Traditional use and availability of aquatic biodiversity in rice-based ecosystems

III. Xieng Khouang and Houa Phanh Provinces, Lao PDR[1]

by
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INTRODUCTION

Aquatic organisms are extremely important resources for the population of Lao PDR, particularly for those living in the rural areas. For rural people, fish and other aquatic animals such as frogs, snails, snakes and turtles are an easily accessible and inexpensive source of food, which may not be replaced easily with other items of the same nutritional and other qualities.

The important waters for capture fisheries are the Mekong River and its tributaries, their floodplains, lakes, swamps and reservoirs. In Lao PDR rice fields are not necessarily connected to riverine floodplains, especially not in the in mountainous regions of the country. These rainfed and irrigated rice fields are, nonetheless, important areas for capture fisheries, a characteristic that is frequently overlooked during rural and agricultural development planning. Based on national estimates, the total catch of fish from rice fields is about 30 000 tonnes[2]. However, this figure is not verified and is essentially an estimate derived from the known area of rice cultivation. Using known yields from other ricefield fisheries, the actual catch could be substantially higher. Another weakness of national capture fisheries estimates is that subsistence catches from streams and swamps are not recorded and may also contribute considerably to the overall production. There is still limited information and data on the catch and consumption of other aquatic animals apart from fish, which - based solely on qualitative observations of the diet of the Lao people - also constitutes a considerable proportion of the diet. A recent field study which considered this aspect of the diet of rice farming communities in southern Lao PDR has confirmed the diversity of aquatic species in the diet of rural Lao people and the dependency of these people on the use of these resources[3].

A fisheries survey in Luang Prabang Province carried out recently by the Living Aquatic Resources Research Center (LARReC) in cooperation with the Mekong River Commission (MRC) Fisheries Program, Assessment of Mekong Fisheries Component (AMFC)[4], estimated that the average annual per caput consumption of all fish and aquatic products is 29 kg/caput per year with fresh fish accounting for 16-22 kg/caput per year. Fish and aquatic animals account for 43% of the total animal product consumption[5]. This study can be considered typical for Lao PDR since the survey covered both lowland and highland areas. Consumption levels in areas close to rich fisheries resources (such as the Champassak area of southern Lao PDR and communities surrounding the Nam Ngum reservoir) may have even higher consumption figures.

An extrapolation of national fisheries production calculated from the size of the population and the information from consumption studies gives an estimate of 90 000 tonnes for the country, which is far greater than current national estimates[6]. The source of the ‘extra’ catch is the subsistence fishing which almost every family in the country engages in to some extent throughout the year. The Lao Agricultural Census shows a value of 78% of agricultural households that engage in fishing activities indicating that fishing is an essential part of the Lao rural livelihood.

RICEFIELD FISHERIES IN LAO PDR

Traditionally, Lao farmers have a wide variety of methods for the capture of wild fish and other aquatic animals from flooded rice fields and associated waters. Some farmers, who own land where water and fish accumulate in the rainy season, enhance the wild fish catch by digging trap ponds and harvest as much as 60-125 kg/ha during the rice-growing season. The catches depend on the location of the rice farm, amount of drainage received from the catchment and the topography. A wide range of species is caught which varies according to specific sites or ecosystems.

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[2] Based on data from Department of Livestock and Fisheries in 2002.

[3] Meusch, E., Yhoung-Aree, J., Friend, R. and Funge-Smith, S.J. 2003. *The role and nutritional value of aquatic resources in the livelihoods of rural people - a participatory assessment in Attapeu Province, Lao PDR*. FAO Regional Office Asia and the Pacific, Bangkok, Thailand, Publication No. 2003/11, pp33.

[4] Sjorslev, J. G. (ed.) (2000). *Luangprabang Fisheries Survey*. National Agriculture and Forestry Research Institute (NAFRI), Living Aquatic Resources Research Center (LARReC) and Assessment of Mekong Fisheries Component (MRC). Vientiane, Laos. 45 pages

[5] Note that this figure increases to 55% to 59% of the total animal intake if standard conversions are applied in order to correct for differences in protein content of various food.

[6] National estimates are based largely on fisheries from rivers and large water bodies.

There is an increasing amount of irrigation in Lao PDR and the wet season irrigated rice area (i.e. irrigated to ensure the wet season crop) in the country was estimated in 1999 by the Ministry of Agriculture and Forestry at 200 000 hectares. A 1999 Department of Livestock and Fisheries (DLF) estimate indicates that 16 200 ha of the rice area were deliberately managed for integrated rice-fish culture, although again this estimate is based largely on the rice area of two provinces where the ethnic groups traditionally manage fish in their rice fields using a number of techniques which enhance fish recruitment and maintain broodstock during the dry season (Houa Phan and Xieng Khouang Provinces). This traditional activity also takes place elsewhere and is a particular cultural feature of the Tai Dam tribal group, and ethnic Tai groups in general[7].

Although the areas that can reasonably be considered under active management and culture relate to these two provinces, there are a wide range of other management practices that take place in rice paddies throughout the country that have a management purpose to enhance the productivity or capture of fish and aquatic animals and plants.

These systems benefit particularly from the current low use of pesticides that typifies traditional rice cultivation in Lao PDR. Irrigation development and more intensified production regimes may lead to an increase in the use of fertilizers and chemicals. It is not yet clear in what way this will affect the abundance and availability of aquatic biodiversity. In the case of active stocking of rice fields with fish there is clear evidence of increased fish yields, however, many of these studies have not considered the other associated aquatic biodiversity, including aquatic plants. In many cases, increased rice yield is also reported.

METHODOLOGY

SCOPE OF THE STUDY AND LOCATION OF SITES

Two field studies were undertaken at the end of the dry season 2002 and during the monsoon season in 2003.

The first study and data collection on living aquatic animals and plants was conducted at the end of the dry season, beginning of the wet season (from mid of May until the end of June 2002) in two of the northern upland provinces of Lao PDR adjacent to the Vietnamese border. The study team consisted of 2 LARReC staff with experience in the use of participator rural appraisal (PRA) tools.

Prior to the field survey, a two day meeting was held at LARReC office to review existing documents on living aquatic resources in the region and in particular in Lao PDR with an emphasis on aquatic animals in rice field.

In the first field study during the dry season three villages were selected:

- Ban Khoum (Kham District, Province of Xieng Khouang)
- Ban Hok (Kham District, Province of Xieng Khouang)
- Ban Xienglouang (Viengxay District, Province of Houa Phanh)

During the second survey one village in each of the Provinces had previously had contact with the Provincial Livestock Office, principally through the extension of fisheries activities (Ban Hok and Ban Xiengluang).

The second field survey was carried out in mid June 2003. It was during the monsoon season and it had been raining for a couple of weeks before the arrival of the team. The access to the villages where data were to be collected was quite difficult due to poor road conditions. The following villages were selected:

- Ban Khoum (Kham District, Province of Xieng Khouang)

[7] See also related studies on this CD on the ‘Dai’ in Yunnan and Northern Vietnam. These tribes are ethnically similar and the name ‘Tai’ or ‘Dai’ are used varyingly. These ethnic groups should not be confused with “Thais” who are nationals of Thailand and represent a broader range of ethnic groups. There are linguistic similarities in the languages and it is thought that some groups of the Thai people originated from the same region as the Tai/Dai.

- Ban Hok (Kham District, Province of Xieng Khouang)
- Ban Xieng Kio (Kham District, Province of Xieng Khouang)

The third village (Ban Xieng Kio) in Kham District was a village located in a more isolated area of Xieng Khouang Province that had not had prior extension activities (especially aquaculture extension activities) and far less development has taken place.

Like most of the northern provinces of Lao PDR, Xieng Khouang and Houa Phanh Provinces are classified as mountainous but are rich in aquatic resources that come from rivers and streams and the associated wetlands and rice paddies. There are few floodplain areas due to the narrow nature of the valleys in these provinces, but rice fields (which are often slightly terraced to maximize use of sloping land for wet rice cultivation) are an important habitat for fish and aquatic animals that are widely exploited. On the steeper slopes of the valleys, villagers also practice slash and burn cultivation, clearing off land for planting with crops such as hill rice (khao hai), maize (salee), cassava (man don), and “Job's tears” (mak deuay). In valley areas, where suitable, farmers will plant lowland rice, fruit trees, raise livestock (cattle, pigs and poultry) and also practice aquaculture in small fish ponds. If not actually located on a riverbank, most of the villages will be situated not far from a river or a stream, since this still forms the principle source of water for washing and drinking.

LIMITATIONS

The Team decided to start the activities at the end of the dry season/beginning of the rainy season in 2002.

Principal limitations to the study were:

- Not all the aquatic animals could be recorded since the duration of the study was limited to the beginning of the wet season. It was noted that the availability of aquatic organisms in the region varies quite significantly between the dry and wet season. Within the timeframe of the study, the information gathered is probably not sufficient to allow an in-depth and comprehensive analysis of the situation
- It was also noted that in the first field study, the main focus of the study was the living aquatic animals found in the rice fields, therefore the aquatic plants were added to the scope during the second study, since these were evidently widely utilized.
- Access to the study areas is constrained due to the remoteness of the area, poor road conditions and limitations of public transport.

METHODS USED

It was agreed that PRA tools should be used in each of the targeted villages and that the PRA should support information of the use and availability of aquatic animals in rice fields while asking questions on the following issues:

- Problem listing
- Ranking
- Mapping
- Seasonal calendar
- Impact on policies
- Trend in livelihood strategy

The key informants were identified as the local authorities at the Provincial, District and village levels, farmers, fishermen and elder people.

The field study consisted of the 4 following steps:

- Discussion with the local authorities at the Provincial and District level.

- Upon arrival in the field, the LARReC team consulted first the Provincial authorities and then the District authorities to get some background information and an overview of the socio economic situation.
- The villages were then selected in consultation with the authorities based on certain criteria's related to knowledge on the availability and use of aquatic biodiversity in the floodplain of the area.
- Discussion with the PRA team members prior to the field visit.

Village activities

A heterogeneous group of 15-20 villagers per village was formed, consisting of men and women, village head, farmers, fishermen, and elder people. The Team then gave a small briefing to inform the group members about the objectives of the survey and then the PRA process started following the 6 issues listed above taking into consideration the use and availability of the aquatic animals in the rice fields.

In-depth discussion with farmers/fishermen and collection of species:

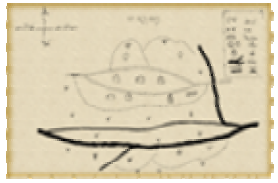
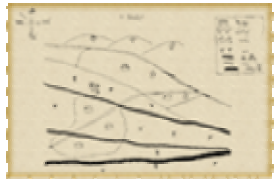
- At the end of the PRA, 3 farmers/fishermen per village were identified and selected based on their experience and local indigenous knowledge on the availability and use of aquatic animals in the rice field.
- Then a more in-depth discussion was initiated with the small group of 3 persons. Field visit together in a small team was carried out to collect aquatic animals and plants and to take photos.

Interview with the group members after the fields visit:

- After collection of the aquatic animals and plants and consolidation of the information collected, the Team held individual and group meetings to discuss the findings of the field visit and to clarify queries that came up while in the field.

MAPPING

During the study visits maps of the land and water resources of each village were prepared with the groups. These maps were used as the basis for the discussions about the village's rice fields and aquatic resources.

Ban Hok  Ban Xiengluang  Xieng Kio 

STUDY RESULTS

BACKGROUND TO THE VILLAGES BAN HOK AND BAN KHOUM

Ban Hok, Kham District, Xieng Khouang Province

Ban Hok village owns its name from the Houa Hok stream which if translated from the Lao language means "a stream surrounded by natural forest". The stream flows from the northern mountains and flows near by the village. Another stream called Houa Keua divides the paddy fields of the villagers in two major parts and meets downstream with two hot springs. The village was established in 1940 with 15 households at the time. After the civil war that devastated the northern region of Lao PDR, in 1975, the number of households increased to 33. At present 56 households or 254 persons (146 women) live in Ban Hok village. The villagers belong to the Tai Dam ethnic group and practice an animist-type religion.

The village is located on the bottom a sloping land, at about 300 meters from the National Road No 7. Ban Mouang village surrounds the village on the northern side, Ban Na Meuang village on the southern, Ban Na Thong village on the east and Ban Lao village on the west. The village area extends to about 5 square kilometers and the total area for rice cultivation is about 37 ha.

The main agricultural activity, practiced by 97% of the village households, is wet-rice cultivation. Villagers also cultivate leguminous crops, raise livestock and are involved in capture fisheries. Aquaculture in small fish ponds is also practiced in the village. Most of the households possess two to three small ponds. They are also involved in artisanal activities such as weaving for self use and income generation. Off-farm income comes mainly from non-timber forest products (NTFP).

The problems that the farmers are facing mainly include insufficient drinking water, lack of land and lack of knowledge regarding aquaculture techniques.

Ban Khoum village, Kham District, Xieng Khouang Province

Ban Khoum village is about 50 years old and comprised of 50 households with a population of 333 persons, out of which 173 are women. The villagers belong to the Tai Dam ethnic group who believe in spirits. The rice area is divided by the Nam Mat river flowing from North to South.

Ban Khoum is located on the Nam Mat river bank about 7 kilometers from Meuang Kham district municipality. Most of the households are located on the two sides of the road No 7. Villagers practice agricultural activities such as rice cultivation, livestock, and growing of fish in ponds. The village is surrounded on the north by a forest conservation area, on the east by Ban Phieng Khop, Ban Vieng Kham on the west and on the south by the village rice field.

The village is located in a valley, on an area of 3 hectares, and possesses 42 hectares of paddy fields situated along the Nam Mat river, Houai Man stream, Houai Sagai stream, and water channels. The village has good potential for agricultural development.

Ban Khoum villagers have enough rice to consume throughout the year. 96% of the villagers' practice rice cultivation as the main crop. Other crops as well as livestock raising, rice-fish farming and fish culture in ponds are also widely practiced. More than 10% of all households own small fishponds of the average size of 300m².

The main income of the villagers comes from selling rice surplus, garlic, peanuts, maize and chili. Other sources of income are from the sale of cattle, pigs, and fish. Silk production and weaving is also commonly practiced by women as a source of income.

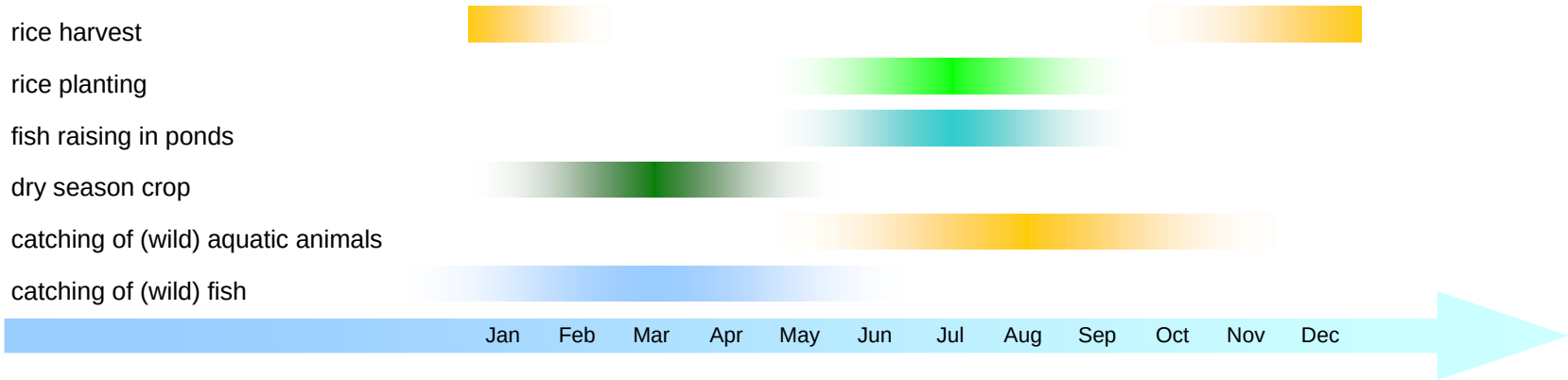


Figure 1: Typical seasonal calendar of activities for the above villages

TRENDS IN LIVELIHOOD STRATEGIES

This figure shows the trend of the fisheries in the livelihood of the people living in the village. It has been reported that capture fisheries are constantly declining since 50 years ago. Aquaculture (in the form of small-pond aquaculture) in the area has been introduced over the past 8 years principally as a result of outside projects interventions[8]. Most of the cultured species are tilapia (*Oreochromis niloticus*) and common carp (*Cyprinus carpio*). The main reasons given by villagers to explain the decline of the capture fisheries are population growth, the open access of fishing zones and fish habitat and the use of unregulated fishing gears.

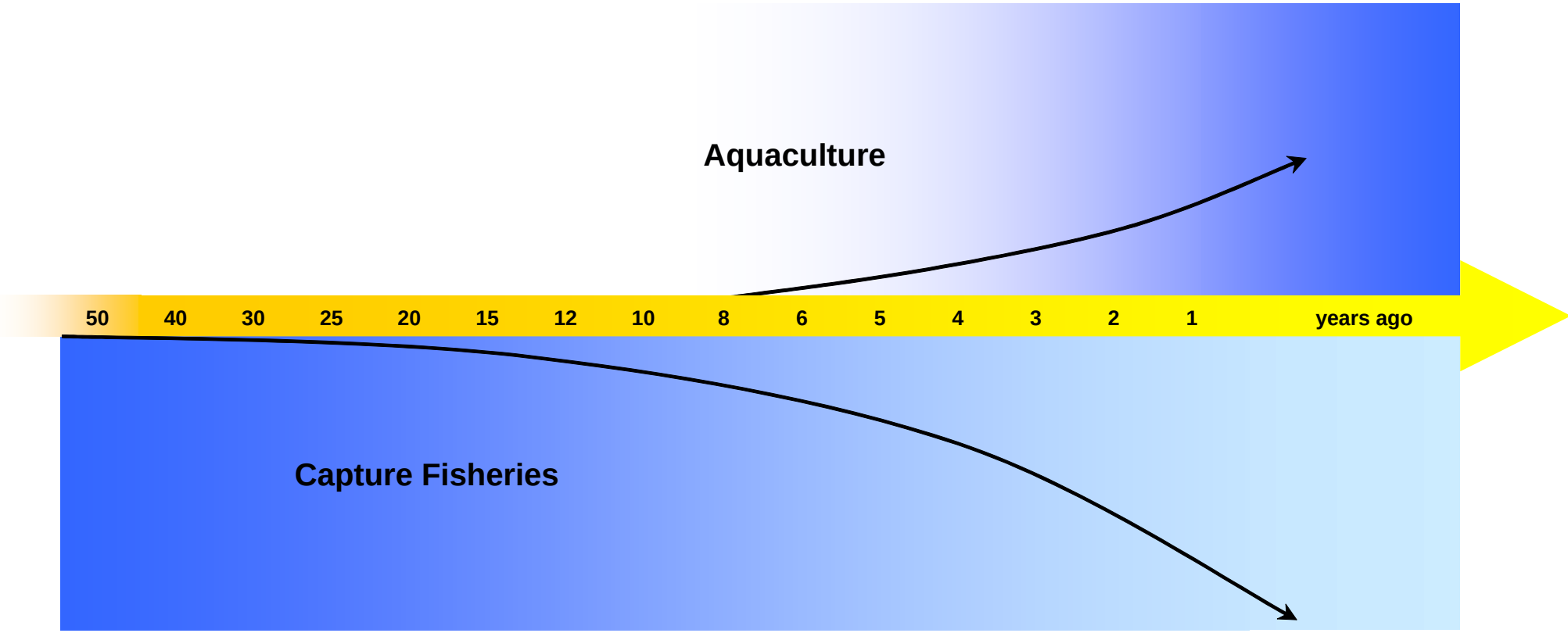


Figure 2: Trends for capture fisheries and aquaculture in the above villages

HOUSEHOLD STATUS

The local authorities have been trying to classify the wealth of the villagers according to criteria set forward by the government and this part of the field study was carried out by the State Planning Committee for poverty assessment. Through discussions held with the villagers and in order to better

[8] It should be noted that these Tai groups also have their own forms of management of rice fields and broodstock fish to ensure recruitment in the rice paddies which is a traditional practice and predates the project interventions.

understand the status of the families, a revised set of criteria has been discussed to classify the wealth of the villagers. In brief, there are three categories that are considered:

Better-off families	Medium wealth families	Poor families
Own a house with wooden floor and walls	Own a house made out of wood	Own a house made from bamboo
House roof made out of galvanized roofing sheet or tiles	House roof made out of thresh	House roof made out of thatch
Own a rice field of a least 1 ha	Own a rice field of about 0.5 ha	Most of the time do not own a rice field
Land for gardening of about 0.3 ha		
Land for gardening of about 0.3 ha		
Own not less than 3 buffalo	Own 1 buffalo	Do not own buffalo and cattle

Village wealth ranking is mainly based on the income that the villagers are making from the production and selling of rice:

- 18% of the total number of households (6 households) are selling surplus rice
- 73% of the total number of households (24 households) are self-sufficient in rice consumption
- The remaining 9% (3 households) have a shortage of rice for about 3 months/year

From the sale of other on-farm products other than rice and also off-farm products (especially derived from surrounding forest and wetland resources) the income will be divided between the households:

- 60% of the total number of households (20 households)will have an income of more than 300 000 kip[9]
- 40% of the total number of households (10 households) will have an income less than 300 000 kip, and
- 9% (3 households) will have no income at all.

The ranking has been identified according to income from the sale of agricultural activities mentioned above:

- 15 households or equivalent to 30% of the total households has an income of more than 300 000 kip per year.
- 23 households equivalent to 46% have an income of about 300 000 kip.

[9] US$ 1 = 7613.55 Kip (2004)

- 14 households equivalent to 24% have an income of less than 300 000 kip.
- An average of about 10 households sells rice once a year.
- Rice is sufficient for home consumption for 34 households and 6 households have rice shortage of two to three months per year. Two households have no land for rice cultivation.

LOCAL MANAGEMENT SYSTEMS FOR THE AQUATIC RESOURCES

Mechanisms of ownership

Although rice fields belong to the village community the area is divided and allocated to the families living in the village area. Each parcel of land will be given out to a household and will be more and less the same in size. There are no formal ownership documents issued by the local authorities but it is understood by the communities themselves that the rice and the fish harvested in each of these individual parcels belongs to the household. This system is operational until there is a new chief of the village elected. There is an election in the village every 3-5 years. After the election of a new chief in the village the issue of land use is discussed and land is reallocated within the village community again.

In the villages surveyed there exist collectively owned and privately owned rice fields.

Collectively owned rice fields

In the collectively owned rice fields' (i.e. rice fields owned by the village community), there are two production systems. The first production system is where fish (typically common carp, but other wild species are found as well) are cultured together with rice in the paddy field, whereas in the second production system fish are not deliberately cultured together with rice.

In the first production system, fish can be raised because of flat landscape and availability of water, which is typically provided from the traditional irrigation system practiced by Tai ethnic groups. A dam made of wood and stone is constructed further up the valley and water is channeled along the sides of the valley to feed terraced rice paddies and small ponds. Maintenance of this traditional system is also part of the cultural activities of villagers, although more recent development of reinforced concreted weirs and dams has led to a decline in the traditional systems.

One of the beneficial effects of this traditional irrigation system, which is often overlooked by agriculturalists, is that even when rice is not being planted, there is often water in the paddy fields or collected in certain parts of the system which forms dry season refuges and allows the holding of broodstock fish during the dry season. These are then ready for breeding activities at the commencement of the next monsoon season. This additional service and benefit may not be included in the valuation consideration of efficiency of this type of rice field system[10].

The typical size of a rice field where fish are cultured is about 0.5 ha. The village authorities collect 30 000 kip (US$ 3.94) for each 2 lai[11], which is 0.32 ha, of rice field used but also a small part of the harvested rice is given to the village authorities. The latter contribution is mostly on a voluntary basis. The village authorities do not collect tax for the fish cultured and harvested in the rice field.

In the second type of production system fish culture is not practiced due to lack of flat areas, inappropriate water distribution system and exposure to inundation (typically flooding during heavy rainfall). It is also noted that these areas are typically located far from the village and therefore there is risk for loss of fish to thieves. Here a similar approach is used in terms of land allocation and a local taxation system applies for rice. The only difference is

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[10] It should also be noted that anecdotal information regarding the development of larger irrigation schemes may not lead to an equivalent amount of services. Villagers mentioned the loss of aquatic products and species, the causes of this can be speculated upon and may include loss of dry season refuges, ease of capture of broodstock fish in larger irrigation canals, and intensified cropping cycles that impact the recruitment of wild fish and frogs to the paddy fields.

[11] 'lai' is a common unit of measurement of area in this region, it is equivalent to 1600 m2 or 40 x 40 meters.

that for fishing (although fish are not actually stocked, wild fish and other rice field resources are also present) it is an open access[12] but there are some certain local rules where fishing gears are restricted by the community. For example is not allowed to use gill net (moong), cast net (hair) and it is not allowed to drain or block the pass way of the fish.

Privately owned rice fields

These rice fields have been allocated to farmers and the right to use the paddy field has been issued by the District authorities. Private rice fields are limited in number. A family will not own a rice field in a size of more than 1 hectare. Apart from the tax that they have to pay for the rice field, they will also have to pay an additional 30 000 kip/lai (US$ 24.63/ha) to the village authorities.

LOCAL MANAGEMENT ARRANGEMENTS

Recent changes in the management of aquatic resources have been introduced by the community. In open access rice fields and privately owned rice fields every village member can fish, provided there is no active fish culture[13] (managed stocking of ricefields). Fishing effort and target species are managed by restricting the fishing gears used. This system appears to be working well and is considered by the villagers as an improvement on the situation before (about 6 years ago) when there were no gear restrictions at all.

Streams and irrigation canals

There are rules and regulations to manage aquatic resources in streams and irrigation canals. For example, there are specific sites for fishing, fishing gears used, seasonal fishing period and penalty rules. All these rules have been developed by the local community. In case of a first time violation of the local regulation there will be a warning and the fish will be confiscated by the village authorities, the second time a fine of 15 000-20 000 kip applies and the fish are confiscated and given to the village authorities. The third time, apart from the two measures above, imprisonment can be foreseen.

Rice fields

In rice fields restricted fishing gear includes gill net, cast net, digging hole, and poisoning. If there is a violation, the first time will be warning and the fish will given to the owner of the paddy fields, the second time a fine of 15 000-20 000 kip applies and the fish will be given to the owner of the rice field, the third time imprisonment can be foreseen. The fine will be given to the Village Authorities. These rules were introduced about 10 years ago.

IMPACT OF GOVERNMENT POLICIES

Ban Hok, Kham District, Xieng Khouang Province

Recently, the Government of Lao PDR has issued a policy of decentralization delegating more power to the provincial, district and village authorities. Provincial authorities are in charge of developing provincial strategies for socio-economic development whereas district and village authorities are responsible for developing and implementing their own plan of action. As an impact of this new policy, the village community has developed management plans for the capture of wild aquatic animals and plants and for fishing gears in order to regulate the catch in the more sustainable way.

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[12] Since the fish are not stocked and open access these paddy fields may form a critical resource for the poorest families in a village with little rice land and therefore no ability to culture fish in paddy fields. Again, this is an issue often overlooked when rice fields are intensified through irrigation – those who are often the most dependent upon the open access resources lose their access to these crucial fisheries.

[13] It was mentioned to the guest editor that even where active stocking is practiced villagers can still hunt frogs using torches, this is another form of gear restriction and targets only non-managed wild species.

As mentioned above the impact of decentralization was seen as a positive impact in delegating more power to the communities in the village. Village communities are developing management plans by themselves for the capture of wild aquatic animals and plants and for fishing gears in order to regulate the catch. They are also putting great efforts in trying to identify markets to enable the sale of their products.

ISSUES OF ABUNDANCE, DECLINE OR INCREASE?

Most of the villagers are involved in catching aquatic animal. But poorer farmers rely more on fishing and according to anecdotal information about 30 % of the total number of households will fall in this category.

From interviews with elderly persons, it is clearly perceived that there is a decline in fish catch compared over the last 50 years. The reason of fish catches decline might be because of loss of habitat. Some of the deep pools are not deep anymore due to a lot of erosion. Rice fields are very important water bodies. During the rainy season fish from perennial water bodies migrate not only to find feed but also to reproduce. They will migrate through seasonal stream that drains and connect the rice field to the rivers. Soon after the first rain, the paddy fields are populated with various diversified organisms. Fishing activities will take place from June to October and will be concentrated in the migratory fish pathway moving from one water body to another. Simple scoop nets (sa-wing) are commonly used if no restriction are issued.

Other reasons given are because there are more fishermen than before due to the population increase in the village. Better roads bring better access to the market and therefore bigger table-size fish have a high demand and fetch a better price in the market, this then leads to a greater incentive to catch fish for sale.

In the past, less specialized fishing gear was used but now some fishing gear used in the area has been modified to catch more fish relative to their size. An example of this is the use of the large scoop net (sa-wing). The study team was informed that previously the scoop net was not used as intensively as it is now. As a result of declining catches and the more intensive use of gears and more specialized gears, the villagers decided to issue local regulations on the used of specific fishing gears.

Villagers catch aquatic animals from early morning till noon and typically the catch will not be enough to prepare a meal for all the members of the family. When compared to the past, just the early morning catch was enough to prepare a typical meal for a family of 4 persons. The fish size is also reported to be smaller than before.

It was also reported during the study that in recent years fish diseases have been observed mainly red spot with Tilapia (pa nin), common carp (Pa nai) and Pa pheek. White spot disease (EUS) has been observed for *Channa striata* (pa kor) in the last few years especially in neighboring villages of Houa Phan and apparently disease occurs mainly in June and July[14].

TRADITIONAL USES

PREGNANT WOMEN AND LACTATION

About six women in each of the village were interviewed. It was observed that during pregnancy most of the women practiced some sort of food avoidance or had some sorts of food restrictions. Some of the restrictions apply to certain aquatic animals. The diet has definitely less nutritional value because of some of these restrictions. The aquatic animals and plants that would generally not be eaten during pregnancy are *Rasbora* spp. (Pa siew), *Cyprinus carpio* (‘pa nai’, ‘pa kham’), ‘pa jame’, frogs and other species of amphibians.

[14] This is the start of the monsoon season, although in other interviews villagers have also reported that EUS is observed in the cooler months of December which is during the dry season.

Red meat from wild animals is also not recommended. For example, wild deer and albino buffalo are strictly restricted to all pregnant women in the country. There are also certain plants that are not recommended for women to eat during pregnancy, for example *Acacia pennata* (Phak Kha), cabbage and sour fruits.

If pregnant women eat these aquatic plants and animals mentioned above they will feel sick for many weeks. These aquatic animals and plants are believed to cause headaches, stomach problems, vomiting, inflammation and eventually death. The restrictions mentioned above do also apply after giving birth and during the lactation period and concern in particular fermented fish (pa dek).

It was also evident to the team that women are much more involved in the collection of aquatic animals in rice fields compared to men.

MEDICINAL AND CULTURAL VALUES

It is believed that the consumption of Pa kor kung (*Channa* sp.) is good to liberate you from high temperature (high fever). The raw fish will be released in an earthen bowl for 2-3 hours and then only the water is drunk. This species could be found in the rice field only at the beginning of the raining season. It could also be prepared in a sort of soup with tamarind used as aroma and for acidity.

Table 1. Villagers' ranking of 50 most important Non Timber Forest Products

Ranking	Product	No. Giving this Rank		Total %
		Men	Women	
1	Bamboo shoots	13	17	13
2	Fish	13	7	10
3	Vegetables	11	11	9
4	Wildlife	11	6	8
5	Cardamom	7	7	7
6	Rattan canes	6	6	6
7	Dammar resin	2	4	5
8	Frogs	5	5	5
9	Mushrooms	3	6	4
10	Yang oil[15]	4	4	4
Total top 10 products		74	74	71
Other 40 products		26	26	29
Total 50 products		100	100	100
Source: Foppes, J. and S. Ketphanh. 1997. The Use of NTFPs in Lao PDR. DoF/IUCN NTFP Project. Vientiane.				

[15] collected from the yang tree, or *Dipterocarpus alatus*

It was also reported that the consumption of ‘pa fek’ (feral *Carassius auratus*) brings good health to the villagers. Non timber forest products (NTF) are also good traditional medicine in the region. It is interesting to note that several studies on other parts of Lao PDR have shown that fish are an important NTFP and that fishing is an important forest based activity. Forests often have a great deal of water associated with them and fishing in forests can be an important activity (Table 1).

In summary, it could be observed that culturally based food intakes and restrictions during pregnancy and the lactation period are common in Lao PDR but will differ between ethnic groups living in different part of the country. With these traditions of various restrictions it can be assumed that this has a negative impact on the health of both mother and child.

AQUATIC ANIMALS

The survey on aquatic animals and plants and fishing gears was divided in eight groups: (1) fish, (2) amphibians, (3) reptiles , (4) crustaceans, (5) mollusks (6) insects, (7) aquatic plants, and (8) fishing gears.

FISH SPECIES

Fish play the most important role for the livelihood of the villages surveyed. It is the main source of animal protein. Most of the fishes caught in the three villages are for consumption. Fishing is dominant in the wet season from May to December, while in the dry season fishing is not practiced regularly. Initial results from the survey show 23 fish species. Of these, 17 species were caught in the rice fields. Ten of these species are more frequently caught, five species are more difficult to catch. Six fish species can breed in the rice field. There are some species that cannot be consumed during pregnancy and breast-feeding namely ‘pa kham’ (also known as ‘pa nai’, *C. carpio*), ‘pa chad’, and ‘pa gin gna’ (grass carp *Ctenopharyngodon idella*). Most of the villagers prefer consuming fresh fish, but if there is surplus, fish will be processed into a variety of products such as dried fish, ‘pa bam’ and other types of fermented fish, enabling longer preservation times and thus facilitating barter or sale on the village market.

In the first survey which was in the middle of May (end of the dry season/beginning of rainy season), it was reported by the villagers that 23 fish species could be found in the rice fields. The survey team was able to photograph 17 species. During the second survey (full monsoon) it was reported that four more species could be found because of the rainy season. In summary, a total of 26 fish species could be found in the villages studied out of which 22 species have been photographed. The fishes play an important role in the diet of the households in the village, especially for the poor people when they are facing food shortage.

AMPHIBIANS

From participatory discussion and information gathering as well as field visits a total of ten species were identified. Of these, six were caught alive, whereas the four remaining species are more difficult to find. Five species are mostly consumed fresh. The catch of the amphibians varied between June and November.

There are a same number of ten species of amphibians reported during the first and the second survey. During the first survey only six species were photographed in the three villages. During the second study, one more species was photographed. The total number of species photographed during the two surveys amount to a total of seven species. The three species without photos are called in the common Lao language: ‘kop mun’, ‘kied tapad’ and ‘oug’.

REPTILES

In the studied areas, seven types of reptiles were identified. Three were caught alive namely a snake (‘ngou pa’ – a fish snake), a turtle and a lizard. Reptiles, which are more difficult to find, are ‘ngou leuam’ (python), ‘ngou pa’ (fish snake) and ‘tao’ (turtle) because these species are popular and

have a high demand in the market. Most of these reptiles can be found from May until November. Villagers reported that these reptiles are at risk of decline.

In the first survey, it was reported by the villagers that seven species of reptile were found in rice fields but only three species were photographed. In the second survey the same number of reptiles was reported by the villagers. One more species could be photographed. In summary out of a total of seven reptiles found in rice fields four species were photographed. The three species that were not photographed in the field were three species of snakes called ‘ngou dang rane’, ‘ngou lout’ and ‘ngou pong oil’.

CRUSTACEANS

There were five species of crustaceans found in the studied areas namely white freshwater crabs (‘pou na khao’), black freshwater crabs (‘pou na dam’), ordinary crabs (‘pou na thammada’, ‘pou khee leck’) and freshwater shrimps (‘koung na’). The most frequently found are the white freshwater crabs, black freshwater crabs, and ordinary crabs. Humans could consume these three species but villagers prefer to use them as feed for pigs, dogs and chickens. Freshwater prawns are popular for human consumption and are often eaten raw. Normal prawns are found in the rice fields and in fish ponds. Most of the crustaceans are caught using scoop nets.

A number of five crustaceans have been reported by the villagers during the first survey. Only four have been photographed. During the second survey the same numbers of crustaceans have been reported and all the five crustaceans have been photographed.

MOLLUSKS

Mollusks are consumed fresh. Eight species were found in rice fields and water channels. ‘Hoi khong’ is found in rice fields, ditches or nearby the rice fields on the bank of streams. This species eats rice plants and other crops and is not consumed since the taste and the smell are not good. Four snail species are popular for human consumption and for sale at the market namely ‘hoi ork’, ‘hoi khom’, ‘hoi ki’ and ‘hoi chub’. The less frequent caught is ‘hoi chub’. This species can be found from time to time in streams and in water channels where water is flowing all year long. The physiognomy of this species is black with red lines, and it is relatively long.

In the first study a number of eight mollusks were reported by the villagers. All of them have been photographed from the field. The second survey also found the same eight mollusk species.

INSECTS

Different insect species could be found in the rice fields. From discussion and field observation 16 important insect species have been reported in the villages. During the field survey, seven species were caught alive. Out of the total number of species found in the villages, six species are caught more frequently. Another five species are less frequently caught. Villagers will consume about nine species out of the total. Most of the insects are caught in the rainy season in the rice field. Only six insect species can be caught in the dry season.

In the first study 16 different species of insects have been observed and reported by the villagers. Seven insects have been photographed. In the second study the same number of insects have been reported. Three more photos of insects have been obtained which brings the total up to 10 photos out of a total of 16 insects.

AQUATIC PLANTS

During the discussion with the farmers it was reported that in the villages 15 aquatic plants could be found. While visiting the rice field the Team found 14 plants. A number of ten aquatic plants are frequently consumed by the villagers. About five plant species are used for feeding pigs, duck and chicken. Ten species have been observed growing on stream and the bank of water channels. Four plant species are often marketed. The collection of aquatic plants is mainly done during the months of May until November.

In the first study the villagers reported the existence of 16 aquatic plant species out of which 14 species were photographed. During the second study six more species were reported in the villages which gives a total of 20 species. All of them have been recorded and photographed.

FISHING GEAR

Most fishing gear is made in the villages using different types of bamboo. Some of the nets are also made from jute and nylon; for example cast net (hai) and scoop net (sawing). There are 14 types fishing gear recorded in the studied areas, out of which ten are commonly used.

The same types of fishing gear were reported during the first and second field visit. Few photos were obtained in the first field survey. Much more have been photographed in the second study. Out of 14 types of fishing gear, 11 have been photographed.

FOCUS ON THE UTILIZATION OF AQUATIC PRODUCTS

This section of the report deals with how particular aquatic resources are consumed. Aquatic products are prepared or preserved in a wide variety of ways depending on the species.

PRESERVED FISH PRODUCTS

There are four common ways to preserve fish in the study area, namely to prepare fermented fish sauce (‘pa dek’), pickled fish (‘som pa’), dried fish (‘pa heng’) and fermented fish paste (‘pa bam’). The latter is a specialty of the northern region of Lao PDR. The way fish are preserved will depend in most of the cases on the species.

Fermented fish sauce (‘pa dek’)

Locally called 'pa dek' this is typically prepared from four fish species: *Clarias batrachus* (‘pa douk’), *Channa striata* (‘pa kor’), *Cyprinus rubrofuscus* (‘pa nai’) and *Oreochromis niloticus* (‘pa nin’). This sauce and fish mixture is used as a flavoring for a number of foods or used as a dipping condiment to be eaten with glutinous rice (‘khao nieow’). ‘Pa dek’ is made during times of fish abundance and is left to ferment in large earthenware jars for months or even years.

Pickled fish (‘som pa’)

‘Som pa’ is frequently prepared in the household and is usually for home consumption, but may be sold in the market as it is relatively easy to conserve and the wrapping in banana leaves acts as a form of packaging. The fish is pounded or minced and mixed with spicy ingredients, before it is covered in banana leaves for fermentation. Fermentation takes place in 2-3 days and the product is then normally eaten with sticky rice. ‘Som pa’ will be prepared from *C. batrachus* (‘pa douk’), *C. striata* (‘pa kor’), *C. rubrofuscus* (‘pa nai’), *O. niloticus* (‘pa nin’), *Systomus aurotaeniatus* (‘pa pok’), *Rasbora aurataeniata* (‘pa siew na’), *Carassius auratus* ‘pa pheek’ and ‘pa lee hane’ (for the last one it was not possible to get the scientific name).

Dried fish (‘pa heng’)

‘Pa heng’ is dried fish and is prepared by either sun drying or more typically by drying close to the kitchen fire. This is because the times of plenty are during the monsoon season and sun drying of fish is difficult. All fish species can be prepared this way but usually this method is used for the larger, higher value fish species such as *C. striata* (‘pa kor’), *Pterocryptis* spp. (pa yeun), *Mastacembelus favus* (‘pa lot’), *O. niloticus* (‘pa nin’) *C. rubrofuscus* (‘pa nai’), *C. auratus* (‘pa pheek’) and few others.

Fish paste (‘pa bam’)

‘Pa bam’ is a specialty of the northern provinces and in particular in Houa Phan Province. It is prepared mainly from *C. auratus* (‘pa pheek’), small size *C. batrachus* and *C. rubrofuscus*. The bones of the fish are soft and the taste is nice.

Figure 3: Pictures of Pa Bam, a specialty of Northern Lao PDR

UNPRESERVED FISH

Fish eaten fresh in Lao PDR is prepared in many ways. Lao cuisine is very rich, has a lot of variation and is well diversified using different kinds of spicy ingredients.

Live raw fish (‘pa dten’)

This literally means 'jumping fish' since it is made with small fish that are eaten live. The main fish species[16] eaten raw are *Rasbora aurataeniata* (‘Pa siew na’), *O. niloticus* (‘Pa nin’) and *C. auratus* (‘Pa pheek’). The length of these fish eaten raw would vary from 2-3 centimeters. For raw fish (Pa dten) first the fish have to be released in a bucket filled with clean water for at least 3-4 hours to allow the fish to clean up in the water.

Then the spicy sauce is prepared by boiling fermented bamboo shoot until the water turns rose/red in color. To the soup made from fermented bamboo shoots fried then crushed small sized common carp or tilapia is added. Then chili powder and monosodium glutamate is mixed.

[16] The same dish prepared with small freshwater prawns 'gung dten' is also popular.

For aromatic flavor, different kinds of aromatic herbs and plants are added, similarly to those needed to prepare the national meal called ‘Lab’, such as citronella or lemon grass, tamarind to give an acid taste, ginger (‘khing’), galangal (‘kha’), onion (‘phak boua gnai’), spring onion (‘phak boua’) and pepper (‘phik thai’).

Then different kinds of leaves are also added but sometimes eaten separately with the meal such as French and Chinese parsley, coriander (‘phak hom pom’), dill (‘phak si’), *Melothria heterophylla* (‘phak tam nin’), *Eryngium foetidum* (‘phak hom thet’), *Polygonum odoratum* (‘phak pheo’) and *Marsilea quadrifolia* (‘phak wen’) which is also found in the rice fields.

Once the spicy sauce is prepared, the live fresh fish from the bucket is released into the spicy sauce bowl plate, (i.e. marinated alive) and then eaten raw with a spoon.

Fried fish (‘jeun pa’)

The fresh fish is marinated with basic aromatic flavorings commonly used in the village, i.e. salt, green pepper, chili, garlic, onion, ginger, basilica, galangal, lemon grass and tamarind which gives an acid taste. Then it will be fried mainly with pork oil.

Grilled fish (‘ping pa’)

Sometimes fresh fish is grilled on a bamboo stick over firewood similar to barbecue. Aromatic plants and herbs are added together with chilly to obtain a spicy flavor. Grilled fish will be eaten with sticky rice and chilly sauce prepared from fresh vegetable and hot spicy ingredients flavored with 'pa dek' (this dish is called 'jeaw'). Some steamed or fermented vegetables normally accompany the meal.

Fish soup (‘dtom pa’)

Fresh fish is often prepared as soup. Most of the soup prepared in the villages is clear and vegetable available from the season is added together with other spicy aromatic flavorings as mentioned above. The soup can be bland or flavored with young tamarind leaves.

CONCLUSION

The study was carried out with good participation from the villagers. One of their motivations in participating actively in the study was because no study of this kind has ever been made in this part of Lao PDR until now. The local authorities gave a strong support for coordinating field activities and making arrangements with the village authorities as well as villagers.

The biodiversity observed in in rice fields of Xieng Khouang and Houa Phanh provinces can be summarized as follows:

- 26 fish species have been recorded, out of which 22 have been caught during the survey.
- 10 species of amphibians have been recorded out of which seven have been caught during the survey.
- seven species of reptiles have been recorded from the rice fields out of which four have been caught during the survey.
- five species of crustaceans have been recorded and caught during the survey.
- eight species of mollusks have been recorded and caught during the survey.
- 16 species of insects are found in the rice field out of which 10 have been caught during the survey.
- a total of 20 species of aquatic plants have been found in the studied area.
- 14 types of fishing gear have been identified, out of which 10 are commonly used.

In conclusion it could be said that there is a rich biodiversity of fish, crustaceans, amphibians, mollusks, reptiles and plants in the rice fields of the surveyed areas. These aquatic animals play an important role for the livelihood of the local people, particularly as a source of protein for the rural poor. The collection of aquatic animals is an activity which is widely practiced within the whole community and by rich and poor alike, although the types of species targeted and the areas where they are caught may vary depending upon wealth level. Women play an active role in the collection of aquatic species from paddy fields and adjoining wetlands, streams and channels. They are also the principal people engaged in the preservation of aquatic products.

To be able to maintain this rich biodiversity there is a need to manage the paddy field as an ecosystem, i.e. to manage both rice production and fish culture. It is also crucial to understand how the system is inter-connected. Inevitably, the intensification of agriculture and the use of chemicals will have an impact on the living aquatic biodiversity and the cost of this to the livelihood of the rural people of these provinces should not be underestimated. The replacement of these resources through the culture of fish is not guaranteed since access to suitable land for pond construction is limited and the open-access status of the rice fields is not suitable for privately owned fish ponds. The impact therefore, of loss of aquatic biodiversity will especially have an impact on the poor who are more reliant on such resources.