The role and nutritional value of aquatic resources in the livelihoods of rural people

A participatory assessment in Attapeu Province, Lao PDR

A contribution to the Dialogue on Water, Food and the Environment

Food and Agriculture Organization of the United Nations
Regional Office for Asia and the Pacific

and

IUCN – the World Conservation Union

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Water and Nature Initiative

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DISCLAIMER

PREPARATION OF THIS DOCUMENT

As a joint initiative to investigate the relationships between living aquatic resources, rice agriculture and the livelihoods of the people who manage these systems, this document is a contribution to the Dialogue on Water, Food and the Environment by the FAO Regional Office for Asia and the Pacific and IUCN – the World Conservation Union (IUCN). This document isbasedupon a field report prepared by Eric Meusch and Jintana Yhoung-Aree with additional authorship and technical editing by Richard Friend (IUCN) and Simon Funge-Smith (FAO).

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Abstract

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As a contribution to the Dialogue on Water, Food and the Environment, the FAO Regional Office for Asia and the Pacific and IUCN – the World Conservation Union have undertaken a joint initiative to investigate the relationships between living aquatic resources, rice agriculture and the livelihoods of the people who manage these systems.

This assessment is intended to address the concern that the ecological and livelihood functions and values of rice fields and adjoining wetlands are not fully appreciated in development planning. A participatory assessment was conducted in Attapeu Province, Lao PDR to determine the role of aquatic resources in the nutritional status of people engaged in rural livelihoods and to determine any opportunities, constraints or threats that may exist concerning the management of aquatic resources and future development in the province.

People from the three communities of Tamoyot Village, Sanamsai District, Saisi Village, Saisetha District, and Gayeu Village, Samakisai District participated in activities designed to assess the local availability and use of aquatic resources, their importance in local livelihoods, and the over-all health and nutritional status of the villagers.

The results of these activities illustrate that a broad diversity of aquatic plants and animals (approaching 200 species) are frequently accessed and used by villagers, and that fish and other aquatic animals make up the main animal protein sources in peoples' diets. Local conditions concerning health and nutrition, however, are quite low and evidence of malnutrition (underweight, stunting, and wasting) was observed in significant numbers of people in all three villages. Typical diets are insufficient in terms of quantity and quality, and are especially low in protein and fats.

These findings indicate that strategies for rural development, food security, and poverty alleviation in these areas need to pay special attention to aquatic resources management to ensure the health and well-being of rural people. Integrated management of freshwater and wetland resources is necessary to meet objectives of increased rice production whilst maintaining the viability and productivity of the aquatic resources upon which rural livelihoods depend.

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Acknowledgements

We would first like to express our appreciation to the people of Gayeu Village, Saisi Village and Tamoyot Village in Attapeu Province for their hospitality, their patience and their generous sharing of time and information. All field activities conducted during this mission were done in collaboration and with coordination support from local government authorities in Attapeu Province and programme staff from the IUCN Lao PDR Office. Logistical arrangements were provided through collaboration of IUCN staff with the Attapeu Provincial Division of Agriculture and other provincial and district authorities. Thanks also to our national counterparts from the Living Aquatic Resources Research Centre (LaRReC), the Provincial Division of Agriculture, the Provincial Division of Public Health and personnel from district agriculture and public health offices who provided invaluable assistance in many forms throughout this study. A final note of thanks to the many people who gave generously of their time to offer comments and feedback on the draft of this report.

Introduction

As a contribution to the Dialogue on Water, Food and the Environment, the FAO Regional Office for Asia and the Pacific (FAORAP) and the World Conservation Union (IUCN) initiated a collaborative field study to investigate the relationships between living aquatic resources, rice agriculture and rural livelihoods.

The goal of the Dialogue on Water, Food and the Environment is to:

- Improve water resources management by bridging the gap between the food and environmental sectors.
- Improve the links between the sectoral approaches that dominate policy making and implementation, particularly at the national level.

The Dialogue is intended to provide a mechanism by which the differing objectives of water-for-food and water-for-nature can be reconciled. However, there is a further dimension: the function of water and wetlands (aquatic environments) as a source of food. In this respect, the objectives of water-for-food and conservation are inextricably linked. Fishing and foraging for aquatic animals are often an integral part of rural food strategies and are as much about the management of water and aquatic environments as they are about the management of land. Rural people may have water management strategies that seek not only to ensure agricultural yields, but also to ensure the production of associated aquatic flora and fauna. There is a concern that development planning does not appreciate the ecological and livelihood functions and values of rice fields and adjoining wetlands. This study illustrates the importance of both aquatic resources and rice-based agriculture in rural livelihoods in Southeast Asia, and highlights the need for integrated water resource management.

The four-week field study was conducted in Attapeu Province, the Lao People's Democratic Republic (Lao PDR) and involved local stakeholders in participatory assessment of the role of and nutritional value of aquatic resources in the livelihoods of rural people. This initiative complements the UNDP/GEF/IUCN/MRC Mekong River Basin Wetland Biodiversity Conservation and Sustainable Use Programme that works in partnership with governments and local people to improve policies and mechanisms for developing and managing wetlands in a sustainable manner. The study further complements a number of regional initiatives that are concerned with the role of aquatic resources and their management in the livelihoods of rural people in Asia (Friend & Funge-Smith, 2003).

There is a concern that development planning does not appreciate the ecological and livelihood functions and values of rice fields and adjoining wetlands.

Attapeu Province is located in the southeastern part of Lao PDR, bordering Viet Nam and Cambodia. The province covers 1 012 000 hectares of land, 70 percent of which is still forested. Attapeu straddles the Se Kong River and its tributaries the Se Kamon, and Se Pian. Sixty percent of the land area is mountainous and the remainder consists of river valleys and lowlands. The province consists of five districts and has a population of just over 200 000 consisting of 14 ethnic groups. A team consisting of an expert on participatory assessment, a nutritionist, and members of local agriculture and public health authorities conducted a series of village and household level activities in selected villages in Attapeu Province during two missions in November and December, 2002 (four weeks in total).

Objectives

The aim of this assessment is to better understand how people in Attapeu Province living in rice production areas use aquatic resources in their livelihood strategies. An important aspect of the study is the nutritional role of aquatic resources in the diets of rural households, including poorer groups

The Dialogue on Water Food and the Environment aims to have the following impacts:

- To encourage better decisions at the policy level that are equitable for the irrigation and environmental protection of communities.
- To improve the livelihoods and health of poor people through better water policies.

http://www.iwmi.cgiar.org/dialogue/index.asp

Country health information profile
Lao PDR

The country's health situation is characterized by low life expectancy, high mortality rates and a high birth rate. The major causes of child mortality and morbidity are communicable diseases, notably malaria, acute respiratory infections, measles and diarrhoeal diseases. The incidence, severity, and outcome of these diseases are influenced by aggravating factors such as inadequate nutrition, lack of clean water, poor sanitation and limited access to health care. Only seven percent of pregnant women deliver in a hospital or clinic under the supervision of qualified staff.

The main direct causes of maternal deaths are postpartum haemorrhage, postpartum sepsis, eclampsia, obstructed labour, complications during termination and infectious diseases. Important risk factors include early and later pregnancies and short intervals between births, aggravated by hard work during pregnancy and inadequate nutrition, which often results in anaemia.

The health sector is generally under-financed and foreign aid is very important. The European Union, the Japan International Cooperation Agency (JICA), the United Nations Development Programme (UNDP), the United Nations Children's Fund (UNICEF), WHO and 72 non-governmental organizations are contributing to health sector development in the Lao People's Democratic Republic.

Population
Total: 5 403 000
0-14: 2 361 010
>65: 179 826

Fertility Rate 5.00

Crude birth rate
per 1 000: 37.00 (2000)

Crude death rate
per 1 000 live births: 13.00 (2000)

Maternal mortality ratio
per 100 000 live births: 650 (1998)

Infant mortality ratio
per 1 000 live births: 93.00 (1998)

Life Expectancy
in years (1999): Men 51.9 Women 54.4

Percent of population with adequate sanitation Urban: 84 Rural: 34

Adapted from: World Health Organization Country Health Information Profiles
http://www.wpro.who.int/chips/default.asp

and those with special needs such as pregnant and lactating women and children less than five years of age. The three principal issues addressed by this assessment are:

- the nutritional value of living aquatic resources;
- food security strategies at provincial, district and household levels;
- potential opportunities, constraints and threats to nutritional security that relate to water management and the environment.

HEALTH, NUTRITION AND AQUATIC RESOURCES

Diet and nutrition are key factors affecting health, food security and poverty. Health and poverty alleviation are basic themes of Dialogue activities and are also high priorities for national and local development in Lao PDR. An understanding of diet and nutrition are particularly important for vulnerable groups such as poor households and those with special needs such as pregnant and lactating women and children less than five years of age.

'Nutritional status' is the result of the interaction of a number of variables, which are shown in Figure 1. This conceptual framework was used as the basis for understanding the links between health and nutrition and aquatic resources. In this framework, the aquatic resource base is the source from which food is acquired and is expressed in terms of variety and certainty of acquisition, frequency, quantity and quality.

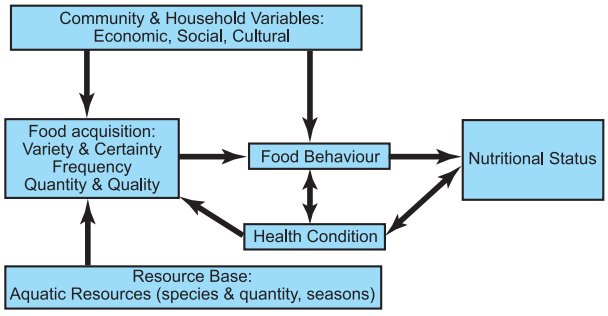


Figure 1. Linking aquatic resources to nutritional status

'Food behaviour' (the acquisition and use of food) is influenced by community and household variables such as family economics, social structure and organization, markets and cultural beliefs. The interaction of food acquisition and food behaviour under the influence of community and household variables determines nutritional status. The result of this interaction is individual health. Poor health can limit an individual's ability to acquire food and for the body to use it efficiently once consumed.

Protein-energy malnutrition

Protein-energy malnutrition (PEM) is by far the most lethal form of malnutrition. Children are its most visible victims. Malnutrition, "the silent emergency," is an accomplice in at least half of the 10.4 million child deaths each year.

Micronutrient deficiencies

Called micronutrients because they are needed in only miniscule amounts, these substances are the 'magic wands' that enable the body to produce enzymes, hormones and other substances essential for proper growth and development. As tiny as the amounts are, the consequences of their absence are severe. Iodine, vitamin A and iron are most important in global public health terms; their lack represents a major threat to the health and development of populations the world over, particularly to preschool children and pregnant women in low-income countries.

Infant and young child feeding practices

Nutrition and nurturing during the first three years are both crucial for lifelong health and well-being. In infancy, no gift is more precious than breastfeeding; yet barely one in three infants is exclusively breastfed during the first four months of life.

From: World Health Organization – Nutrition for Health and Development.htm (updated 4 July 2003)

Approach

PARTICIPATORY ASSESSMENT

This study used participatory techniques to collect information. This approach is consistent with an overall increase in respect for the knowledge of local people among development practitioners (Chambers, 1983). Local people are often those most experienced in managing, harvesting and using resources.

Participatory approaches are most appropriate for complex, multiple resource-use rural economies and for addressing questions regarding behaviour and

FAO country nutrition profile
Lao PDR

With an estimated per capita income of US$400 in 1997 the Lao People's Democratic Republic (Lao PDR) is one of the poorest and least developed countries in the East Asian region. Social indicators are among the worst in the region. Forty six percent of the population lives below the national poverty line (World Bank, 1999). The coverage of medical facilities and immunisation is low, and infant (96 per 1 000) and maternal mortality rates (65 per 10 000) are still high.

Glutinous rice represents the main food in the Lao diet. The daily dietary energy supply per caput increased from 2 030 kcal in 1968 to 2 400 kcal in 1995. In 1999, rice provided 69% of the energy supply and 64% of the protein supply. Generally three meals are consumed per day, light meals or snacks are seldom consumed. A typical meal consists of rice complemented with small portions of vegetables, mainly green leafy vegetables and fish. Other common food items are roots, eggs, meat, poultry and various kinds of fruit. Food consumption patterns vary geographically and ethnically.

Almost all mothers breast-feed their children and almost half of the mothers continue breast-feeding for 20 to 23 months. However complementary food is introduced much too early: one fifth of the infants receive food, mainly rice, during the first month of life. The early introduction of rice may provoke intestinal disorders and contrasts with the late introduction of other nutritive foods: 70% of children aged 10 to 11 months receive only breast-milk and water. Only a small number of children receive complementary foods at the recommended age. Breast-feeding and weaning practices differ geographically and ethnically. Feeding pre-chewed or steamed rice to new-borns is a common feature among the Lao Loum and Khamu ethnic groups while the H'mong ethnic group shows more appropriate breast-feeding and weaning practices.

The National Health Survey in 2000 has found high prevalence rates of malnutrition among children: 40% of the children under 5 years of age were underweight, 41% were stunted and 15% wasted. Compared to surveys conducted earlier, the prevalence of underweight remained the same while the prevalence of stunting decreased and in contrast the prevalence of wasting increased.

In 2000, the prevalence of chronic energy deficiency (CED) among adults was alarmingly high (19%), even higher than reported during a previous survey in 1995 (14%).

Malnutrition among children as well as among adults is more prevalent in the Southern region compared to the Northern and Central ones.

The National Health Survey included data on micro-nutrient deficiencies. The total goitre rate (TGR) among school aged children was 9%. Clinical signs of Vitamin A deficiency were also prevalent. A study conducted in Vientiane Province found anaemia in 56% of females aged 15 to 45 years.

The increase in the prevalence of wasting among pre-school children and of CED among adults is alarming and requires immediate and well designed multi-sectoral interventions integrated into health, agriculture, education and overall socio-economic development.

Adapted from: FAO Country Nutrition Information Profile
http://www.fao.org/es/ESN/nutrition/lao-e.stm

values. A growing body of evidence based on participatory methodologies illustrates the importance of resources and activities that have traditionally been regarded as insignificant or unimportant. This is particularly true for aquatic resources in what are traditionally regarded as rice-based economies, and where aquatic resources are regarded as supplementary rather than as key components of rural livelihoods.

Participatory studies are not intended to be definitive, but rather to open up a range of issues and present new perspectives on existing problems by engaging stakeholders in analysis and problem solving. Techniques for accessing local knowledge that have been developed include Participatory Rural Appraisal (PRA), Rapid Agro-ecosystem Zoning (RAZ) and Rapid Rural Appraisal (RRA) (Conway and Barbier, 1990; Chambers, 1994; Beebe, 1995; IIRR, 1996).

These techniques are cost effective and involve systematic, semi-structured activities carried out in the field. PRA adds the element of incorporating the knowledge of local people. Chambers (1994) describes PRA as "...a growing family of approaches and methods to enable local people to share, enhance and analyze their knowledge of life and conditions..." At the provincial and district levels, semi-structured interviews were conducted with local officials to discuss issues related to the local resources, wetlands and their role in the livelihoods of local people.

The main focus of these discussions was local strategies for food security and income. At the provincial level, meetings were held with a number of informants, including officers from the Governor's Office, Agriculture, Public Health, Environment, Women's Union and the Planning Office. At the district level, discussions were held mainly with government staff from Agriculture and Public Health agencies. At the village level, activities were planned as a multi-layered structure. Initial activities were designed to include as many people as possible and encourage participation.

Participatory studies are not intended to be definitive, but rather to open up a range of issues and present new perspectives on existing problems by engaging stakeholders in analysis and problem solving.

One aim of these initial activities was to familiarize people with participatory methods and to help them feel comfortable about expressing their opinions. These sessions also provided general information about the community, including the ranking of household well-being according to local criteria. Activities progressed to meetings with groups of people organized by gender or economic status and asking for rankings and prioritizations on items from previous discussions. Finally, key informants were identified to take part in activities addressing specific issues identified in previous discussions. Such a progression of activities allows the assessment team to gradually become more informed and incorporate local information into more focused inquiry. A methodological framework and description of activities conducted are provided in Tables 1 and 2.

SITE SELECTION

Selection of the three villages used for the study was done in collaboration with the provincial agricultural authorities using the following criteria:

The aim was to select villages that would reflect the broadest possible range of livelihood strategies, not to compare villages. Individual participation was not determined by statistical sampling methods but depended on who was available at the time and interest and willingness to participate. Other selection criteria included:

- Villages within the three target districts of the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme. This includes the three lowland districts of Samakisai, Sanamsai and Saisetha.
- People in the villages should be engaged in a cross-section of livelihoods rather than one type.

Table 1: Methodology framework for village-level participatory activities

	Geography Hydrology	Livelihoods	Rice farming system	Aquatic resources	Health and nutrition
Information	Local features Topography Water bodies	Village history Sources & seasonality of livelihoods	Cropping practices, varieties, techniques Changes in history & trends	Main wild species (where, when, how, who) Local migration paths Management practices History/trends	Food behaviour Nutritional status Health condition
Methods	Mapping (village and resources)	Historical timeline Activity Identification Prioritization Food Identification Prioritization Disease Identification Prioritization Seasonal calendar	Historical timeline Seasonal calendar	Resources identification Historical timeline Seasonal calendar Semi-structured interviews	Anthropometrical assessment Household food frequency survey Semi-structured interviews

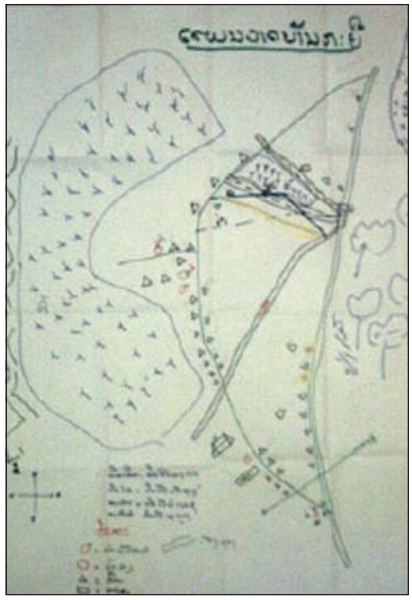


Table 2: General description of activities conducted at the village level

	ACTIVITY	NOTES ON METHODOLOGY
Anthropometric assessment	The assessment team measured nutritional status through anthropometric assessment. The data included name, age (date of birth for young children), sex, height, weight, educational level (years of schooling), employment, disease occurrence, chronic illnesses (including disability), and pregnancy history (number of pregnancies and child mortality). For adults, Body Mass Index (BMI) was used to determine nutritional status. BMI is calculated from the parameters of body weight in kilograms divided by square height in meters. This value is classified into three levels: a BMI value below 19 is defined as underweight, the values of 19 to 24.9 as normal, whereas those at 25 or higher are overweight.	For children aged 0 to 18 years, their weights, heights and ages were analyzed using the computer software program ANTHRO (Centers for Communicable Disease Control and World Health Organization, 1999). It resulted in Z-scores for weight-for-age, height-for-age and weight-for-height. These three indices are classified using ±2.0 SD (standard deviation) Z-scores as the cut-off point. In other words, a child whose Z-score is less than or equal to -2.0 SD is classified as malnourished, whereas a child whose Z-score is greater than -2.0 SD is defined as normal in terms of his/her nutritional status. Those with a Z-score of less than or equal to -3.0 SD are severely malnourished.
Food frequency survey	The assessment team collected quantitative data on food consumption as well as the nutritional status of the population using a food frequency checklist and household form, respectively.	A checklist of foods was categorized into groups of starch and carbohydrate, protein (animal, plant), fat and oil, vegetables, fruits, as well as condiment and seasoning items. Aquatic plant and animal foods were highlighted on the list. This checklist and a household form were used to collect information on the type and frequency of foods consumed by household members.
Focus group discussions and individual interviews	The villagers were asked to discuss topics concerning their livelihoods including daily and seasonal activities, food supply (availability) and health problems that are common in their communities. Focusing on health and guided by the outcomes of these discussions, individual interviews were conducted with key informants on such aspects as health services, health seeking behaviour, food consumption, beliefs and taboos during pregnancy and lactation, as well as infant and young child feeding practices.	Focus groups were also used to collect information about availability and use of aquatic resources. Small groups of villagers were assembled to discuss species collected, their availability, seasonality, and use. Gear and techniques for harvest were also discussed. Historical trends in availability, harvest and use were also included in focal group discussions. Groups of men and women met separately, so that differences in perspective could be better understood.
Observation and informal talks	Discussions and individual interviews were conducted with villagers in their houses. To assess the availability of dietary iodine, salt samples were assessed using a semi-quantitative screening test called the I-kit developed by the Department of Biochemistry, Faculty of Science, Mahidol University, Bangkok. The assessment team visited local water bodies to look at fishing gear and watch people fish or collect aquatic resources.	The data obtained included information on household resources (*e.g.* water supply, latrine, cooking facilities), environmental sanitation and food hygiene, food preparation and dishes consumed.

Other issues taken into consideration included ethnicity, distance from the main markets and availability of dry season irrigation.

The aim was to select villages that would reflect the broadest possible range of livelihood strategies, not to compare villages.

For the purpose of this study, an absolute or standard definition of 'better-off' or 'worse-off' was neither required nor desired. Participants set their own criteria for what they considered 'better-off' and 'worse-off', because what matters is villagers' perceptions of relative status within the village. The criteria differed for each village but key considerations included food security, food availability, livestock ownership, type of house and available labour in the household.

DISAGGREGATION OF RESULTS

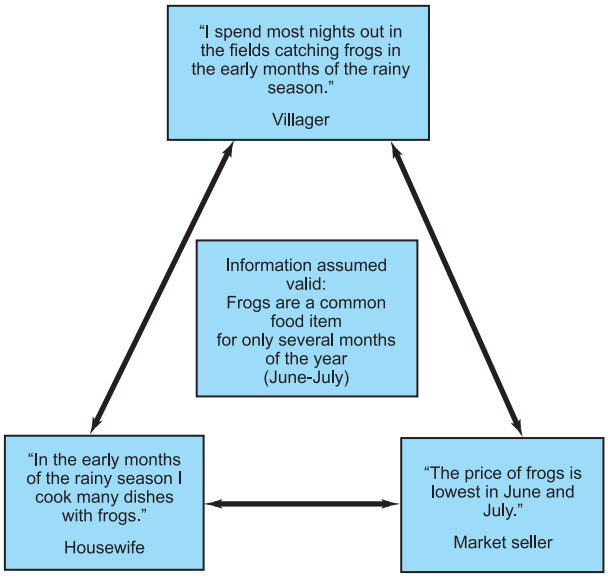
Because different groups within a community or household use resources in different ways, it is important to try to understand what these differences may be. In this study, the researchers looked at differences between gender groups (men and women) and economic groups (better-off households and worse-off households). This was done by creating a household well-being ranking exercise in which each household was ranked in relation to other households in the community by a group of peers within the village.

SPECIES IDENTIFICATION

Focal group discussions and individual interviews were used to develop an understanding of the diversity of aquatic species in the study area. One such activity used local names to identify aquatic organisms and then using pictorial field guides to determine the scientific name. Guides were available for fish (Baird *et al.*, 1999; Kottelat, 2001), turtles and other reptiles (Stuart *et al.*, 2001), insects (INMU, 2000) and plants (INMU, 1999). In cases where the guides included common names in Lao, these were also used as a reference. Where guides were available, identification of organisms is purely anecdotal and has not been formally verified through the collection and examination of specimens. Field guides for amphibians, mollusks, and crustaceans were not available.

TRIANGULATION

One important aspect of using participatory techniques is confirming and validating responses. Because information gathered is anecdotal and sample sizes are determined by factors other than statistical viability, confirmation and validation can not be achieved through statistical analysis. Triangulation is used to confirm information gathered through participatory methods. Triangulation is done by approaching the same topic from different points of view, using different questions, or asking different people the same questions. If responses are consistent, it is assumed that the information given is reasonably valid.



Findings

ATTAPEU PROVINCE

Located in the far southeast corner of the country, Attapeu is one of the most remote provinces in Lao PDR. Attapeu has only developed reliable transport and communication links with the rest of the country since the mid-1990s. People in the province are still relatively poor compared to people in the rest of the country. Thirty percent of the population live in remote mountainous areas, practice upland crop cultivation and suffer from chronic food shortages. The remaining 70 percent live in the lowlands river valleys producing rice. They too suffer from frequent food shortages and marginal livelihoods. Basic public services such as health and education are under-resourced and service providers struggle to meet the needs of the local people. Currently, only

an estimated 61 percent of children attend school, only 27 percent of the schools have latrines and 60 percent of the households have access to clean water. There is only one hospital and 20 village clinics to serve a provincial population of just over 200 000 people.

PROVINCIAL DEVELOPMENT STRATEGY

Provincial authorities have determined that there are over 9 000 households living in poverty and in need of assistance[1]. Reducing poverty is a high priority for the provincial government and food security is one of the key indicators of poverty and vulnerability. Assistance is provided in the form of 'food for work' development projects, distribution of rice seed on credit, credit to buy buffaloes and charitable handouts of food, blankets and medicines.

One of the main long-term strategies for development in the province is the expansion of the agricultural sector, especially rice production. The province has over 14 000 ha of lowland rice production land and ranks seventh in the country for its potential in rice production. Currently, only 3 500 ha are under rainfed rice cultivation and another 448 ha is irrigated paddy land. Because of the perceived under-use of land, provincial development planning objectives include the movement of poor families from

mountainous areas and helping them establish villages in more productive lowland rice producing areas. Another key objective of provincial planning authorities is to increase the area under irrigation to 1 000 ha within the next year. This is combined with efforts to increase rice production through the use of improved varieties and a provincial station that is currently producing seed for distribution to farmers. In addition to increasing rice production, the province also plans to promote livestock production as a secondary source of income.

VILLAGE OVERVIEWS

Three villages were selected according to the criteria listed previously (see Site Selection).

Tamoyot Village

Tamoyot Village in Sanamsai District is a small village consisting of 28 households with a population of approximately 158 people. Most people are Su, one of the many ethnic Mon Khmer groups of the Upland Lao or Lao Theung peoples. Tamoyot is a fairly remote village, located about 13 kilometers from the district town of Sanamsai. The people of Tamoyot make a living from growing upland rice and foraging in the forest and wetlands. Food shortages are common, and many households only produce enough rice to last a few months. Most households rely heavily on fishing and foraging in local streams and wetlands as part of their livelihood strategy. There has been an effort to promote paddy rice production, but people are reluctant to make the changes required to shift from their tradition of upland cultivation.

Saisi Village

Saisi Village in Saisetha District is located on the banks of the Se Kamon River. The village has been long established and currently consists of 200 households with a population of 1 062 people. The villagers are ethnic Lao and make a living by producing paddy rice, growing vegetables, and fishing in the Se Kamon River. Because the village is on the river, villagers can easily get to markets in nearby towns to buy and sell. Most of the families produce enough rice for consumption and some families produce a surplus for sale. Many families,

[1] **The term 'poverty' is based on the local criteria of adequate housing, food security, household assets such as livestock, and annual income below $US 20.**

however, still suffer from rice shortages during certain months and have to rely on alternative sources.

Gayeu Village

Gayeu Village in Samakisai District is located near a provincial town on the main road to Sekong Province and Pakse town in Champasak Province. The villagers of Gayeu are primarily ethnic Oyi, a sub-group of Lao Theung. The village consists of 78 households with a population of 428 people. Gayeu is located on a plain between a mountain range and the Se Kong River. The villagers have a history of producing paddy rice and have a highly developed system of terraced rice fields that extend to the foot of the mountain. Although the village rice land is considered productive, many households still experience shortages of food . Villagers supplement their livelihoods by fishing in a nearby oxbow lake and the Se Kong River and have developed a unique system of trap ponds in their paddy fields.

LOCAL LIVELIHOODS

When asked to brainstorm livelihood activities, participants from the three villages came up with extensive and variable lists. The total number of activities listed ranged from 25 to 72, although some villages tended to group activities rather than split them into separate activities (i.e. 'fishing' rather than 'fishing with a gill net and 'fishing with a cast net', etc.). Most were economic activities such as different types of production (i.e. crops and livestock) and foraging (i.e. collecting crabs, mushrooms), but household duties (cooking, carrying water, etc.) were also listed. Related activities such as net making and tool making were also prevalent, showing that most households remain somewhat independent of outside economic influences. This activity provided valuable insights into the complex nature of livelihoods in the project area and gave a better general understanding of importance of fishing and aquatic resource related activities in relation to other activities. Table 3 summarizes the results from all three villages. It is interesting to note that there are minor differences between men's and women's responses and a large difference between better-off and worse-off households. One of the differences is that 'collecting aquatic animals' was ranked fairly low by better-off households (too low to be included in this summary), but was ranked higher than 'fishing' by worse-off households.

'Better-off' typically means families that own (or have hereditary rights to) land and are actively engaged in agricultural production. People in better-off households spend more time engaged in production and usually have more cash to spend on food items. Better-offs have more options in terms of obtaining food, the quantity of food obtained and how they use their time.

Table 3: Priority of activities

Men from better-off households	Women from better-off households
• rice production • food preparation • clear/prepare production land • raising livestock • collect fire wood • carrying water • **fishing*** • cutting lumber	• rice production • collecting fire wood • carrying water • raising livestock • food preparation • milling rice • **fishing*** • gardening
Men from worse-off families	**Women from worse-off families**
• rice production • food preparation • raise livestock • **collecting aquatic animals** • **fishing*** • gardening • clear/prepare production land	• food preparation • **collecting aquatic animals** • raise livestock • **fishing*** • gardening • rice production • child care

Status of health and nutrition[2]

Food security is an important indicator of poverty status in Lao PDR and therefore an objective of development interventions. Classification of food security on the basis of rice security, without appropriate consideration of the availability and quality of other sources of food, can lead to inappropriate characterization of communities. Food security does not relate solely to quantity of food, but also to nutrition and health.

HOUSEHOLD FOOD ACQUISITION: DIVERSITY, CERTAINTY AND QUANTITY

People acquire food by cultivation, gathering wild food, barter and buying from local markets. This study provides insights into food availability and consumption among households in terms of diversification and frequency and highlights the importance of both rice and aquatic animals.

Staple foods

Glutinous rice ('sticky' rice) is the staple food. Some Gayeu residents also eat non-glutinous (ordinary) rice in combination with sticky rice because they can grow it. Farmers said that normally they do not produce enough rice for consumption, and rice shortages always occur for about three months around the time of planting. The situation becomes worse if insect infestations, disease outbreaks and floods are heavier than usual. They reported that the recent shortage period was from April-June in Gayeu and September-November in Saisi. When facing chronic food shortages, community members adopt a variety of coping strategies. For instance, some reduce the amount of rice consumed, while others search for alternative sources such as wild yams, taro, cassava, and other roots. In vulnerable families, people may eat only wild yams or roots collected from the forest. Overall, the poor and better-off have access to similar types of caloric sources (glutinous rice, ordinary rice, cassava, sweet potatoes, taro, wild yams and roots), but better-off family members tend to eat these foods more often.

[2] **A more detailed report on the health and nutritional status in the study area is available. Key sections of this report are included here to provide an overview of issues related to health and nutrition identified in the study area. For a full version of this report please contact: simon.fungesmith@fao.org.**

Animals and animal products

The villagers consume animal protein from several sources. Domestic animals (poultry, eggs, pork and beef/buffalo). People only buy meat occasionally since it is expensive and it is difficult to get to markets. However, chickens raised in the backyard (and their eggs) are relatively common compared to other sources of protein from domestic animals.

Summary

Communities have access to a diverse variety of cultivated and non-cultivated foods, but supplies are uncertain largely due to low productivity, especially for rice. Animal and vegetable groups are plentiful since these are readily gathered from wetlands, major water bodies and nearby forests. The diets of most community members are not adequate nutritionally, partly because they are low in fat. In addition, insufficient knowledge about proper storage and handling reduces the amount of iodine available in salt supplies. Overall, aquatic animals are a substantial part of the food supply in these three communities compared to cultivated items (except rice). Food acquisition is limited by several major factors including low purchasing power, labour, time, food preference and health status.

The term 'aquatic animals' mainly refers to fish, eels, frogs, freshwater shrimp, snakes, snails and turtles. Several types of fish are available in these villages. In this study, snakehead (*Channa striata*) is used as a reference fish because of its popularity as a household food and as an item for sale, both in Attapeu and throughout southeast Asia.

Food security does not relate solely to quantity of food, but also to nutrition and health.

The people in this study feel that a snakehead is 'large' if it is more than 5-6 inches long. Large snakeheads are almost always sold whereas smaller ones are eaten by the family. By many regional standards, a snakehead 5-6 inches long is considered quite small. It would seem that only the small fish are retained for household use. The findings also reveal that aquatic animals contribute substantially to household food supply in terms of diversity and frequency of consumption. Other animals collected

from the wild include ant eggs, crickets, locusts, bees, hornets, monitor lizards, and rats. These are available seasonally and play a significant role in the diet of community members.

Food preservation is a practical way to store food and cope with seasonality, food shortages and vulnerability. The researchers found that the villagers use short-term fish preservation methods such as sun-drying, as well as longer-term methods like fermentation and salting. Fish prepared using short-term preservation techniques can last 5-10 days, whereas long-term fish preservation can extend availability for the entire year. In many cases, those who make fermented fish (*pa dek*) said that it is no longer adequate for an entire year, since the fish used in the preservation process are declining in number. *Pa dek* is considered a condiment and supplies only a small amount of nutrients. Nevertheless, some community members, especially the poor, may cook *pa dek* as a main dish. Salted fish (*pa katoaw*) is prepared using tiny fish soaked in saturated brine or by mixing them with salt. When the flesh hardens as the salt saturates into the flesh, the fish are packed tightly in bamboo sections. One respondent said that five bamboo sections (6 cm in diameter and 40 cm in length) of *pa katoaw* will supply the needs of a family of six for an entire year.

Seafood is rare, only mackerel and canned fish were seen in the market. The villagers seldom eat these types of foods because they are expensive. In the remote area of Tamoyot, villagers do not have ready access to such foods. Focus group participants also reported eating different types of wild animals as food, though the household level data indicated that these are rarely eaten. There are several possible explanations for this discrepancy:

- Since 1997 the Lao PDR government has been enforcing laws to conserve wildlife, which may lead to under-reporting.
- Hunting is seasonal and at the time of the study people were not hunting.
- Since hunting is a 'male' occupation, in households without a capable hunter, wild meat may be rarely eaten.
- For those families living in areas where foods are diverse, they may choose to obtain more readily accessible foods from water bodies, wetlands and bushes.
- It is questionable whether wildlife is still abundantly available for hunting, as many respondents noted declining populations.
- There is a relationship between food behaviour and food acquisition (see Figure 1).

No matter what foods are available in the communities, those who prepare foods for the family will choose what the family eats. Some interviewees mentioned that they do not like to eat meat from wild animals.

Non-staple plant foods

Leafy and non-leafy vegetables cultivated in these communities include lettuce, cabbage, mustard greens, morning glory, water mimosa, wax gourd, cucumber, string bean and pumpkin. 'Garnishing' vegetables such as spring onions, coriander, sweet basil, sacred basil, lemon grass, chilli and other dills are planted in small areas close to houses. Many families grow these vegetables for income. Uncultivated vegetables and fruit from trees are commonly consumed. Those grown in semi-wetland areas and available all year round include *pak kadon, pak kayang, pak samek, pak tiew,* and *pak paew*. Bamboo shoots and mushrooms are seasonally available.

Common (un)cultivated trees around the backyard are *yod gatin, lin mai*, mango leaves and tamarind (leaves and pods). According to food frequency data (see Annex 1a) aquatic plants are important household foods. Based on observation data, in poorer families women collect these plants and prepare them as the main meal. In other families, they are eaten in combination with other foods or for dipping in chilli sauce.

Fats and oils in human nutrition

Report of a joint expert consultation

Organized by the Food and Agriculture Organization of the United Nations and the World Health Organization, Rome, 19 to 26 October 1993 (M-80 ISBN 92-5-103621-7 © FAO 1994).

Minimum desirable intakes of fats and oils

Adults: Adequate amounts of dietary fat are essential for health. In addition to their contribution to meeting energy needs, intakes of dietary fat must be sufficient to meet requirements for essential fatty acids and fat soluble vitamins. The minimum intake consistent with health varies throughout a person's life and among individuals. Adequate intake of dietary fat is particularly important prior to and during pregnancy and lactation. Increasing the availability and consumption of dietary fats is often a priority for overcoming the problems of protein-energy malnutrition. Recommendations to populations concerning desirable ranges of fat intakes may vary according to prevailing conditions, especially dietary pattems and the prevalence of diet-related non-communicable diseases.

Recommendations on minimum intakes for adults

- For most adults, dietary fat should supply at least 15 percent of their energy intake.
- Women of reproductive age should consume at least 20 percent of their energy from fat.
- Concerted efforts should be made to ensure adequate consumption of dietary fat among populations where less than 15 percent of the dietary energy supply is from fat.

Infants and young children: Both the amount and quality of dietary fat consumed can affect child growth and development. These influences are mediated through energy levels and through the action of specific fatty acids and various non-glyceride components of the fat. Breast-milk provides between 50-60 percent energy as fat, and during the weaning period (that is, the transition from full breast-feeding to no breast-feeding) care needs to be taken to prevent dietary fat intakes from falling too rapidly or below the required levels. The use of fat, especially vegetable oils, in the foods fed to weaning infants and young children is an effective way to maintain the energy density of their diets.

The consumption of adequate amounts of essential acids is also important for normal growth and development. Arachidonic acid and docosahexaenoic acid (DHA) are particularly important for brain development, and breast-milk is a good source of these fatty acids. Particular problems exist for pre-term infants who had an insufficient intra-uterine supply of arachidonic acid and DHA and who were born with low fat reserves.

Recommendations regarding infant and young child feeding

- Infants should be fed breast-milk if at all possible.
- The fatty acid composition of infant formulas should correspond to the amount and proportion of fatty acids contained in breast-milk.
- During weaning and at least until two years of age, a child's diet should contain 30-40 percent of energy from fat and provide similar levels of essential fatty acids as are found in breast-milk.

Fats and oils

This food group is not included in Table 4 (page 20) because respondents rarely acquired food rich in oil. Moreover, vegetable oil is not purchased, and lard is only rarely used to prepare omelets for children. Coconut milk dishes are prepared for certain ceremonies, and most are sweet rather than savory. One of the reasons for limited vegetable oil consumption is that Lao PDR does not have an established grain pressing industry. Vegetable oil is mostly imported and when it reaches remote rural areas it is prohibitively expensive. Rendered pork fat is more commonly used, although again, this is a relative luxury. Traditional menu items do not have a great deal of fried food.

Fruits

Fruits are acquired mainly from the market. A few varieties are grown around the house, most notably, mango, jackfruit, custard apple and tamarind. Wild fruits were rarely mentioned in focus group discussions or individual interviews.

Iodine rich food sources

As a source of iodine, salt is an important daily consumable item, while seafood is rare. Communities obtain their salt supplies from domestic factories (Champasak Province) and Viet Nam (according to the labels on packages). There are two forms of salt: fine and coarse. Fine granular salt is used for cooking, while coarse granular salt is used for preserving food. However, since coarse salt is inexpensive, several respondents reported using it for cooking as well. As part of this study, the quality of both forms of salt was tested using a semi-quantitative screening test kit (Department of Biochemistry, Mahidol University). Results showed that 32 percent of household salt samples (n = 37) had insufficient iodine content (below 30 ppm). All coarse salt samples had low iodine content whereas fine salt showed variable levels of iodine content. The major factor affecting salt quality is improper handling and storage. When newly opened salt packages were tested, their iodine content was adequate, ranging from 50-100 ppm. Once the packages are opened, they are kept in open containers and the salt is exposed to air and light. Thus, the iodine content decreases to an unacceptable level and the quality of the salt becomes low.

DIETARY HABITS

Community members generally eat three meals a day. Breakfast is early because of farm work. During farming season, poor people will merge breakfast and lunch into one meal. When farming activities slow down, lunch is optional. Eating between meals is rare. Dinner is taken at dusk or sunset when family members come back from farm work or from work outside their homes. People eat glutinous rice as their main source of calories, though as noted earlier, Gayeu villagers consider ordinary (non-glutinous) rice as part of their daily food. Glutinous rice is steamed for breakfast because it does not take long to prepare. After cooking, it is packed into rice baskets and carried to work or school for lunch. Leftover rice is also eaten for lunch. Explanations regarding the reduced number of meals or eating glutinous and ordinary rice together in daily meals reflects food insecurity. Merging breakfast with lunch or making lunch optional is a mechanism by which people can conserve their rice supplies, particularly in times of shortage.

Another strategy to overcome rice insecurity is seen in the pattern of eating ordinary rice for dinner. After cooking, the volume of ordinary rice increases to a greater extent than glutinous rice. Using a manual for estimating dietary intake as a guide (Banjong, *et al.* 1995), 1 000 grams of ordinary rice is converted to 2 325 grams of cooked rice, whereas 1 000 grams of glutinous rice increases to only 1 515 grams. Gayeu residents always prepare ordinary rice for dinner, which helps them conserve their supplies of glutinous rice for use during times of scarcity when a larger volume of rice might be needed (April to June). Gayeu residents use this practice as a regular coping technique the entire year. This same coping strategy is also found among many Saisi families.

Home visits to selected households allowed the investigators to learn about people's food habits and consumption patterns. Based on the Thai Food Composition Database (INMU, 2002), calories obtained from rice intake were estimated during these visits. The results highlight important food habits and food insecurity found in the study areas as shown in the following cases.

Overall, the habitual diet of community members is comprised of steamed glutinous rice and *jaew*, a sauce made of raw fermented fish mixed with chili,

MSG and condiments. In addition, fish, frogs, snails, crabs, lizards and other animal meat (if available) may be added. This dish is eaten with vegetables, commonly collected from swamps, wetlands, other water sources and nearby forests. On some days, if fish or animal meat is sufficient in quantity to prepare soup, then soup would be an additional dish to *jaew*.

Although the total diet could not be completely assessed, estimated caloric intake measurements indicate that the main source of calories is from glutinous rice supplemented with ordinary rice in Gayeu and some Saisi families. Absolute intake of calories in terms of quantity may meet daily requirements most of the year. Quality is most likely deficient, especially in some important micronutrients such as iron, iodine and vitamin A. There are several reasons for this assumption. First, only a few dishes are prepared at one time, and many people must share only a small amount of food. In some cases, food beliefs restrict what foods some family members can eat and some of these foods are rich in micronutrients such as vitamin A. Finally, little animal meat is eaten, which can restrict the bioavailability of micronutrients contained in rice and plant foods (Bouis and Hunt, 1999).

The recommended daily caloric intake from carbohydrate, protein and fat should be in the proportion of 60 percent, 10 percent, and 30 percent respectively (Guthrie and Picciano, 1995). People in these communities consume low amounts of fat, if any at all. As a result, fat-soluble vitamins, most notably vitamin A, cannot be adequately absorbed by the body, which in turn compromises the body's immune system. Micronutrient deficiencies due to low animal food intake can lead to the risk of infection (Halstead, *et al.* 1967).

Community members equate 'food' with 'rice' and therefore anxiety sets in only when rice is scarce and means must be found to obtain more of it. All respondents rely significantly on uncultivated foods, especially aquatic animals and plants as major food sources. These foods, however, are only seasonally available or may be declining, and obtaining them is limited largely to non-farming seasons. Furthermore, community members do not place an emphasis on the cultivation of diverse food sources and their storage, preferring to collect foods from the wild (especially yams) when they are immediately needed. Both poor and better-off families have similar dietary patterns with inadequate dietary intake leading to nutrition insecurity for both groups.

Consequently, the criteria used by focus group participants to classify households into 'worse-off' and 'better off' are not adequate for determining differences between groups in terms of food and nutrition security. It is possible that knowledge about food and nutrition may be a more important criterion for determining dietary intake than economically-based characteristics.

FOOD BELIEFS AND PRACTICES DURING PREGNANCY AND LACTATION

Nutritional status during pregnancy is extremely important. Dietary intake influences pregnancy outcome and lactation (WHO, 1989). The findings from this study indicate that mothers did not 'eat for two' but continued to eat the same foods (in quantity and quality) as before they were pregnant. Almost none of the pregnant women observed in this study attended antenatal clinics. Many mothers realized they were pregnant only three to five months after gestation. When asked about their interest in antenatal clinic services at the hospital, mothers said that only sick people go to hospitals. If a woman is having a healthy pregnancy, then she does not need to see a doctor. Among other things, this perception limits women's access to health and nutrition information.

Mothers said, "Only sick people go to hospitals. If a woman is having a healthy pregnancy, then she does not need to see a doctor".

During the first one to two weeks following birth, food restrictions are strictly adhered to. The mother eats only rice with salt, though a few women may be given baked chicken or fish. Food restrictions continue for one month or longer. Prohibited foods include certain types of animals, vegetables and fruits. For animals, red meat (like blood) is strictly prohibited as are red-tailed fish and red fowl. Wild pig, barking deer, rabbit, albino buffalo, toad, some kinds of fish and fermented products are other examples of the types of foods considered taboo. Fruits and vegetables believed to deprive a woman of her health are watermelon, sour fruits and pickled foods. They also avoid spicy dishes and monosodium glutamate (MSG). These foods are believed to cause headaches, vomiting, severe bleeding, loss of consciousness and convulsions, inflammation to the womb, and eventually death. Some items are believed to enter the breast milk and cause diarrhea and fever in the baby. Members of

poor families and those who have had an infant die are among those who most strictly adhere to food restrictions.

Special foods to promote health are rare. Foods believed to be nourishing for breast milk production are banana flower, young jackfruit, bitter foods and specific tree roots. Foods prepared in the form of soup are favourites, especially jackfruit soup and soups made with bitter foods. Apart from food practices, nourishing the body using herbal medicine is encouraged. Herbal recipes consist of herbs collected from bushes or the forest, and are usually taken in the form of tonic drinks or for bathing.

Home births are often attended by Traditional Birth Assistants (TBA). Though they have received training, their skills are not sufficient to change traditional feeding practices. Although all newborns are given breast milk, almost none of the infants observed were given colostrum. Mothers believe that because colostrum is not white like breast milk, it is not 'ripe' and should be discarded or it will cause diarrhea in the babies. During the few days that it takes for a mother's breast milk to begin flowing, a mother will feed her infant with chewed rice and a mixture of water and banana. Some mothers said they fed rice to their babies as early as a few hours after birth because the infants cried. Exclusive breastfeeding in which a baby is fed only breast milk for four to six months was definitely absent from the study communities. An early study by Valyasevi *et al.* (1967) showed that feeding chewed glutinous rice to infants less than 30 days old causes protein intake deficits because calories from rice replace calories from breast milk, even to the extent of one-half of the total daily requirement.

In summary, culturally-based food consumption patterns and restrictions are common among the respondents. Most importantly, nutritious foods that lactating women need to regain their health and improve the quality of their breast milk are prohibited, such as animal meats. This is complicated by the fact that these foods are not easily available or not eaten as part of the habitual family diet. Consequently, the health of mothers and their young children is compromised.

HEALTH AND NUTRITIONAL STATUS

The nutritional status of pregnant women is reflected in the birth weight of their infants. In this study, it was impossible to determine the weight of newborns because most women gave birth at home and there is no system for weighing. Malnourished pregnant mothers give birth to low birth-weight newborns. These newborns are susceptible to infection and death. Death of newborns and infants was common among the respondent families. According to histories of conception, community women experience many pregnancies, ranging from one to fourteen, with an average of six. Almost 70 percent of the women spoken to have experienced a miscarriage or child death. Of this group, 14 percent have lost three to eight children. There are several possible explanations:

- Mothers do not receive ante-natal care and home births are common.
- Women have poor access to proper health services. TBAs are the only health care providers available in these areas. In a remote area like Tamoyot, TBAs are poorly trained, which may partly explain the high prevalence of miscarriages and child mortality.
- Although trained TBAs are available in Gayeu and Saisi, it is uncertain whether their skills and supportive equipment are enough to enable them to save mothers and infants during difficult births or when they have postpartum complications. Their nutritional knowledge and care for mothers and infants during the postpartum period is inadequate to support maternal and child survival.
- Children are not given regular immunizations (if any at all), thus making them susceptible to preventable childhood diseases.
- Traditional beliefs and taboos about foods suitable during pregnancy and lactation lead to mothers being malnourished during pregnancy, thus making them susceptible to infections.
- Frequent pregnancies drain a mother's nutritional resources and cause further malnutrition, which increases the likelihood of low birth-weight, delayed development and infant mortality.
- Local perceptions about health care services prevent them from learning about health, food and nutrition. As a result, traditional practices persist.

In these three communities, no single factor causes poor health in mothers and children. Rather, the problems are complex, multifaceted and interrelated and will require an integrated approach that takes into account the socio-cultural context.

Quantitative findings contribute further to the picture of poor health and the many illnesses that community members face. Almost half (45 percent) of the people from participating households reported that they are frequently ill. Infections of the digestive system are prevalent among both men and women. Gastritis was reported among adults and diarrhea among children. Malaria is common, especially in Tamoyot and Gayeu. Respiratory tract infections are widespread and coughs, colds and fever are common among children. Pulmonary diseases attack adults, partially because of tobacco smoking. Women complained about sickness that causes vaginal discharge and uterus pain. Health problems caused by poor personal and environmental sanitation and hygiene (*e.g.* skin diseases, head lice, intestinal parasites) appear not to be dominant at the individual level, though they were reported during group discussions.

For non-infectious diseases, except kidney stones, nutritional deficiency signs were not clear. However, paleness of nails, eyes and skin were seen in children who were thin and underweight. Fatigue and numbness, which may be caused by vitamin B deficiency, were evident among women of reproductive age. Four mothers said that their children aged 9-11 years had failing eyesight at night, a symptom associated with night blindness due to vitamin A deficiency. Apart from the reported data, the home visits allowed the researchers to observe the health status of young children. Some exhibited angular stomatis, dry hair and were extremely thin, though their mothers did not recognize these as signs of nutritional health deprivation.

The nutrition status of 0-18 year old children was categorized as either underweight, stunted or wasted. Underweight rates of 40.3 percent, 50.3 percent and 44.8 percent were measured in children living in Gayeu (near a larger town), Saisi (rural) and Tamoyot (remote), respectively. Severe underweight status was observed among 9.0 percent, 8.0 percent and 6.9 percent of children in these communities. Both male and female children are underweight at similar rates. Half of the malnourished cases are children under the age of five.

Stunting reflects past or chronic malnutrition. Over half the children observed were diagnosed as stunted. Stunting ranges from 57.2 percent in Gayeu to 63.8 percent for both Saisi and Tamoyot. Almost one-third of the children suffer from severe stunting at rates of 24.1 percent, 27.6 percent and 22.4 percent in Gayeu, Saisi and Tamoyot, respectively. Similar rates of stunting were found in both boys and girls, and stunting was most prevalent among children under five (43.7 percent).

Wasting is demonstrated by a sensitive index for current nutritional status. The prevalence of wasting occurs in association with the period of post-weaning (WHO, 1986), fluctuations in food supplies, or the incidence of infectious diseases. The prevalence of wasting is 5.8 percent in Gayeu, 6.3 percent in Saisi and 4.4 percent in Tamoyot. The results also show that girls are more prone to wasting than boys, with infants and young children being most susceptible. The prevalence of children who suffer from both stunting and wasting is 3.6 percent.

Malnutrition, in terms of underweight and stunting, are prevalent among children living in the study communities. Moreover, the prevalence of underweight children is significantly associated with morbidity. Stunting indicates that children are receiving a poor diet and improper feeding. Inadequate intake and infectious disease interaction results in poor growth. The evidence of wasting in young children supports the contention that the food supply in the study areas fluctuates, resulting in malnutrition and infection among children. This vicious cycle has been occurring in these communities for a long time.

Nutritional status of adults is presented in terms of weight, height and Body Mass Index (BMI). The findings show that the average height is 158.8 cm for male adults and 150.6 cm for female adults. Based on the International Growth Standard, these figures are the same as the reference heights of 13 year, 4 month old boys, and 11 year, 10 month old girls.

Both males and females lie on the borderline of lower normal growth. On average, over one-third (33.5 percent) of adults in the study communities are malnourished. Results indicate that under-nutrition in adults is prevalent in Saisi, followed by Gayeu and Tamoyot. Surprisingly, the remote community of Tamoyot shows the lowest rate of adult malnutrition, as well as child malnutrition rates that are midway between, equal to, or below those of the other two non-remote communities. Community location (near town, rural, remote) may not be a good predictor of nutritional status among adults or children. The prevalence of female malnutrition is three times higher than for males.

These findings reflect the poor state of health and nutrition among adults and children in the study communities. Women's health and nutritional status is lower than that of men, which places them at greater risk of infection, major reproductive health problems and increased mortality. This situation has arisen at least partly from chronic food insecurity and poor hygiene and sanitation practices.

Summary of findings on health and nutritional status

Local diets consist mainly of rice, supplemented with insufficient amounts of animal proteins and almost no fats. The typical diet in many households is insufficient in both quality and quantity, leading to low productivity and poor health. Traditional dietary habits and lack of appropriate information are at least partially responsible for this situation. Of the animal protein sources consumed in rural households, aquatic resources contribute more to local diets than domestic animals or animals hunted in the forest. Aquatic animals are captured for sale or barter to compensate for shortages of rice. Households that routinely suffer from food insecurity in the form of insufficient rice often depend on wild aquatic resources to compensate.

Availability and importance of aquatic resources

Aquatic resources are fundamental to local livelihoods in Attapeu and are a key component in the well being of local people. Their livelihood strategies involve the use of multiple resources.

AQUATIC ENVIRONMENTS

The study areas in Attapeu are characterized by a wide range of aquatic environments. These include permanent and seasonal, flowing and standing, natural and man-made water bodies. Each type of waterbody has its own annual hydrological cycle, is characterized by its own community of aquatic organisms and is subjected to a particular pattern of resource use by local people. The main categories of aquatic environment identified during this study include rivers and perennial streams, perennial ponds, marshes, oxbows and rice fields, seasonal ponds and seasonal streams[3].

Rivers and perennial streams

Rivers and perennial streams are key features in the lowlands of Attapeu and important sources of fish and other aquatic produce. They sustain a range of aquatic organisms throughout the year. They are also subject to large annual fluctuations in volume and flow between the rainy and dry seasons. Because these are permanent water bodies, they serve as dry season refuges to a broad range of fishes and aquatic animals and are critical habitats for a number of strictly riverine species.

Fishing in rivers requires a certain level of specialization. The changing nature of the environment caused by the fluctuations in water flow and the seasonal activities of fish, some of which are migratory, requires specific knowledge and equipment. Boats, specialized nets and other gear are needed to fish successfully in rivers and large streams. Much of the simpler, cheaper and more common household gear has limited application in the river. This means that successfully accessing riverine aquatic resources requires financial investments in gear and a certain amount of skilled labour (typically strong males). Households that lack the labour to use the specialized gear or the means to purchase boats and equipment are limited to resources along the edges of the rivers using smaller gear during periods of low water and assisting others during peak fishing periods. Those who can fish in the river are subject to seasonal scarcity, but are able to catch some fish throughout the year.

Perennial ponds, marshes and oxbows

Perennial ponds, marshes and oxbows are fairly common in the lowland-floodplains of Attapeu. They serve an important function by receiving excess water during the rainy season and holding it throughout the dry season. These water bodies are usually shallow and vary greatly in size over the course of the year, expanding during the rainy season and receding during the dry season. In many cases, they function like an aquatic lung, receiving water directly from a rising river or stream during the rainy season, and then draining it back into the river or stream as the water level drops in the river or stream.

[3] **By many definitions, including Ramsar, all these water bodies are types of wetlands.**

These water bodies serve as refuges for fish and other aquatic organisms during the dry season and are the source of many flood plain fishes during the rainy season. The key species are mainly floodplain fishes but some riverine fishes are trapped when the water recedes following periods of flooding. Because the water is relatively fertile and shallow in areas, many types of aquatic plants, molluscs, crustaceans, amphibians and reptiles are abundant. Fishing in perennial water bodies such as ponds, marshes and oxbows is less specialized than river fishing and requires less investment. Because these water bodies are typically shallow (or have shallow areas), aquatic plants and animals are easy to access with simple, small gear or by hand-collecting. These areas are often of special importance to poor people. When the water recedes and seasonal water bodies have dried or been harvested, people fish in permanent water bodies with other types of gear, including small-scale, household gear.

Diversity is a key strategy for coping with the seasonal nature of rice production and other crops and varying availability of water resources.

Rice fields, seasonal ponds and seasonal streams

Rice fields are an important and often overlooked source of aquatic resources. Rice fields and constructed seasonal ponds extend the productive phase of the aquatic environment. Seasonal rains inundate wide areas of lowland, typically from June through to October. Fish from perennial water bodies migrate out to seek food and reproduce in these newly created water bodies. Migration out to rice fields (and return migration at the end of the rainy season) takes place through seasonal streams that drain into the rivers. Rice fields and seasonal ponds play a similar role in local hydrology in that they hold water higher in the watershed for longer periods than would otherwise be possible.

Several species of fish and aquatic animals have evolved to take advantage of these temporary aquatic environments. At the beginning of the rainy season they quickly disperse and reproduce (or in some cases reproduce and disperse) to fill the empty ecological niches that quickly appear in newly inundated areas. Almost as soon as the rains begin, rice fields are populated with organisms that have been dormant or relatively inactive in permanent water bodies during the dry part of the year.

Much of the household fishing activity is focused on rice fields from the beginning of the rainy season (June) until they dry up (in early to mid-November to January). Harvesting is done with simple, inexpensive gear and requires few specialized skills, which makes it easily accessible to poor people. Fishing effort focuses on migration pathways to and from water bodies, and can be especially productive at the end of the aquatic cycle when fish are moving out of the flood plain back to permanent water bodies.

ACCESSING AQUATIC RESOURCES

Aquatic resource use patterns are influenced by the type of aquatic environment and a range of socio-economic factors such as value, rules of access, ownership and marketability. This varies from village to village and a wide range of situations are represented in the lowland areas of Attapeu. Some of the factors that determine aquatic resource use patterns include:

- the types of water bodies accessible
- natural productivity of water bodies
- distance traveled to water bodies
- traditional, cultural and historic patterns of aquatic resource use
- opportunity cost of aquatic resource acquisition relative to other livelihood activities
- level of specialization or investment required
- proximity to markets
- general status of food security

Seasonality of aquatic resources

When assessing aquatic resources and their availability, the initial impression is that fishing activities take place throughout the year. This is, however, an over-simplification of a quite complicated series of activities. Over the course of the year, fishing effort is focused on different water bodies using different techniques and targeting different fish species. Such issues are complex and interrelated, but can provide a useful framework to better understand resource use. A general description of how these factors affect aquatic resource access patterns is provided in Table 4.

Tamoyot is a village with an extensive pattern of resource use. The village is located in a lowland

Table 4: Examples of factors affecting aquatic resource acquisition patterns in Attapeu			
	Tamoyot Village	**Saisi Village**	**Gayeu Village**
Water bodies accessible	• Huay Samong stream • Huay Samong irrigation ditch • many perennial ponds and swamps • many seasonal ponds and swamps	• Se Kamon River • some dispersed seasonal ponds • a few remote perennial ponds • 2+ seasonal streams • rice fields • 1 private pond	• Se Kong river • Nong Lome, perennial oxbow lake/pond • 3+ seasonal streams • rice fields (with trap ponds) • several private ponds
Proximity of water bodies	• Village located adjacent to stream and irrigation ditch • Several seasonal and perennial ponds and swamps located within 5 km of village	• Village located on the banks of the Se Kamon River • Rice fields in two locations relatively near village • Ponds located in/near forest beyond rice-fields	• Village located adjacent rice fields and perennial streams • Se Kong River is 1+ km from village • Nong Lome is 2+ km from village
Traditional, cultural and/or historic context	• Ethnically Su. They moved to the present location 20 years ago because of water availability. They practice rotational upland rice cultivations.	• Villagers are lowland Lao. They have a century's long history of rice cultivation and fishing in the Se Kamon River valley.	• Ethnically Oi. The villagers have practiced paddy rice cultivation in intricately laid out, terraced rice fields at the foot of the mountain for generations. Have recently moved to current location near the river.
Level of specialization or investment	• The nature and scale or water bodies accessible to Tamoyot are conducive to a general approach to aquatic resources access and use.	• Saisi village's main water body (the Se Kamon River) requires specialized skills and equipment for fishing.	• With a range of water body types available, villagers have a choice of how and where effort is spent.
Relative productivity of water bodies available	• All water bodies seem to remain relatively productive based on seasonal cycles.	• Production of lesser water bodies does not approach the production of the river.	• The rice field fishery is becoming less productive, the river and the oxbow lake are becoming more important.
Proximity to the market	• Somewhat remote, road to village not passable for much of the year. One half to a full-days journey to district town. Much commerce is done through barter with other villages rather than the market (i.e. trading fish or wildlife for rice).	• Both district and main provincial markets are easily accessible. The main provincial market can be reached by road or boat in less than an hour.	• The main provincial market is within ten kilometres of the village. It can be accessed on a daily basis (about 30 minutes by bicycle). The village is located on the main road to Sekong and Pakse.
General status of food security	• Food security is a major issue. Many households only produce enough rice to last 4-5 months. Aquatic resources and various forest products are used for barter to secure food the remainder of the year.	• The majority of the villages produce enough to last the whole year. Vegetables are grown for sale and aquatic resources are harvested for consumption and sale.	• Most households produce enough rice for consumption. Seasonal shortages of other foods mean that villagers depend heavily on aquatic resources and forest products at certain times of the year.



area that has a number of water bodies and a range of wetland habitats. Much of the surrounding area consists of rocky, laterite soils where topsoil is extremely shallow or nonexistent. This type of land is not suitable for agriculture and is covered with scrub forests that flood on a seasonal basis. The relatively low population pressure in the area allows local people to access different types of water bodies throughout the year. One of the main constraints to harvesting aquatic resources is the inhospitable nature of the forest during certain times of the year (i.e. a large number of leaches during the rainy season), and the level of effort that people are willing to expend.

Saisi is a village with a long, historical relationship with the Se Kamon River. Most households own boats and gear for fishing in the river. The productivity of the river, although seasonal and perceived to be decreasing, is still higher than that of the nearby seasonal water bodies (rice fields, seasonal ponds and a seasonal stream). These water bodies are fished as well, but most of the fishing effort focuses on the river.

Gayeu village has a long tradition of rain fed rice production. The village has a large area of paddy fields that are intricately terraced and well managed. There is a local practice of digging trap ponds to harvest rice field fish, and there is a system of hereditary rights to key locations for trapping fish along seasonal migration routes to and from the rice fields. Because the rice field fishery has sharply declined, much of the fishing is done in permanent water bodies. Some families fish in the Se Kong River, but the majority fish in the nearby oxbow lake. Although the river is closer than the lake (1+ km versus 3+ km), most people prefer fishing in the lake rather than trying to specialize in river fishing (i.e. using boats, specialized nets, and specialized techniques).

Species diversity

Lists of fish and aquatic organisms were compiled from interviews with villagers rather than sampling. Nonetheless, they provide a good indication of the aquatic biodiversity in the lowlands of Attapeu Province. As seen in the lists of aquatic species reported from each village, a wide range of organisms representing different aquatic environments are being caught and consumed or sold. In the fish lists reported from each village in Table 5, a broad range of species representing different aquatic environments is being caught. The list grows longer when we add other aquatic animals such as crustaceans, molluscs, amphibians, reptiles, insects and aquatic plants.

Fish – An impressively high number of fish species were reported during each village activity, ranging from 66 species reported by Tamoyot to 102 species reported by Saisi. These species fall into two major groups: riverine species and floodplain species.

Aquatic animals (non-fish) – Other aquatic animals reported include several species of crabs, shrimp, frogs, shell fish, turtles, and insects. In some cases, these animals (especially frogs, shrimp and crabs) are as important to household consumption as fish.

Aquatic plants – Aquatic or semi-aquatic plants are an important part of rural diets in Attapeu. Aquatic plants include those that float or are submerged and rooted in water. These are most abundant during the rainy season when the area is inundated by flood water. Semi-aquatic plants grow in moist areas along the edges of water bodies and are most abundant during the dry season.

Historical trends in aquatic resources access and use

Local people say there is a general trend toward intensification of resource use which includes agricultural development as well as increased efforts to harvest aquatic resources. An important driver of this trend is the ongoing shift from a subsistence-based economy, where people provide for most of their own needs, to a cash-based economy. Local people participating in this assessment felt that most living aquatic resources, especially the fisheries, are in decline and provided the following explanations:

- over havesting due to population growth
- the use of modern, more efficient gear such as monofilament nets
- a trend from subsistence to commercial fishing and a growing demand for aquatic products in local markets
- environmental degradation

Households that routinely suffer from food insecurity in the form of insufficient rice often depend on wild aquatic resources to compensate for this deficiency.

Indicators used to determine whether aquatic resources are in decline are based on observations of declines in certain key species as well as a perceived decrease in catch per unit effort (CPUE). These indicators include:

- more time spent fishing to catch less fish (i.e. spending three times as much time to catch the same amount of fish)
- fishing more frequently to meet demand (catches cover one meal, whereas previously one catch provided enough for several meals)
- more investment required in household fishing gear (i.e. must own three gillnets, whereas previously one cast net would suffice)
- less fish being preserved for future use (i.e. one jar of fermented fish prepared in a household, rather than five as in previous times)
- other aquatic animals increasing in the diet while fish decline (i.e. eating more small frogs than fish, rather than the opposite as in previous times)
- decline in the use of traditional gear and techniques because of diminishing return on effort

Decreases in total fish production, in absolute terms, are difficult to determine. In this case, what is more significant is the availability of fish to individual households (Table 5). By all the measures listed above, the availability of fish and other aquatic resources at the household level is declining. Poor households are likely to be the most adversely effected because of their limited availability of labour or capital to purchase more effective gear.

Table 5: Numbers of aquatic species reported

	Tamoyot village	Saisi village	Gayeu village
Fin fish	61	102	95
Crustaceans	3	6	6
Molluscs	4	7	6
Amphibians	8	14	6
Reptiles	8	10	5
Insects	–	7	7
Aquatic plants	19	16	31

PROMOTING RICE PRODUCTION

One of the main development priorities of the province is to increase rice production. The lowlands of Attapeu make up the seventh largest area of potential agricultural land in Lao PDR and are part of the country's overall plan for meeting food security. Although the province has increased rice

production in recent years, it has realized little of its potential for agriculture production. Provincial plans to increase rice production include expansion of land area under cultivation, an increase in dry season cropping through the development of irrigation systems and promotion of improved varieties of rice.

Provincial authorities are encouraging farmers to increase the area they are cropping. Land not yet being farmed is considered 'underused' and 'available' for development and is thus targeted for conversion into agriculturally productive land. This low lying land area includes a wide range of aquatic habitats that play an important role in supporting aquatic biodiversity.

Current efforts to promote dry season rice production have met with limited success. Although there has been substantial investment in infrastructure for irrigation in some areas, farmers have been reluctant to invest in a second rice crop. As a result, much of the dry season irrigated land is not used for rice production. One of the main reasons is that farmers feel that profits are too low to assume the risk of borrowing money to produce the second crop.

Local people do not see increased rice production as incompatible with productivity of other aquatic resources.

Village-level discussions revealed that the use of improved varieties of paddy rice is widespread in Gayeu and Saisi villages. In Tamoyot, people practice upland rice production almost exclusively. Farmers estimated that approximately 70 percent of the rice planted last year was of improved varieties. Seed varieties are easily available, and the Provincial Agriculture Office is currently working to produce seed locally. Although farmers are using new varieties, they have changed little about their production systems. They continue to manage rice production using traditional methods. The use of fertilizer and pesticides is still minimal, but said to be increasing.

The current decline in productivity of aquatic animals from rice fields is not blamed on rice production practices, but on over-harvesting of fish below the rice fields in the adjoining wetland habitats. Irrigation schemes are even perceived to increase aquatic resources other than rice by maintaining an aquatic environment through the dry season. Fish, frogs and shrimp are reported to inhabit the irrigated fields if there is a permanent refuge within the irrigated area to maintain the population (rather than entering through the irrigation system). Agricultural chemicals are a threat to aquatic production, but as few chemicals are used, there is no first hand experience with their adverse effects.

Local people do not see increased rice production as incompatible with productivity of other aquatic resources. However, the conversion of land providing important habitats for aquatic animals may pose serious threats to the main source of animal protein in local diets. Livelihood strategies are dependent on the use of a range of resources and a combination of different activities. Diversity is a key strategy for coping with the seasonal nature of rice production and other crops and varying availability of water resources.

Both aquatic resources and rice are fundamental to nutrition and health, yet local development strategies emphasize rice production. This is being done without due consideration of the impact on the aquatic resource base and the potential development opportunities of appropriate management of wild aquatic resources.

Given the inadequacies of local diets and the prevalence of chronic malnutrition, the role of aquatic resources in rural livelihoods is vital. As the main animal protein source in already protein-poor diets, aquatic resources are central to maintaining people's health and well-being. Strategies for food security and poverty alleviation in Attapeu Province should pay special attention to sustainable aquatic resources management.

Water, food and the environment

Results of the study demonstrate the importance of aquatic resources in the health and nutritional status of rural people in lowland areas of Attapeu Province, Lao PDR. The general status of local livelihoods is quite poor and, in many cases, basic needs for food are not being met. Clinical signs of malnutrition were prevalent in all three communities in both men and women and at all ages. The health status of women and children was significantly worse than men.

Key issues

Aquatic resources make up most of the animal protein consumed in terms of frequency and quantity. This is significant given that the over-all diet is protein-deficient.

Rice and cheaper (bulkier) food items are given priority over protein in local diets. Rice is consumed more frequently and in higher quantities than other types of food, providing most of the calories consumed.

Time and resources devoted to acquiring aquatic resources are a substantial part of livelihood strategies. This includes both fishing and foraging activities, making and maintaining gear and processing fish products.

Aquatic resources are a key part of the coping strategy for periods of rice shortage.

Aquatic organisms are often sold and bartered, especially the larger, more valuable organisms and especially when rice is in deficit.

Few coping strategies exist for shortages of aquatic resources. Given their importance in the diet, any shortages will have major impacts on people's well-being.

Local practices lead to poor nutrition during pregnancy and lactation, leading to poorly nourished children. This has an impact on the rest of the child's life.

Food security and poverty alleviation strategies must include aquatic resources management.

Community and household factors that affect food behaviour have a huge impact on people's health and nutritional status. Aquatic resources management needs to include elements of education and public health.

Local diets consist mainly of rice, supplemented with insufficient amounts of animal proteins, and almost no fats. The typical diet in many households is insufficient in both quality and quantity, leading to low productivity and a marginal livelihood. Traditional eating habits and lack of appropriate information are at least partially responsible.

Knowledge about food and nutrition may have been a more useful criterion for determining dietary intake than economically-based characteristics. Community location did not turn out to be a good predictor of nutritional status among adults or children. The 'remote' community of Tamoyot showed the lowest rate of adult malnutrition with child malnutrition rates that were midway between the 'non-remote' communities.

Developing effective management interventions for isolated parts of such a complex system is likely to have negative impacts on other parts.

Livelihoods of rural people in the lowlands of Attapeu and aquatic resources cannot be easily separated. Of the animal protein sources consumed in rural households, aquatic resources contribute more to local diets than domestic animals or animals hunted in the forest and are used to compensate for shortages of rice. Households that routinely suffer from food insecurity in the form of insufficient rice often depend on wild aquatic resources to compensate for this deficiency. A rich diversity of fish, crustaceans, molluscs, amphibians, reptiles and plants from a range of water bodies play a central role in traditional livelihoods. Though many of these resources are seen to be declining, they are still important.

INTEGRATED APPROACH – RICE AND FISH

Both aquatic resources and rice are fundamental in meeting objectives of promoting poverty alleviation through improved health and nutrition, enhancing food security, and increasing productivity. The link between rice production and aquatic resources is inescapable. Because many aquatic resources are seasonal, cyclical and are common property resources, sustainable management will require an integrated approach. Developing effective management interventions for isolated parts of such a complex system are likely to have negative impacts on other parts. Interactions and connections need to be identified and addressed in management strategies

that also address the need to maintain the health of the ecosystem. Developing an understanding of 'connectivity' between resources will be crucial to sustainable management.

PROMOTING SUSTAINABLE LIVELIHOODS

There is huge potential for promoting sustainable livelihoods in the lowland areas of Attapeu Province. Family and village social structure is intact and arable land and natural resources are still relatively abundant. Livelihoods are diversified and adapted to seasonal and environmental changes. Enhancing such diversity will minimize risks, reduce vulnerability and reduce dependence on non-cultured resources. It is important to promote livelihood strategies that include elements of accessibility, diversity and stability, rather than emphasizing rice production potential alone.

STEWARDSHIP

People's participation is a key component of sustainable management of aquatic resources and sustainable development. Because livelihoods in Attapeu are so closely linked to natural resources, local people are the most logical entry point into sustainable management. Because of their daily interaction with these resources, they know the status better than most outsiders and can provide a valuable mechanism for long-term management. This level of participation is only possible when local people have an active role in management. However, people will only be able to consider the long-term perspective required for sustainable management when their immediate needs for health and well-being are met.

HEALTH, NUTRITION AND POVERTY ALLEVIATION

The lack of food security is one of the major constraints to enhancing people's livelihoods in the villages studied. People who have poor diets typically suffer from ill health and are unable to contribute to local development. Many households do not have enough rice to last throughout the year and are constantly coping with shortages. These households are often highly dependent upon natural resources to overcome their rice deficits. Current provincial plans to increase rice production and eradicate poverty may not adequately serve this group and may even increase their vulnerability by reducing the resources upon which they depend.

Any improvements in the health and nutrition status of rural people in Attapeu will have wide reaching impacts and make a significant contribution to poverty alleviation. Cross-sectoral interventions to address the interconnected issues of health and nutrition should emphasize nutritional quality and food behaviour aspects of food security. Health interventions, including awareness-raising, that cover nutritional issues for women and children will also have great impact.

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Annexes

Annex 1a

Frequency distribution of selected food items in Gayeu and Saisi households

Annex 1b

Diversity of foods by food groups and number of households

Annex 1a: Frequency distribution of selected food items in Gayeu and Saisi households

Food Items	Number of households in Gayeu (near large town)						Number of households in Saisi (rural)					
	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total
1. Starchy food group												
• Glutinous rice	2	1	6	2	5	16	–	–	–	–	28	28
• Ordinary rice	–	1	–	–	15	16	17	4	2	5	28	28
• Wild yam	12	–	–	4	–	16	12	–	2	14	–	28
• Taro	4	6	3	2	1	16	15	2	1	9	1	28
• Cassava	7	4	1	3	1	16	11	3	2	10	2	28
• Other roots	–	5	5	–	–	10	2	12	4	–	–	18
2. Protein sources												
2.1 Animal protein												
• Chicken	–	4	7	1	4	16	4	7	12	3	2	28
• Eggs (chicken/duck)	1	6	8	–	1	16	2	10	4	7	5	28
• Beef (cattle/buffalo)	6	5	3	2	–	16	3	13	7	3	2	28
• Pork	4	7	4	1	–	16	6	10	10	2	–	28
• Internal organs	7	6	–	3	–	16	14	6	6	2	–	28
2.2 seafood												
• Mackerel	13	2	–	1	–	16	24	1	1	2	–	28
• Canned fish	5	6	3	2	–	16	17	7	2	2	–	28
2.3 Freshwater aquatic animals												
2.3.1 Fish												
• Pa Soi	1	–	1	7	7	16	–	–	1	2	25	28
• Pa Koh (snakehead)	–	–	3	2	11	16	1	1	11	5	9	27
• Pa Dook (catfish)	–	–	3	3	10	16	7	1	10	5	4	27
• Pa Seiw (rasbora spp.)	–	3	4	4	5	16	–	1	5	9	13	28
• Pa Pak (Barbodes/Puntius spp.)	–	3	5	3	1	12	–	2	–	9	10	21
• Pa Kode (Mystus spp.)	–	3	3	4	5	15	–	2	4	7	7	20
• Pa Sood	–	3	7	2	2	14	–	3	8	9	2	22
• Pa Kieng	–	–	3	3	6	12	–	2	3	4	9	18
• Pa Khow	4	4	4	4	–	16	16	3	1	6	1	27
• Pa Ian (swamp eel)	1	2	–	4	–	7	–	3	2	4	1	10
• Pa Heng (sun-dried fish)	5	3	7	1	–	16	4	4	11	9	–	28

Annex 1a: Frequency distribution of selected food items in Gayeu and Saisi households *(continued)*

Food Items	Number of households in Gayeu (near large town)						Number of households in Saisi (rural)					
	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total
2.3.2 Other aquatic animals												
• Frogs	–	–	2	4	10	16	–	–	5	14	9	28
• Crabs	–	1	4	3	8	16	2	3	8	13	2	28
• Shrimp (Macrobrachium)	–	1	4	2	8	15	2	3	13	5	5	28
• Snail	–	4	3	9	–	16	3	3	10	8	4	28
• Snake	13	3	–	–	–	16	21	4	1	1	–	27
2.4 Wild animals												
• Wild fowl	14	1	–	1	–	16	26	–	–	1	–	27
• Wild pig	15	–	–	1	–	16	25	–	–	2	–	27
• Deer	14	–	–	2	–	16	27	–	–	–	–	27
• Barking deer	14	–	–	2	–	16	26	–	–	1	–	27
• Squirrel	10	5	1	–	–	16	16	4	4	3	–	27
• Birds	2	11	2	1	–	16	11	8	5	3	–	27
• Monitor	8	2	–	6	–	16	17	1	4	5	–	27
• Lizards	13	2	1	–	–	16	24	2	–	2	–	28
• Rat	11	5	–	–	–	16	24	2	1	–	–	27
2.5 Insects												
• Cricket	–	3	3	10	–	16	1	4	5	16	2	28
• Locust	6	2	1	7	–	16	15	1	1	9	1	27
• Beetles	2	3	1	10	–	16	9	1	5	11	2	28
• Hornet/bees	13	2	–	1	–	16	10	2	6	7	2	27
• Red ant eggs	–	4	2	9	1	16	2	1	3	21	1	28
2.6 Legumes & seeds												
• Peanuts	7	3	2	3	1	16	8	6	7	3	3	27
• Mungbean	6	7	–	3	–	16	6	6	8	7	1	28
• Soybean	15	–	–	1	–	16	19	4	2	3	–	28
• Sesame	–	3	12	1	–	16	3	4	13	4	4	28

Annex 1a: Frequency distribution of selected food items in Gayeu and Saisi households *(continued)*

Food Items	Number of households in Gayeu (near large town)						Number of households in Saisi (rural)					
	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total
3. Fat & oils												
• Vegetable oil	16	–	–	–	–	16	25	–	3	–	–	28
• Lard	4	3	6	2	1	16	5	5	9	5	4	28
• Fried dishes	4	5	5	2	–	16	6	7	10	4	1	28
• Sauteed dishes	9	3	3	1	–	16	17	5	5	–	1	28
• Coconut milk containing food	6	5	2	3	–	16	6	7	10	5	–	28
4. Vegetables												
4.1 Leafy vegetables												
• Cabbage	4	3	6	–	3	16	7	1	10	9	1	28
• Chinese white cabbage	–	1	1	3	11	16	5	1	7	4	11	28
• Chinese cabbage (Kwangtoong)	6	2	3	2	3	16	14	–	9	2	3	28
• Mustard green	–	–	2	3	11	16	1	1	4	9	13	28
• Swamp cabbage (morning glory)	–	1	8	1	6	16	3	1	8	5	11	28
• Lettuce	–	1	5	4	–	10	–	–	2	9	17	28
• Tip pumpkin leaf	13	1	–	2	–	16	16	2	3	5	2	28
• Pak E-lerd	2	6	5	1	1	16	–	1	5	6	4	17
4.2 Non-leafy/fruit vegetables												
• Tomato	–	5	3	8	–	16	–	4	11	7	6	28
• Pumpkin	8	5	–	3	–	16	17	2	2	5	2	28
• String bean	1	6	4	4	1	16	2	1	7	11	7	28
• Cucumber	7	3	3	3	–	16	15	–	3	7	3	28
• Wax gourd	7	–	1	3	5	16	10	2	3	7	6	28
• Watermelon (young fruit)	6	4	2	4	–	16	10	2	6	10	–	28
• Eggplants	–	10	5	1	0	16	1	–	2	3	22	28
• Solanum (mak paeng)	1	4	7	1	3	16	2	–	3	4	19	28
• Raw papaya	3	5	6	2	–	16	–	4	14	4	6	28
• Jackfruit (young fruit)	5	2	–	9	–	16	10	–	7	11	–	28
• Sesbania flower (Dokkae)	6	4	2	2	5	16	16	1	4	7	–	28
• Banana stem	2	9	4	1	–	16	4	9	7	5	3	28
• Banana flower	3	8	5	–	–	16	3	12	7	5	1	28
• Linmai (pod)	2	7	4	2	1	16	5	4	8	8	3	28

Annex 1a: Frequency distribution of selected food items in Gayeu and Saisi households *(continued)*

Food Items	Number of households in Gayeu (near large town)						Number of households in Saisi (rural)					
	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total
4.3 Bush & Forest												
• Bamboo shoot	–	2	1	11	2	16	–	–	3	12	13	28
• Mushroom	–	–	3	13	–	16	–	1	3	19	5	28
• Leukena (Pak Katin)	2	10	3	1	–	16	1	5	15	1	6	28
4.4 Aquatic sources												
• Pak Kadon	–	2	7	4	3	16	1	1	6	15	5	28
• Pak Kayang	–	–	4	2	10	16	1	–	7	8	12	28
• Pak Kood	12	3	1	–	–	16	18	1	2	7	–	28
• Pak Kached	9	2	1	4	–	16	12	1	6	9	–	28
• Pak Samek	–	3	6	4	3	16	2	2	11	11	2	28
• Pak Tiew	5	–	3	8	–	16	1	1	5	18	3	28
• Pak Wanh	1	5	–	10	–	16	8	2	1	16	1	28
• Pak Paew	1	9	1	–	5	16	3	3	7	5	10	28
• Freshwater algae (Tao)	2	1	3	10	–	16	3	3	5	14	3	28
4.5 Vegetables for flavouring and side dishes												
• Spring onion	1	2	–	3	10	16	–	–	–	2	26	28
• Coriander	3	3	4	5	1	16	1	–	1	2	24	28
• Hompon (dill, mixed)	–	–	–	4	12	16	–	–	2	2	26	28
4.5.1 Herb of aroma or seasoning vegetables												
• Sweet basil	5	3	1	2	5	16	8	–	3	5	11	28
• Fresh chili	–	–	3	–	13	16	–	–	–	1	27	28
• Dried chili	2	–	2	2	10	16	5	2	1	–	20	28
• Galangal	–	5	9	–	2	16	–	1	7	6	13	27
• Ginger	1	5	9	–	1	16	–	1	7	9	10	27
• Tamarind (green pods)	–	–	4	6	6	16	3	1	6	10	8	28
• Tamarind (young leaf)	–	1	7	5	3	16	10	4	7	5	2	28

Annex 1a: Frequency distribution of selected food items in Gayeu and Saisi households *(continued)*

Food Items	Number of households in Gayeu (near large town)						Number of households in Saisi (rural)					
	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total	Rarely (<1/mo)	Seldom 1-2/mo	Occasional 3-4/mo	Often 2-4/wk	Everyday 5-7/wk	Total
5. Fruits												
• Banana	–	4	6	–	6	16	1	–	13	3	11	28
• Orange	9	2	–	–	5	16	9	3	9	6	1	28
• Pomelo	4	4	5	3	–	16	–	1	10	10	7	28
• Mango	2	–	2	12	–	16	–	1	6	20	1	28
• Papaya	4	7	4	1	–	16	1	2	11	13	1	28
• Water melon	7	4	–	5	–	16	5	4	5	14	–	28
6. Condiments & Seasoning												
• Pa dek (fermented fish)	–	1	4	1	10	16	–	–	–	1	27	28
• Salt	–	–	–	–	16	16	–	–	–	–	–	28
• Fish sauce	13	2	–	–	1	16	11	–	2	3	12	28
• Soya sauce	16	–	–	–	–	16	15	1	2	2	8	28
• Monosodium Glutamate (MSG)	–	–	–	–	16	16	–	–	–	–	28	28

Annex 1b: Diversity of foods by food groups and number of households

Category	Number of household		Total (N = 44)
	Worse-off (n = 21)	Better-off (n = 23)	
1. Caloric food group			
Diversity of carbohydrate group			
• Median (varieties)	6	6	6
• Range (varieties)	2-8	1-8	1-8
Weight (reflecting frequency)			
• Median (scores)	88	104	97
• Range (scores)	38-135	25-160	25-160
2. Animal proteins			
2.1 From domestic animal meat			
Diversity of domestic animal meat			
• Median (varieties)	5	5	5
• Range (varieties)	2-7	3-7	2-7
Weight (reflecting frequency)			
• Median (scores)	50	43	50
• Range (scores)	13-115	9-140	9-140
2.2 From aquatic animals			
Diversity of aquatic animals			
• Median (varieties)	8	9	8.5
• Range (varieties)	6-10	5-10	5-10
Weight (reflecting frequency)			
• Median (scores)	150	153	152
• Range (scores)	100-230	83-210	83-230
2.3 From nature (excluding wildlife)			
Diversity animal from nature			
• Median (varieties)	5	5	5
• Range (varieties)	2-7	2-7	2-7
Weight (reflecting frequency)			
• Median (scores)	70	63	66
• Range (scores)	30-140	21-128	21-140

Annex 1b: Diversity of foods by food groups and number of households *(continued)*

Category	Number of household		Total (N = 44)
	Worse-off (n = 21)	Better-off (n = 23)	
3. Vegetables			
3.1 From farm (plus few from market)			
Diversity of vegetables from farm			
• Median (varieties)	11	12	11
• Range (varieties)	8-14	7-15	7-15
Weight (reflecting frequency)			
• Median (scores)	190	195	193
• Range (scores)	38-270	109-295	38-295
3.2 Trees from backyard			
Diversity of trees from backyard			
• Median (varieties)	7	7	7
• Range (varieties)	2-9	2-9	2-9
Weight (reflecting frequency)			
• Median (scores)	77	93	85
• Range (scores)	20-160	29-160	20-160
3.3 From nature including aquatic plants			
Diversity of aquatic plants and others			
• Median (varieties)	9	10	9
• Range (varieties)	8-11	8-11	8-11
Weight (reflecting frequency)			
• Median (scores)	143	173	168
• Range (scores)	72-200	72-235	72-235

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