers (resin tappers). A hole is cut in the tree and burned to get the resin to flow, then every week or so the tapper collects the resin, each time burning the hole again so that the resin will keep flowing. Resin is tapped in almost all of the villages visited. It is used locally to make torches for lighting at night and to seal boats. Resin traders buy liquid resin in just about any village where people tap it, and in Ratanakiri and Mondulkiri provincial towns there are large-scale traders who export resin to Viet Nam. However, in some villages there are so few trees (usually because of logging) that people tap resin just for use in

<sup>68</sup> See Baird (1995) for a discussion of NTFPs in the area of the Sesan River.

the village.<sup>69</sup> The number of people involved in resin tapping in the survey villages along the Srepok River itself is not great, the most being in Kbal Romeas and Sre Sranok where there are an estimated 10 and 15 families who tap resin, respectively. In Pech Roda District of Monduliri Province, however, resin tapping is a major source of income and plays an important role in determining how people use other natural resources. This is apparently because there is a larger number of trees available than in other areas. So et al. (2001a) write about Pu Ropet (in Krang Teh commune, Pech Roda District):

Liquid resin collection is the villagers' highest income generating activity. The resin product brings a high price and has a good market demands. Furthermore, this area has an abundance of tree species that produce liquid resin. Many trees are planted along the water canal and stream. Most people spend considerable time gathering resin in the forest; some almost the full year. Approximately 74% of the indigenous people depend on liquid resin for their livelihood. Compared to others livelihood income activities it is very important. Its collection generates an average net income of 906,309 Riel per year.

In Pech Roda district, resin tapping areas are effectively divided up by village, and more or less define the areas where people in each village fish. People sleep in the forest to tap resin, far from their homes. The number of trees per family varies within the district; in Pu Chry Chang people reported having between 50 and 100 trees per family. 100 trees can produce an estimated 3,000 liters of resin per year; the price in Pu Chry Chang is between 500 and 670 Riel a liter, so this would come to 1,500,000 to 2,000,000 Riel per year for one family, a significant amount of income. (In Monduliri provincial town the price is reportedly about 800 Riel per kg.) In Bu Sra Commune, people reported having lost many of their resin trees to loggers in recent years. There are areas along the upper Srepok River (including on islands), far from any villages, where several people from Monduliri provincial town each have thousands of resin trees.

Hard resin is collected in some villages, typically in the dry season.<sup>70</sup> There are two kinds. One is formed by sap oozing out of the branches of *Shorea siamensis* (*reang phnom*) and *Shorea obtusa* (*pchek*) trees, and is called *chor reang* (*reang* resin). Insects inside cavities in trees create the other, called *chor s'ong*. The trees are not privately owned, and anyone can collect hard resin from any tree he or she finds. In the first case (*chor reang*), people shoot the resin down with slingshots, climb the tree to get it, or collect it from the ground, and in the second (*chor s'ong*), they cut the tree down to get it. The price of hard resin paid to villagers is roughly 400-700 Riel per kilogram (in Monduliri provincial town it is reportedly 1,000 Riel per kg). It is used locally for sealing boats (mixed with liquid resin) and is also exported. In Sre Sranok and Sre Angkrong, hard resin is an important source of income and people travel long distances to collect it – longer than for any other NTFP. In Sre Sranok, people said that they spend seven to ten days in the forest at a time collecting hard resin, and can collect about 100-150kg on one trip. So et al. (2001b) found that in Sre Thom (Koh Nhek District), most adults could collect 4-5kg of hard resin daily. In contrast, So et al. (2001a) found in Pu Ropet (Pech Roda District) that they could collect only 2-3kg of dry resin in a day.

Strychnine (*sleng*) seeds are collected by people in many villages, primarily from March to May, and are one of the more important NTFPs. Villagers said that the trees grow along streams and rivers and in evergreen forest. Prices were about 2,000-4,000 Riel per kg in 2005. Chinese traders in Monduliri provincial town buy large quantities, and traders from Lumphat and Kon Mum district towns also go out to villages to buy them from people who collect them. We did not learn what they are used for. To get the seeds, collectors often cut the trees down, although some communities now have rules prohibiting this. In some villages, people travel far from home to collect these seeds.<sup>71</sup>

Honey is collected by people in every village if they find it, and is sometimes sold and sometimes consumed. Only in Kbal Romeas (Stung Treng) did we hear about people going out explicitly looking for honey, and many people in this village do so. In Kbal Romeas, one group of five to 10 people can collect 30-40 liters per year, selling at 2,000 Riel per liter. In Pa Ar (Lung Khung Commune, Bokeo District), people said that if someone found a hive, he or she marked the tree so that no one else could

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<sup>69</sup> So et al. (2001b) report that in Sre Thom Village (Sok San Commune, Koh Nhek District) approximately five to six trees are tapped by people in the village "to make torches for visiting neighbors during the night". The trees are tapped daily.

<sup>70</sup> Survey villages where people collect hard resin include: Sre Sranok, Kaeng San, Thmey, Phum Pir, Neang Dei, Srepok Thom, Ta Kok Jarai, Pruok, Ka Laeng, Rayor, and Chi Klap.

<sup>71</sup> This was particularly true of villages in Sok San Commune (Koh Nhek) where, for example, people from Anchor Village go to O Lve to collect the seeds. On such trips, they use gillnets to fish in pools and are able to catch enough fish to make fish paste (*prahok*).

collect the honey from that tree – then came back later to collect it and sell it. So et al. (2001a) write about Pu Ropet:

Honey has a very good price in the market – one liter can sell from 3,000 to 5,000 Riel (price in village). It is collected for 3-4 months from February to May. They usually wait until they have collected a large amount and then sell it in the market, keeping a little back for home consumption. 97% of the families interviewed practice this occupation and each family gains average net income about 58,210 Riel per year.

In Ratanakiri, people sold large quantities of one particular kind of mushroom (*pset pak*) in 2004, for 2,000-3,000 Riel per kg. In 2005, traders did not buy them: we were told that Thai and Lao authorities were not letting them across the border. In O Kan and Sre Sranok, people sold 50-60kg per family in 2004. We met a trader in Koh Nhek District who was buying several different kinds of wild mushrooms (called *pset sokrom*, *pset pchek*, and *pset pomea* in Khmer) to sell in Phnom Penh. In Chi Klap (Sok San Commune, Koh Nhek District) people travel long distances to collect these mushrooms.

Various wild fruits, mushrooms, vegetables (including aquatic plants) and potatoes are collected to eat.<sup>72</sup> People eat wild potatoes (particularly *kduech*) in times of rice shortage, and we observed people eating them in Chi Klap and Ka Laeng to make their rice stores last longer. According to the general discussion groups, of the survey villages along the Srepok, 10 families in Koh Meayoe Loe, 3 or 4 families in Nong Bua, 55 families in Thmey, 15 families in Kompong Sangkum and about 10 families in Kbal Romeas have had to eat wild potatoes in the past two years, owing to food shortages. (No families in Kaeng San, O Kan, Neang Dei, Srepok Thom, Phum Pir or Sre Sranok have had to do so.)

Rattan and bamboo are collected in all villages, but nowhere to sell, though in some villages they are used to make crafts that are sold. In the survey villages in Stung Treng, people had the experience one year of being offered a price for bamboo, cutting it and taking it to the trader in Stung Treng – then he declined to buy it. Imperata grass is also harvested in most villages for thatch. Ginseng and a medicinal tuber (called *meum thnam chen* in Khmer) are also reportedly collected in Mondulkiri during certain seasons and sold to Vietnamese traders for a high price (Megan McInnes, personal communication).<sup>73</sup>

Although there are restrictions in many villages on crossing village boundaries to cut timber (generally in villages in Ratanakiri as a result of natural resource planning carried out in conjunction with the government Seila program), people can usually cross village boundaries freely to collect NTFPs. Ian G. Baird (personal communication), however, reports that the Brao have some spatial restrictions associated with crossing the paths and settlements of other communities, and these affect where people harvest some NTFPs, such as liquid resin. Of all NTFPs, people travel the furthest to collect dry resin, mushrooms and strychnine seeds, and (in parts of Mondulkiri) to tap liquid resin.

## 8.7 Mining

Gem and gold mining has been practiced by villagers in some areas within the Srepok River basin. In O Kan village (Chey Oddarm Commune, Lumphat District, Ratanakiri), people said that villagers used to collect gold in the O Kan stream in the past, but no longer do so. In Ka Laeng (Ka Laeng Commune, Lumphat District), villagers used to mine gems.

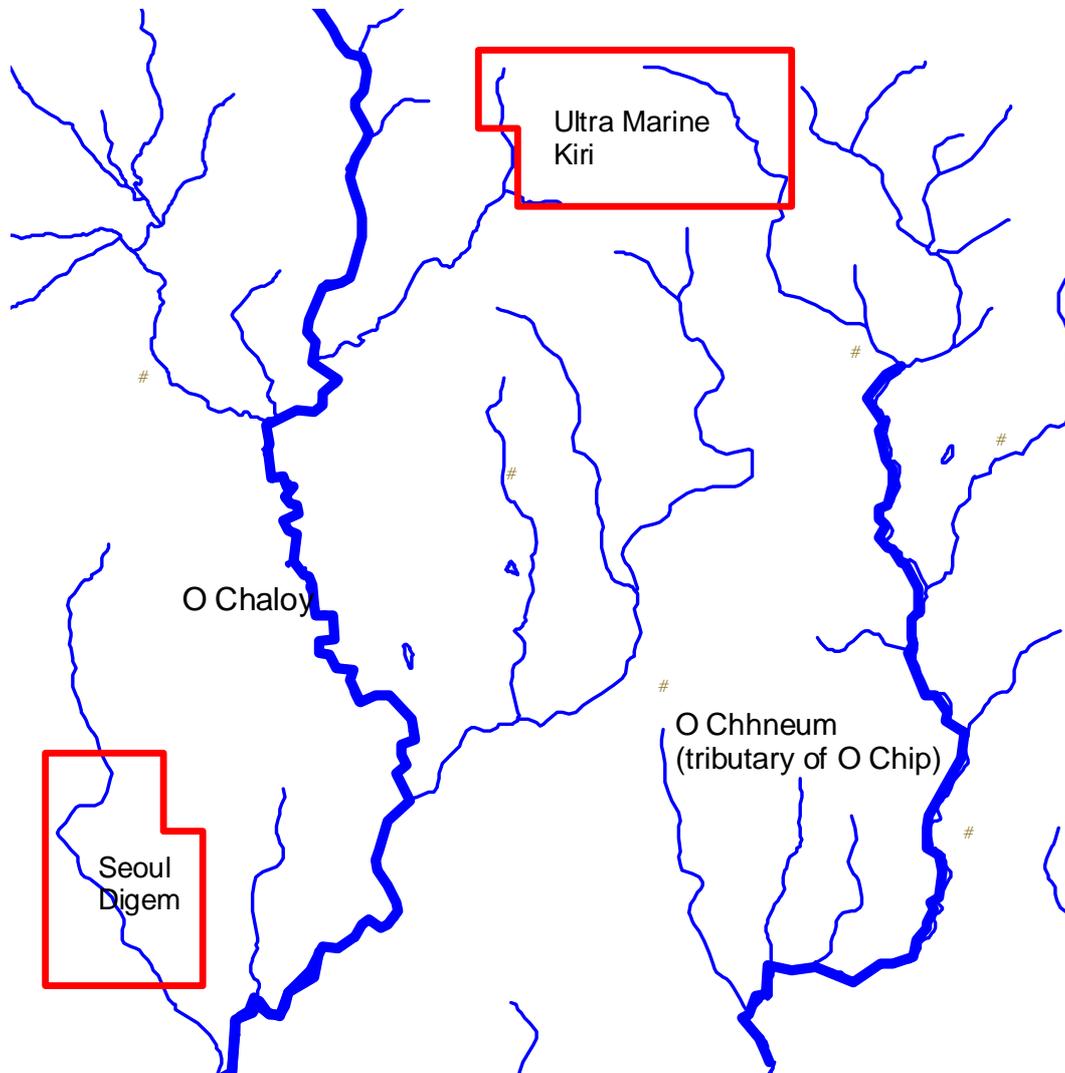
Now, however, fewer local villagers are involved in mining. More people from outside the area have moved in to mine, and companies are starting to get contracts for mining operations. The area where villagers used to mine gems in Ka Laeng is now the Chumrum Bei Srok mine, with a population of 472 families as of February 2005, most of whom have moved in from other provinces since late 2000. Many of them dig their own mines, and miners interviewed said that they do not pay fees and can sell the gems to whomever they want. The massive influx of people from other provinces has led to

<sup>72</sup> Important wild vegetables include: *chres* leaves; *sdao* leaves and flowers (mostly in the dry season); bamboo shoots; rattan ends; *prech* leaves (*prech* grows on high areas, and people can collect the leaves in the dry season, from February to April); *cha huoy* flowers (these grow along streams where there is moist soil, and people collect them primarily in the dry season); *pset kngaok* mushrooms; *pset pak* mushrooms; *pset pong rolok* mushrooms; *andeng* flowers and buds; *chunlea* leaves; *spey teuk*, *pramat dey*, *saray thmar*, *bah* leaves; *reang* buds and leaves; *kantrom* leaves; *s'om* leaves; *to'* leaves; *sao mao prey* leaves; *andeng* flowers; *mchu prik*; *chrach*; and *kraven*. *Thao*, a kind of algae that grows in rice fields, is also eaten by ethnic Lao people.

<sup>73</sup> Consultant at NGO Forum on Cambodia until August 2005.

problems of land alienation in Ka Laeng, as described above. Recently, a Korean company (Seoul Digem) has been granted a concession for gem mining in this area, covering 5,500 Ha; it is not yet clear how this will affect the operations of the independent miners. Another company (Ultra Marine Kiri) has been granted a concession for gem mining covering 7,500 Ha in the area of Pa Ting Thom Village (Ting Chak Commune, Bokeo District, Ratanakiri). Mining in this latter area has already had severe impacts on water quality in streams used by local communities. These concessions are shown in Figure 22 below.

**Figure 22: Gem mining concessions in Ratanakiri**



Villagers in Ta Kok Jarai Village (Bo Kham Commune, O Ya Dao District) blame the use of chemicals in association with a nearby gold mine for substantial decreases in fish populations in the local stream (O Chen Tay, a tributary of O Tang). The water in O Chen Tay is visibly cloudy, unlike all other streams we visited. Sieng (2004) describes mining at the Prey Meas gold deposit in this area by wealthy migrant miners who hired other people to work for them. The gold deposit was discovered in 1985 and in 1994 people began to move in from other provinces to mine. At the time of that study, 35 families

lived in Yak Baing Prey Meas Village, a recently established settlement. The study found extensive mercury contamination and deforestation associated with cutting timber to support mining shafts and tunnels. Villagers in Ta Kok Jarai reported that a foreign company was now operating a mine in the area, but we were not able to find out any details.

In Mondulkiri, we were told that there is one gem mine along O Ta Me (near the border with Viet Nam) and another near O Daeng Brah (a tributary of O Phlay), but did not learn any details.

## **8.8 Tourism**

Tourism is a growing business in both Ratanakiri and Mondulkiri. A variety of tourist sites are being promoted in both provinces, including waterfalls, lakes and mountains. Many of these lie within the Srepok River basin. In Ratanakiri, three of these sites have been placed under commune or community management, with income from entrance fees going to the communes or communities: Boeng Yeak Laom and Boeng Lum Kut lakes, and Seven Steps (*prampil choan*) Waterfall. A community committee member reported that community income from the waterfall is about 600,000 to 700,000 Riel per year. Other tourist sites within the Srepok River basin in Ratanakiri include the Ka Chanh and Ka Tieng waterfalls, and a riverfront (Kep Thmey) in Lumphat.

In Mondulkiri, three tourist sites in Bu Sra Commune are officially promoted: Bu Sra Waterfall and Phnom Bran and Phnom Nam Lyr mountains. Management rights to Bu Sra Waterfall have reportedly been given to a private company, and there is no imminent move to hand management of other sites over to communities. There are now several guesthouses in Bu Sra Commune to support the tourist industry, most of which are owned by Khmers who have moved in from outside.

Benefits to the local community in Mondulkiri from tourism are unclear, although in Ratanakiri there is at least potential for direct income for local communities. However, negative impacts of tourism on local livelihoods are being seen already in both provinces: at provincial level, and sometimes at local level, the growing tourist industry is a major driving force behind land alienation, as people try to buy up land whose price is increasing owing to expectations of economic growth from tourism.

The WWF-supported SWAP (Srepok Wilderness Area Project), working in the Mondulkiri Protected Forest, is beginning to develop eco-tourism facilities, and project managers expect that eco-tourism will play a major role in the local economy in the future. The Lumphat Wildlife Sanctuary has organized trips for visitors interested in bird watching, and plans to improve facilities for eco-tourists in the future. How both these initiatives benefit local livelihoods will be seen over time.

## **8.9 Labor**

Throughout most of the Srepok River basin, selling of labor is a relatively minor element of livelihood strategies of local villagers. Historically, and now, major opportunities for employment have been more likely to benefit people from outside the local area or outside the province than local villagers. In its food security assessment of Mondulkiri Province, Action Against Hunger (2004) found that:

Ethnic hill-tribe minority groups were also found to be particularly vulnerable and less able to cope with rice shortages. Ethnic Khmer (and Cham to a lesser extent) can always find temporary jobs or some small business that will allow them to survive until the next harvest, however the number of coping strategies for ethnic minorities is reduced due to social discrimination as well as cultural and language barriers (73% of Phnong women and 57% of men cannot speak Khmer at all, or can only speak Khmer poorly).

The rubber plantations established in Ratanakiri in the 1960s hired some indigenous workers, but Khmers from other provinces benefited most from employment as plantation workers. The vast majority of workers hired by the Wuzhishan company in Mondulkiri are from outside the province. In the villages we visited, we encountered almost no cases of indigenous people working for the rubber plantations in Ratanakiri, and none in the villages that had been displaced to create the plantations (Lon and Ka Tieng). However, in the future, SWAP expects to become a major employer of local people, in the eco-tourism industry.

In Nong Bua, Koh Meayoe Loe, Kaeng San, Thmey and Neang Dei, people said that no one worked for hire. In other villages, the most common work was on cashew plantations or in clearing fields. In

Sre Angkrong, we were told that about 10 people worked for hire collecting cashews, and they could earn 5,000 Riel per day this way. People are also hired to clear weeds in bean fields. In Sam Kha, a small number of people work for hire, clearing weeds, collecting cashews and clearing new fields. In Ka Laeng, some people find work at the mine at Chumrum Bei Srok.

## **8.10 Water supply**

In all the villages along the Srepok River, people use river water for drinking and other uses. In some villages they boil the water or filter it, and others they do not. Filters are used by some families in O Kan, Thmey, Sre Sranok and Kbal Romeas.<sup>74</sup> People in Koh Meayoel Loe said that 50% of people boiled water before drinking it, and in Thmey, this number was 40%. In O Kan, those families who lived near O Kan used water from the stream instead of the river. In Kaeng San, during the dry season, some families who had sandy areas on their own riverfront dug small “wells” in the sand.

In some villages along the Srepok River, there were wells: Koh Meayoel Loe, Nong Bua, O Kan, Kompong Sangkum, Kbal Romeas and Sre Sranok.<sup>75</sup> In O Kan, there was only one family with a well, and only that family uses it. In Kbal Romeas and Sre Sranok, families near wells use well water for drinking; families further away use river water. The main settlement in Kompong Sangkum is several kilometers from the river, and people live there during the rainy season when they farm rice. During the dry season, many move to live along the river. There are wells in the main part of the village, which everyone uses during the rainy season. During the dry season, people living along the river use river water. In Koh Meayoel Loe and Nong Bua, some families use well water for washing clothes and dishes or bathing, but not for drinking, because of the taste. During the rainy season, when people spend long periods at their rice fields, they may dig shallow wells along their rice fields or use water from nearby streams and ponds. In the rainy season, some people collect rainwater for drinking.

**Figure 23: “Well” on sandbank of Srepok river in Kaeng San village**



(Photo by Chan Sokheng.)

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<sup>74</sup> In Kbal Romeas and Sre Sranok they were provided by PFD (Partners for Development) a few years ago; in O Kan and Thmey they were provided by the Cambodian Red Cross.

<sup>75</sup> Many of the wells drilled in Stung Treng have been found to be contaminated with arsenic, especially those in alluvial areas. Over the long term, such well water can cause health problems and death, as has been the case in Bangladesh (Ian G. Baird, personal communication).

In villages off of the Srepok, people use water from wells, streams, or springs. Many of the wells don't work (in some cases because they were drilled during the rainy season when the water table is high) or are inadequate. In Nhoel, drinking water is from small hand dug wells near the stream (O Laming); in Pa Ar people have set up bamboo pipes along O Tang Kanh to make it easy to collect water and bathe. (Several wells that had been built in Pa Ar no longer had water at the time of fieldwork.)

In several cases stream water has become contaminated. In Ta Kok Jarai, people used to drink the water in O Chen Tai but cannot anymore because it is contaminated by the goldmine upstream – so now they collect water from a spring further from the village. In La Bang Pir Commune (Lumphat district) villagers suspect that water in O Ka Teung stream is contaminated with chemicals from the rubber factory upstream. In Dak Dam Commune (Mondulkiri) Wuzhishan company sprayed herbicides on grassy hillsides in preparation for planting pine trees, contaminating water supplies.

## 8.11 Health

The survey did not study health in any detail. However, in all the villages visited along the Srepok River, data were collected on deaths of children under 10 for a one-year period. The results are presented in Table 9 below.

**Table 9: Deaths of children in a one-year period<sup>76</sup>**

No.	Village	No. of deaths	Causes of death
1	Koh Meayoel Loe	5	Cough, malaria, fever
2	Nong Bua	0	
3	Kaeng San	4	Cough, malaria
4	Thmey	15	Cough, malaria
5	O Kan	2	Two newborn babies died
6	Sam Kha	0	
7	Neang Dei	1	Illness
8	Srepok Thom	7	Cough
9	Kompong Sangkum	4	Illness
10	Phum Pir	4	Illness
11	Kbal Romeas	2	One 8-year old died of "epilepsy". A 3-year old died of paralysis ( <i>svet day svet choeng</i> ) which he or she had had since birth.
12	Sre Sranok	1	One 2½ year old: body swelled up, then shrank, eyes swelled.

The general discussion groups also identified the number of people who had drowned in the past five years. Of the 12 villages along the river, none had drowned in Koh Meayoel Loe, Nong Bua, Kaeng San, O Kan, Neang Dei, Kompong Sangkum or Sre Sranok. Two had drowned in Thmey, two in Sam Kha, one in Srepok Thom, five in Phum Pir and three in Kbal Romeas.

We tried unsuccessfully to find official statistics of illnesses and causes of death in the villages, but could only find statistics for those people admitted to health centers. These statistics are unlikely to be representative of actual rates of illness and causes of death.

<sup>76</sup> Data are from general group discussions. Data for O Kan, Sre Sranok and Kbal Romeas are for the period from April 2004 to March 2005. Otherwise, data are for January to December 2004.

## **9. Implications for Development Practitioners and Directions for Future Research**

The above description of the current situation in the Srepok River basin, and analysis of changes that have occurred over time, have implications for development practitioners involved in planning for the development of the basin. They include, among others:

1. People throughout the basin are extremely dependent on natural resources. At the same time, the ecosystem is fragile, governance with regards to natural resources is very weak, and any kind of development is likely to impact on natural resources. The interconnected streams of the basin and the Srepok River itself are important for the reproduction of fish stocks, but the ecosystem is vulnerable to even minor changes. The natural signals for fish to migrate are subtle, and even small changes in the water regime can have major impacts on fish populations. Anything that impacts on fisheries in the basin will have major repercussions on local livelihoods, and will increase pressures on wildlife. Most people living in the basin are dependent on water in the streams for drinking, so any changes in their water quality can impact on human health. Loss of forest resources will impact on family incomes and food security, as well as cultural reproduction.
2. Because of the interrelatedness of the different elements of livelihood strategies, any changes in one part of the strategy will impact on others. As wildlife trade is stopped, it will be necessary for other livelihood strategies, such as fishing, to compensate. On the other hand, if fisheries decline too far, then it may be impossible to stop the wildlife trade. Where concession activities impact on past or current livelihood strategies (such as gem mining, farming or collection of NTFPs), villagers will be forced to intensify other livelihood activities – which may not be sustainable. These tradeoffs need to be considered when planning to grant concessions.
3. Without clear tenure for local communities over land and other natural resources and reinforcement of traditional mechanisms for their management, any kind of development is likely to increase land alienation among local indigenous communities and loss of their access to natural resources. Land alienation is currently one of the most important and divisive issues in the area; it is being fueled by increased potential for tourism, agricultural development, and other similar changes. No indigenous communities have title yet over their communal lands, and tenure over other natural resources is even less secure.
4. One of the major obstacles to development in the basin is the inadequacy of infrastructure, most notably roads. However, already, significant negative impacts of road construction have been experienced. The most notable example is in Pu Chry Commune (Pech Roda District), where the construction of a road that will eventually run from Mondulhiri provincial town to Lumphat has resulted directly in the in-migration of approximately 300 families and loss of land by local Punong communities. This is not to say that roads should not be built, but rather that where they are to be built impacts need to be considered and both minimized and mitigated. Communities should be involved in all stages of the road development process, so that they are prepared for what is coming and have some voice in the process. A development committee of affected stakeholders might be a mechanism through which possible impacts are identified, and managed, in a participatory manner. Also, experiences could be shared from other places where indigenous communities have been adversely impacted – often the risks of new developments are not recognized until it is too late. If land tenure along a road is identified as a concern early on in the process, then land registration could be built in as an initial step in road construction.
5. Any increased economic opportunities within the basin are likely to attract people from outside the area, increasing pressure on resources on which local people depend. Outsiders are likely to benefit more from any employment opportunities than will local people; non-indigenous people are often better able to take advantages of opportunities that arise. One example of this is the Wuzhishan company, whose workers are primarily from other provinces. If their employment is long term, and they remain in Mondulhiri, they will need land and will in other ways put pressure in other on resources on which local people depend. Another example is

the gem mine at Chumrum Bei Srok where, up until the late 1990s, local indigenous people mined gems. As word spread, outsiders moved in and now local indigenous people are, for the most part, no longer involved in mining. These impacts need to be considered and ways need to be found through which economic opportunities can preferentially benefit local communities. An “indigenous people’s development plan” is an established international mechanism for the safeguarding of local people’s rights and opportunities, or at least ensuring that they have some access to new opportunities.

6. Major social changes are likely to come with any kind of development. We have already seen evidence of a breakdown in indigenous communities in many of the villages visited, owing in large part to external forces pulling the communities apart. Communities are likely to be weakened further as a result of new development activities. In particular, in many villages, community leaders have become involved in selling land belonging to the community, against the wishes of the community. Traditional community structures have been unable to adapt to new developments, and instead have been replaced with new ones that are often dysfunctional. The low level of education of much of the population throughout the basin makes them extremely vulnerable to changes.
7. Villagers will become increasingly vulnerable to major trans-boundary forces and policy drivers. Already, international investors have had significant impacts on local livelihoods through the development of concessions. The development of National Route 19 from Viet Nam to Stung Treng, and developments envisaged through the “triangulation strategy” (in the tri-boundary region of Cambodia, Laos and Viet Nam) will increase the access of Vietnamese companies to natural resources in the Srepok River basin, with potentially significant consequences for local communities. The increasing dependence in Ratanakiri on a single crop, cashews, is making people very vulnerable to changes on international markets. Already, villagers in Bu Sra have had the experience of planting coffee only to have it become no longer profitable because of increased production in other countries.

Further research is needed for two purposes:

1. To generate more complete data and establish a more precise and detailed baseline against which the situation in the future can be compared.
2. To provide a more complete understanding of dynamics and trends so that the impacts of different development activities can be better predicted.

In particular, the relationship between local livelihoods and natural resources, and outside forces affecting these resources, needs to be better understood and documented.



(Photo by Chan Sokheng.)

## Annex 1. Survey Villages and Ethnicity

No.	Province	District	Commune	Village	Kreung	Jarai	Brao	Punong	Cham	Tampuon	Lao	Khmer	Stieng	Vietnamese	Kraol	Total
1	Ratanakiri	Banlung	Yeak Laom	Lon	4	1	0	1	5	517	0	18	0	0	0	546
2	Ratanakiri	Bokeo	La Ming	Nhoel (Nhan)	0	0	0	0	0	306	0	0	0	0	0	306
3	Ratanakiri	Bokeo	Lung Khung	Pa Ar	0	0	0	0	0	470	0	0	0	0	0	470
4	Ratanakiri	Kon Mum	Serei Mongkol	Srepok Thom	0	0	0	0	0	0	0	859	0	0	0	859
5	Ratanakiri	Kon Mum	Serei Mongkol	Neang Dei	0	0	0	0	0	0	123	0	0	0	0	123
6	Ratanakiri	Kon Mum	Sre Angkrong	Phum Pir	0	0	0	0	0	0	0	519	0	0	0	519
7	Ratanakiri	Kon Mum	Trapeang Chreh	Kompong Sangkum	0	0	0	0	0	0	0	269	0	0	0	269
8	Ratanakiri	Lumphat	Chey Oddam	Ou Kan	0	0	0	0	0	0	20	340	0	0	0	360
9	Ratanakiri	Lumphat	Chey Oddam	Sam Kha	0	0	0	0	0	0	179	140	0	0	0	319
10	Ratanakiri	Lumphat	Chey Oddam	Thmei	0	0	0	0	0	0	706	0	0	0	0	706
11	Ratanakiri	Lumphat	Ka Laeng	Ka Laeng	0	2	1	0	0	411	1	3	0	0	0	418
12	Ratanakiri	Lumphat	La Bang Muoy	Ka Tieng	0	0	354	0	0	1	0	82	0	0	0	437
13	Ratanakiri	Lumphat	Pa Tang	Pruok	45	0	35	0	0	389	25	50	0	0	0	544
14	Ratanakiri	Lumphat	Seda	Kaeng San	0	0	0	0	0	393	10	6	0	0	0	409
15	Ratanakiri	O Ya Dao	Bo Kham	Ta Kok Jrai	0	270	0	0	0	2	0	0	0	0	0	272
16	Stung Treng	Sesan	Kbal Romeas	Kbal Romeas	0	0	0	420	0	0	0	26	0	0	0	446
17	Stung Treng	Sesan	Kbal Romeas	Sre Sranok	0	0	32	0	0	0	0	443	0	3	0	478
18	Mondulkiri	Koh Nhek	Nang Khi Loek	Nong Bua	15	23	0	208	0	221	476	188	17	0	37	1185
19	Mondulkiri	Koh Nhek	Nang Khi Loek	Koh Meayoei Loe	0	11	0	114	3	6	173	23	0	0	3	333
20	Mondulkiri	Koh Nhek	Rayor	Rayor	0	0	0	326	0	10	11	102	16	0	49	514
21	Mondulkiri	Koh Nhek	Sok San	Chi Klap	0	0	0	890	0	8	12	35	0	0	25	970
22	Mondulkiri	Pech Roda	Pu Chry	Pu Chry Chang	0	0	0	231	0	0	0	36	0	0	0	267
23	Mondulkiri	Pech Roda	Bu Sra	Phum Ti 6 (Pu Cha)	0	0	0	346	0	0	0	39	0	7	0	385

Source: Provincial statistics (2003), except for Sre Sranok and Kbal Romeas for which data are from provincial statistics (2004).





Number and page	Khmer name	Caught using what gears?	Caught during which months (using each type of gear)?	In the past year, how many (number) have people in this village caught?	Largest size caught in last two years (kg)	Selling price (dry-rainy season)	Goes up into streams?	Describe migration, spawning of the fish	Other
74 (13))	Pa si i								
84 (16)	Chhlang								
54 (12)	Pa wa								
90 (18)	Krabei								
63 (10)	Riel								
58 (12)	K'ek								
59 (11)	Pruel								
104 (23)	Pra								
52 (1)	Koal reang								
23, 24 (7)	Trasok								
97 (19)	Keh								
109 (21)	Reach								
148 (7)	Chpin								
	Romeas								
85 (17)	Khya								
100 (18)	Stuok								
29 (8)	Chkaok								
49 (8)	Trasek								

7. Are there any dolphins anywhere? In what season?

8. Are there crocodiles? Where?

**Fishing gears**

9. Use of natural poisons

- In the past five years, what years have villagers used natural poisons?
- In the past two years, when they poisoned using natural poisons, how many people participated?
- When people poisoned using natural poisons in the past two years, how much fish did they catch

10. What gears do villagers use these days?

11. Make a seasonality diagram showing catches using different gears:

	1	2	3	4	5	6	7	8	9	10	11	12	How many did each family use this year? How many meters? How many fishhooks?	What size do people use? (mesh size/ hook size?)	How much fish do people catch per day in different seasons?
Water level in Srepok															
Catch by gillnet															
Catch by floating gillnet															
Catch by castnet															
Catch by fishhooks (bangkay)															
Catch by fishhooks (bangkong)															
Catch by fishhooks															

(ronong)																			
Catch by traps (lop)																			
Catch by barrage (thnuos)																			
Catch by ....																			
Catch by ....																			
Catch by ....																			

12. Which of these are used, where, when, and by whom?

- Chemical poisons:
- Manh (push nets), chayra (giant castnets):
- Explosives:
- Electrofishing:
- Large barrages:
- Bagnets:

13. Describe the situation with respect to outsiders coming and fishing in the local area

14. Is there any collective fishing? (such as poisoning fish together? catching fish in one pond together?)

**Prohibitions**

15. What kind of fishing or collection of waterlife is prohibited? By whom? Why?

**Economics of fishing**

16. Where do villagers sell the fish they catch? What price do they get in different places?

17. In the past two years, how much can one family earn from fishing in one year?

18. What fees do people have to pay, to whom, in order to fish, transport fish, or sell fish?

**Aquaculture**

19. Does anyone raise fish or other waterlife or plant anything in the water?

**Other waterlife and animals that live near the water**

20. What other waterlife (including insects) is there that villagers collect to eat or sell? How do those animals depend on the flooding regime?

21. Are there any animals that lay eggs on islands in the river? (birds, turtles, ...) What importance do those animals have for villagers? In the past five years, have bird eggs ever been damaged by flooding?

**Community fisheries**

22. Describe community fisheries activities if there are any.

**Attach maps showing streams, pools, waterfalls, ponds, spirit areas, etc.**

## **C. Instructions for family case studies**

### **Family members**

1. How many members are there in the family?
2. What ethnic groups are there in the family?

### **Family history**

3. Where are the family members from?
4. Where have they lived, and when did they come to this village?
5. When they first came to this village, what was it like? Similar to today, or different?

### **Housing**

6. Note what kind of house they have

### **Livelihood**

7. Farming activities
    - How many plots of land do they have? What kind of land?
    - How many hectares of swiddens do they have? Where? Is it near or far from streams? What do they plant? What problems have they encountered in farming swidden? Do they sell any of the crop?
    - Do they farm lowland rice? How long have they been doing so? How much paddy land do they have? Where is it? What is the yield in one year? How many months does it last? What problems have they encountered in farming lowland rice?
    - Do they plant anything on islands or along the riverbank? What months? Do they always get a crop or are there problems? What yields do they get? Do they sell any of the crop?
    - Do they plant any fruit trees or other crops? Do they sell the crops? How much do they earn? Where do they sell it?
  8. Animal raising
    - How many buffalo, cows, pigs, chickens, ducks do they have? Where are the animals kept?
    - How much income do they earn in one year from raising animals?
  9. Fishing
    - What gears do different people in the family use? In what seasons? Where do they use them?
    - Have they ever camped out along the river? When? For how long?
    - How much fish do they catch? What do they do with it? How much fish do they eat? What other protein do they eat?
    - Have they sold fish? Where do they sell it? When? To whom? How much?
    - Do they process any fish? How much in one year?
    - What problems do they encounter in fishing?
    - How has their fishing changed?
    - What changes have they seen related to fish over the years?
  10. Collection of NTFPs
    - What NTFPs do different people in the family collect? What seasons? Where do they go?
    - What NTFPs do they sell? How are they transported?
    - What NTFPs do they rely on for food?
    - What insects, other animals, etc. do they eat?
  11. Gold panning/gem mining
  12. How else do they earn income? (Crafts? Labor? Trade? etc.)
- Gender differentiation in work**
13. In the family, what do men do? boys? girls? women?

**Coping**

14. When times are tough, how does the family cope? Can others help them out?

**Water regime**

15. Have they ever noticed changes in the flooding/recession of the streams and river?

**Diet**

16. In general, where do they get the food they eat every day? (Where does the protein come from? Vegetables?)

**Education**

17. Are the children in school? Where? What levels? How do they get to school?

**Water use:**

18. Where do they get water for drinking or other uses? For what do family members use river or stream water? Do they have a water filter?

19. For what do they use a boat?

#### **D. General group discussions (for villages along the Srepok River only)**

1. Date: \_\_\_\_\_ 2. Interviewers: \_\_\_\_\_  
3. Village: \_\_\_\_\_ 4. Commune: \_\_\_\_\_  
5. District: \_\_\_\_\_ 6. Province: \_\_\_\_\_  
7. Number of men: \_\_\_\_\_ 8. Number of women: \_\_\_\_\_

**Explain the purpose of the discussions and introduce the interviewers. Have the group draw a map on the ground showing the village, river, roads, and important features.**

##### **Swiddens**

9. What crops do people in this village usually plant in swiddens?  
10. Where are swiddens ordinarily (far from streams? near streams?) Why are they where they are?  
11. How many hectares of swiddens per family are people currently farming? (from how many, to how many)

**Have the participants point out the location of swiddens on the map**

##### **Lowland rice farming**

12. How many hectares of lowland rice fields per family do people have? (from how many, to how many)  
13. What is the yield per hectare for paddy in an ordinary year? (from how much, to how much)  
14. Have villagers pumped or scooped water onto their paddy fields? If so, since 1979 which years has there not been enough water to do this?

**Have the participants point out the location of lowland rice fields on the map**

##### **Planting gardens along the river banks**

15. Do villagers plant crops along the riverbank? What crops? What months?

**Have the participants point out the location of the gardens on the map**

##### **Planting other crops (includes fruit, gardens around ponds, etc.)**

16. Are other crops are grown? (besides lowland rice, swiddens, and gardens along riverbanks) What crops, and where are they planted?

**Have the participants point out the location of these other crops on the map**

##### **Animal raising**

17. In the past year, how many cattle and buffalo have died in this village?  
18. If cattle or buffalo died, what were the symptoms? What kind of illness?  
19. What places are important for cattle and buffalo to graze? Are cattle and buffalo allowed to wander around or are they tended? In which months?

**Have the participants point out on the map places where they tend cattle or let them wander, other places used by cattle and buffalo**

##### **Fishing and collection of waterlife**

20. This year, in this village, how many families only fish, and don't farm?  
21. This year, in this village, how many families haven't fished at all? Why?

22. In the dry season, how many days a week do people in this village eat fish ordinarily? In the rainy season?

23. In the dry season, how many days a week do people eat frogs, snails, clams, shrimp, etc.? In the rainy season?

24. In the past five years, have people ever observed fish having lesions or other illness? Where? What kind of fish? What kind of illness? In what season?

25. In the past five years, have people ever observed frogs, snails, crabs, etc. dying unusually? Explain.

**Have participants show important locations for fishing and sites of fishing camps on the map**

**Collection of forest products and wildlife**

26. How many families in the village tap resin (any month)? Collect honey? Collect wild potatoes or mushrooms ? Collect wild vegetables? Collect malva nuts? Other wild fruits (specify the types)? Cut bamboo? Cut rattan?

27. In the past two years, how many families have eaten wild potatoes due to food shortages?

28. Have people ever seen wild potatoes damaged due to flooding? Explain.

29. In the past 5 (10) years, have people ever seen wild animals (from the size of a wild pig or barking deer on up) sick or dead? What kind?

**Have participants show areas for NTFP and wildlife collection on the map.**

**Gold panning, gem mining**

30. How many families are involved in gold panning, gem mining?

31. How much can each family earn in one year from gold panning or gem mining?

32. In general, where do people search for gold or gems?

**Have participants show areas for gold panning and gem mining on the map**

**Other sources of income**

33. What other sources of income are there for people in the village? Describe.

**Outsiders coming to make a living in the area**

34. In the past year, how many people from outside have come to make a living in the village? What do they do?

**Transport**

35. What do people use boats for transporting along the Srepok and streams?

**Water regime**

36. Since 1979, which years has there been a major flood? For how many days? How high was the water?

37. Since 1979, have villagers' swiddens ever flooded? Which years were their crops destroyed? What is the impact of flooding? How are the swiddens after the floods recede?

38. Since 1979, have villagers' lowland rice fields ever flooded? Which years was the rice destroyed? What is the impact of flooding? How are the rice fields after the floods recede?

39. Since 1979, have people's vegetable gardens ever flooded? What is the impact of flooding? How are the fields after the floods recede?

40. In the past year, how many boats have been lost in the village due to flooding?
41. Since 1979, how many houses have been destroyed by flooding? Explain.
42. In the past 5(10) years, along the riverbank, has the bank ever washed out causing loss of property? Which years?
43. In the past 5 years, has any other property been destroyed as a result of flooding? Explain.
44. Since 1979, what years has there been too little water? What are the impacts?
45. How has the flood regime, flooding, situation of too little water, erosion, etc. changed since 1979?

**Water supply**

46. Where do people get the water they drink in the dry season? In the rainy season?
47. Since 1979 has the river ever had unusual amounts of algae? In which years has the water been smelly or caused itching?
48. Since 1979 has the river water ever been muddy/cloudy in the dry season?

**Have participants indicate on the map where they get water for drinking and other uses**

**Health**

49. How many people in the village have died in the past year? Children? Babies? What were the causes?
50. How many people in the village have drowned in the past 5 years?

**Culture:**

51. What important spirit sites are there along the river?

**Have participants show spirit sites on the map**

**Problems related to natural resources management**

52. What other problems do villagers face related to natural resources management?

**Attach a map showing all of the areas of importance to livelihoods, nearby villages, all settlements in the village, temporary camps, the village boundary, spirit sites**

### E. Women's Groups (for villages along the Srepok River only)

1. Date: \_\_\_\_\_ 2. Interviewers: \_\_\_\_\_  
 3. Village: \_\_\_\_\_ 4. Commune: \_\_\_\_\_ 5. District: \_\_\_\_\_  
 6. Province: \_\_\_\_\_  
 7. Number of men: \_\_\_\_\_ 9. Number of women: \_\_\_\_\_

#### Explain the purpose of the discussion and introduce the interviewers

**10. Ranking of foods (protein sources):** Ask the women's group what protein sources people in this village eat. Have them rank the protein sources that they eat regularly in the rainy season (the number of seeds indicates the amount eaten ordinarily), then repeat for the dry season. Additional protein sources can be added.

No.	Meat source	Dry season	Rainy season
1	All kinds of fish		
2	Domestic meat		
3	Wildlife		
4	Crabs		
5	Shrimp		
6	Clams and snails		
7	Frogs, toads		
8	Insects		
9	...		
10	Other		

**11. Ranking of vegetables:** Ask the women's group what wild vegetables people in this village eat. Have the group rank vegetables that are eaten regularly in the rainy season (the number of seeds indicates the amount eaten ordinarily), then in the dry season. The seven most important wild vegetables should be used for ranking, then "all other wild vegetables" should be a separate category.

No.	Vegetables	Rainy season	Dry season
1	domestic vegetables		
2	..... (important wild vegetable)		
3	..... (important wild vegetable)		
4	..... (important wild vegetable)		
5	..... (important wild vegetable)		
6	..... (important wild vegetable)		
7	..... (important wild vegetable)		
8	..... (important wild vegetable)		
9	All other wild vegetables		

**12. Ranking of NTFPs:** Ask the women's group what NTFPs people in this village collect. Have them select the ten NTFPs that are most important in terms of family income. Have them rank those ten NTFPs according to average income (currently). The number of seeds indicates total income.

No.	Name of NTFP	Total score
1	..... (type of NTFP)	
2	..... (type of NTFP)	
3	..... (type of NTFP)	
4	..... (type of NTFP)	
5	..... (type of NTFP)	
6	..... (type of NTFP)	
7	..... (type of NTFP)	
8	..... (type of NTFP)	
9	..... (type of NTFP)	
10	..... (type of NTFP)	

**13. Ranking of illnesses:** Have the women's group list the illnesses that children in the village succumb to during the dry season, then have them rank those illnesses. Then, ask about illnesses children succumb to during the rainy season, and illnesses adults succumb to during the dry and rainy seasons. (Any number of illnesses can be ranked.)

No.	Name of illness	Children		Adults	
		Dry season	Rainy season	Dry season	Rainy season
1	..... (illness)				
2	..... (illness)				
3	..... (illness)				
4	..... (illness)				
5	..... (illness)				
6	..... (illness)				
7	..... (illness)				

**14. Changes over the past three years:** Have the women's group compare the past three years with regards to: water level, fish catches, swidden rice yields, lowland rice yields, and incidences of cattle/buffalo diseases.

		2002	2003	2004
1	Flood level			
2	Fish catches			
3	Swidden rice yields			
4	Lowland rice yields			
5	Incidence of cattle/buffalo diseases			

**15. Ranking of income sources:** Have the women's group identify all sources of family income in the village, then rank the ten most important income sources.

No.	Income source	Score
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

**Work of men and women**

16. What gears do men and women use to fish? Where?

17. What work can women not do by themselves, but need men to help? What work can women do by themselves?

**Water regime**

18. Since 1979, what changes have they seen to the water regime of the Srepok river and streams?

## **F. Semi-structured interviews**

1. Date:            2. Researchers            3. Village:  
4. Commune:    5. District:            6. Province:

### **Population and history of the village**

7. What is the total number of people in the village?
8. What are the ethnic groups in the village? How many of each?
9. What languages do people of different ethnic groups use? At what age?
10. Describe the history of the village: When was the village established? What happened in the village in the 1970s? What happened in the village during the Pol Pot regime? Important events. When did villagers finally settle/resettle here? How many people in the village were not born here? Or are there people from outside living in the village? When did they come to live in the village?
11. Describe people who are living temporarily in the village: where are they from? what are they doing? where do they stay?

### **Land**

12. Is there a clearly defined village boundary? When was the boundary established? Who established it, and why? For what activities can people not cross the boundary?

### **Swiddens**

13. How are the swiddens situated in relation to streams and rivers?
14. What crops do they grow in their swiddens?
15. What kinds of yields do people get? How many months can they feed themselves?
16. Are swiddens ever flooded? Does it damage them?
17. Do people sell anything grown in their swiddens? How much can they earn in a season?
18. What problems do people encounter with their swiddens these days?

### **Lowland rice fields**

19. Do villagers farm lowland rice? Since when?
20. How much land does each family have?
21. What yields do people get for lowland rice?
22. Have rice fields ever flooded? Has the crop been destroyed?
23. Are yields sufficient for people to eat?
24. What problems do people encounter with lowland rice farming these days?

### **Planting along the river banks and islands**

25. Where do people plant crops along the river banks and islands?
26. What seasons do people plant crops along the river banks and islands?
27. What problems have crops planted along islands in the river or along the river banks encountered? Have crops planted along islands in the river or along the river banks ever flooded?
28. Have people sold the crops that they plant along islands in the river or along the river banks? How much do they earn from this?

**Other farming**

29. What other farming is there? What do people do with the crops?

**Animal raising**

30. How does animal raising depend on rivers and streams?

31. Where are livestock in the dry season? In the rainy season?

32. What do villagers use cattle and buffalo for? Pigs and chickens?

**Collection of forest products and wildlife**

33. Describe collection of different kinds of NTFPs (resin, malva nuts, etc.)

34. What is the importance of NTFPs and wildlife for food for villages and family income?

35. Identify areas people go to collect different NTFPs, wild vegetables, wild potatoes, etc.

36. Describe how people camp out in the forest to collect NTFPs

37. Describe hunting and collection of wildlife. Is there any collective hunting?

38. Does anyone forbid collection of wildlife or NTFPs? Who? Why?

**Gold panning, gem mining**

39. Is there any gold panning or gem mining? How much can people earn? Where do they do it?

40. How and where do people pan for gold? What are the impacts of gold panning or gem mining?

**Other sources of income**

41. What other sources of income do people have? Describe.

**Transport**

42. What kind of transport is there along the Srepok at different times of year?

**Water level**

43. How often do floods come? Droughts?

44. How regular is the water level?

45. How high does the water come up ordinarily in the rainy season?

46. Has there ever been flooding and what kind of damage is there?

47. What evidence of erosion is there? sedimentation?

**Water supply**

48. How do people use water of the Srepok?

49. How has water quality changed over time?

**Nutrition**

50. How important is fish to the diet?

51. How important are wild vegetables, insects, other wildlife to the diet?

52. How healthy do children look?

**Health**

53. What are the major illnesses?

**Education**

54. Where do children go to school? How do they get there?

**Culture**

55. Identify important spirit places.

56. What important ceremonies are held during the year?

**Indebtedness**

57. Are people in debt? To whom? For what?

58. Are people in debt for medical expenses?

**Housing**

59. What is the style of housing in the village?

60. What natural materials are houses made of?

**Community/conflict**

61. Describe the overall level of community solidarity.

62. To what extent are the traditional authorities still influential?

63. What activities do people participate in together?

64. How many families have problems of domestic violence?

**Gender differentiation**

65. Do/can women go out alone to collect things?

66. What activities do women/men not participate in?

### Annex 3. Maximum Sizes (kg) of Selected Fish Species Encountered in Past Two Years<sup>77</sup>

No.	Species	Khmer name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	Mekongina erythrospila	pa s i	2	1	1	1.5	1	1	1	0.3	1.2	0.3	1	1.3	2	none	none	none	2	none	NA	NA	none	none	2
2	Hemibagrus spilopterus	trey chhlang	1	1	1.5	1.2	1.5	1	0.7	1	1	1	1.5	3	1	none	1	none	3	2	2	1	?	0.2-0.3	0.3
3	Bangana behri	pa wa muk pir	6	3	5	3	10	2.5	3	4	2.5	3	4	5.5	none	none	?	none	none	none	?	5	4	1	1.5
4	Bagarius yarrelli	trey krabei	10	13	10	5	5	4	5	2	6	3	4	11	1	none	2	none	5	0.1	15	4	?	none	none
5	Morulus chrysophekadion	trey k'ek	5	3	5	3	7	4	4	3	3	3.5	4	5	none	none	none	none	none	none	NA	2	4	0.5	1.5
6	Cirrhinus microlepis	trey pruel	5	3	5	3	2	4	4	4	3	4	5	5	none	none	0.1-0.2	none	2	0.5	2	2	0.1	0.1	0.2-0.3
7	Pangasianodon hypophthalmus	trey pra thom	10	20	10	2	25	7	6	2	3	2	5	12	none	none	none	none	none	none	NA	5	0.7	none	none
8	Catlocarpio siamensis	trey koalreang	none	none	none	none	none	0.4	none	none	15	30	1	none	none	none	none	none	none	none	none	5	7	5	none
9	Probarbus jullieni, P. labeamajor	trey trasak	15	8	23	20	none	0.5	30	29	15	30	18	30	?	none	0.2-0.3	none	2	1	2	3	0.1-0.2	0.2	0.2-0.3
10	Micronema bleekeri	trey keh	0.7	0.6	0.5	0.4	1	0.7	0.5	1	0.4	0.7	2	1.5	none	none	none	NA	none	none	NA	2	0.2-0.3	very sm.	none
11	Hypsibarbus spp.	trey chhpin	3	2	2	2	3	2	2	0.4	0.5	0.3	2+	3	0.5	none	small	?	2	1	2	0.5	1.5	1	0.3-0.4
12	Osphronemus exodon <sup>78</sup>	trey romeas	2	2	3	2.5	1	2.5	5	2	1	2	2	5	none	0.2-0.5	?	?	0.2-0.5	0.5	?	2-3	4	very sm.	none
13	Barbichthys nitidus	trey kya	10	5	20	3	10	7	6	1	3.5	4	10	15	5-6	none	2	none	8	2	20	10	6	3-4	5
14	Wallago leerii	trey stuok	30	10	25	5	3	20	30	5	8	7	20	47	none	none	none	none	none	none	28	none	none	none	none
15	Cyclocheilichthys enoplos	trey chkaok	4	3	10	4	7	4	5	1	3.5	1	5	5	?	none	0.2-0.3	none	1	<0.1	1-2	1	0.1	0.2-0.3	0.3
16	Scaphognathops bandanensis and steinegeri	trey trasek	0.5	1	0.5	0.4	2	0.5	1.5	0.4	0.3	0.4	0.5	1	?	none	?	none	<0.1	0.5	5	0.5	v. sm.	?	v. sm.

<sup>77</sup> Data was provided by fisheries focus group discussions. Villages were: 1. Koh Meayoel Loe, 2. Nong Bua, 3. Kaeng San, 4. Thmey, 5. O Kan, 6. Sam Kha, 7. Neang Dei, 8. Srepok Thom, 9. Kompong Sangkum, 10. Phum Pir, 11. Kbal Romeas, 12. Sre Sranok, 13. Ta Kok Jarai, 14. Nhoel, 15. Pa Ar, 16. Lon, 17. Ka Tieng, 18. Pruok, 19. Ka Laeng, 20. Rayo, 21. Chi Klap, 22. Pu Chry Chang, 23. Phum Ti 6 (Pu Cha). NA: species that may occur but people do not catch them. None: not found. Very sm.: very small.

<sup>78</sup> In villages 1-4 and 6-10, groups were asked for the maximum sizes of both O. exodon and O. goramy.

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